troublesome. Potatoes and slippery elm seem to prevent and remove scale in many cases. Substances containing tannic acid also seem serviceable with some kinds of water. There should be frequent blowing off when these solvents are used. Crude petroleum seems to prevent scale when the water is principally impregnated with sulphate of lime, but is not recommended where the carbonate of lime is the principal foreign ingredient.

External corrosion is frequently caused by the exposure of boilers to the weather, and by leakage and dripping. It is a bad practice to put ashes on top of the boiler, wood ashes being the most liable to produce corrosion. Coatings of felt or calcined plaster can be used with benefit. Ashes are frequently allowed to accumulate in the ash pits of boilers, and, becoming wet, produce corrosion.

Internal corrosion is caused by scale, or by acid in the water. If the latter occasions the trouble, the surest remedy will be to abandon the water and get a supply from another source. The dyes discharged from factories into streams frequently render the water unfit for use in boilers. This difficulty can sometimes be remedied by neutralizing the acid by the use of soda or soda ash. It should be remarked, however, that all the solvents and neutralizers mentioned above should be used with great caution, as their indiscriminate application is frequently productive of more harm than good.

Internal grooving or channeling probably arises from unequal expansion and contraction, in connection with the use of impure feed water. Glass gages are sometimes stopped up by a mixture of grease with the impurities of the water. The lever safety valve is most commonly used, and, under the care of a competent and reliable man, is all that is needed. It should, if possible, be so arranged that it cannot be tampered with. It should be raised every day, in order to prevent corrosion and sticking to the seat. Pressure gages should be tested every few months. The hight of the water in a boiler should always be ascertained before starting the fire. It is not unusual to look after the fire first and the water afterward; and in many cases, boilers have been nearly ruined from this cause.

Many boilers are braced imperfectly, or not at all. Boilers are frequently left without examination for months, and the bracing becomes defective. Steam users take too many chances, under the advice of boiler makers who are ignorant or careless.

The above will be sufficient to show that there is no need of mysterious theories to account for boiler explosions. Boilers, with the best of care, will wear out, and the process is much hastened if they are improperly set and badly managed.

The Company employs about 30 inspectors, who inspect the boilers under their care quarterly and semi-annually. Defects, when discovered, are pointed out; and unless they are repaired, the Company's liability ceases.

SCIENTIFIC AND PRACTICAL INFORMATION.

ADULTERATIONS IN YELLOW AND RED CHROMES.

The yellow and red chromates of lead, employed as pigments, frequently contain sulphate of lead. This substance is insoluble in strong nitric acid, and in this way it can be detected; but a neater and more convenient method, proposed by Dr. Julius Löwe, consists in the use of hyposulphite of soda. The finely pulverized pigment is placed in a moderately concentrated, cold solution of pure hyposulphite of soda, when the sulphate of lead readily dissolves, leaving the chromate unacted upon. After filtering, the filtrate may be tested for lead by adding a solution of the neutral chromate of potash, when the yellow chromate of lead will be precipitated. If it is desired to ascertain the amount of the sulphate of lead present, it may be precipitated by sulphuretted hydrogen gas, or by sulphide of ammonium, as sulphide of lead, which is then purified and converted into sulphate of lead by the use of fuming nitric acid, and weighed. This method is preferable to the one depending on the insolubility of sulphate of lead in nitric acid, as proposed by E. Duvillier recently, since there might be other insoluble adulterations present, as, for example, barytes.

THE DETECTION OF BLOOD SPOTS.

M. Sonnenschein states that tungstate of soda, strongly acidulated with acetic or phosphoric acid, throws down albuminoid matters from very dilute solutions. These precipitates, insoluble in a large excess of water, dissolve in alkalies, especially if hot. If defibrinated blood is treated with this salt, a red brown precipitate is formed, which becomes clotty on boiling. All the coloring matter is precipitated. To detect blood spots by this means on clothing, the suspected portion is cut off; and after having been treated with distilled water, the filtered solution is precipitated with the above reagent. The precipitate, washed and treated with ammonia, takes a reddish grey color. If phosphoric acid be present, it must be carefully washed away before treating the precipitate with ammonia.

THE TELEGRAPH IN CHINA.

The Great Northern Telegraphic Company has recently established a line between Woosing and Shanghai. Twenty words are sent for a dollar. This is the first successful attempt to introduce the telegraph through the main portion of the empire, as previous efforts have been met with violent opposition from the people, who cut the wires and destroyed the poles.

NITRITE OF AMMONIA.

M. Berthelot has recently succeeded in producing this body for the first time in a crystaline state. Nitrite of baryta is placed in sulphate of ammonia. The precipitated sulphate of baryta is collected on a filter, leaving the nitrite of ammonia in solution in the liquid. The crystalization of the latter cannot be obtained by heat, as the same causes a rapid decomposition of the substance; hence the liquid is placed under the receiver of an air pump, with very hygroscopic materials. In spite of these precautions, however, and although the operation is conducted at the freezing temperature, about two thirds of the product become decomposed. The balance, however, is pure nitrite of ammonia, crystalized in white needles. The body is remarkable for its explosive properties, detonating violently at 165·2° Fah., or by reason of a shock, with a force nearly equal to that of nitro-glycerin.

A CIRCULAR COMPASS NEEDLE.

M. E. Duchemer has addressed a note to the French Academy, in which he claims that a circular compass needle possesses the following advantages over the usual form:

1. A magnetic power, for a given diameter, double that of a needle whose length is equal to this diameter.

2. The existence of two neutral points instead of one, which has the effect of maintaining the position of the two poles constant; the magnetism seems to be so energetically preserved that even the strongest sparks of a Holtz machine do not cause any displacement of the poles of the magnet.

3. A more satisfactory means of suspending the magnet when it is well mounted and balanced by a plate of agate; it seems then to move as if placed in a liquid.

4. An increase in sensibility of the magnet proportional to its diameter.

5. The possibility of neutralizing the magnetism of the vessel by means of a second magnetic circle, changing the position by an amount calculated beforehand, and thus permitting the compensation of the compass before the sailing of the vessel. This idea was suggested by Captain D. Venie.—*Comptes Rendus.*

NEW EXPERIMENTS IN CONVECTION.

The phenomenon of convection of heat in a liquid, consisting in that the superior portion of the mass is always at a more elevated temperature than the lower part, can be clearly illustrated by the following novel experiments:

Two glass tanks are placed before a white surface; one is filled with cold and the other with boiling water. A solution of starch is freshly prepared in a large test tube, and, by the addition of an aqueous solution of iodine, colored a deep blue. The liquid is then warmed until this color just disappears, care of course being taken not to add an excess of iodine, which would prevent this action; and the tube is then plunged into the cold water. The blue color, brought back by the cooling, will appear first in the lower portion of the tube, and will gradually extend upward, thus proving that it is the lower portion of a warmed liquid which first becomes sufficiently cooled to cause a return of the tinge.

In the other tank, containing boiling water, a similar test tube, containing a blue liquid obtained by the addition in excess of caustic potash to a solution of sulphate of copper and tartaric acid, to which a little grape sugar is added, is placed. The formation of yellow oxide of copper begins at the surface of the liquid and descends gradually to the lower portions, showing that it is the upper part which first attains the temperature necessary to cause the re-action which precipitates the oxide of copper.

The Fireproof Building Company.

On January 12, a fire test was made of the Fireproof Building Company's concrete, at their works, corner of Corlears and Cherry streets in this city. Below we give the details, which will doubtless be interesting to our readers: The company had constructed a small house, and a model of a mansard roof. The latter was open at the top, and was made with wooden rafters, covered on both sides with the concrete blocks, the inner blocks being 1½ inches in thickness, and the outer ones, 2½ inches. The inner blocks were hollow, and the outer solid. A part of the outer covering was slated, and a small space was covered with plastic slate roofing, which consists of ground slate mixed with a residuum of coal tar until it acquires the consistency of common mortar, and is then applied with a trowel to a double layer of felting, the slate mixture having a thickness of about ¼ of an inch. This was arranged so that the edges were not exposed, being covered by the common slate. A fire was made both within and around this model, and was allowed to burn for 35 minutes. During its continuance, loud explosions occurred, caused by the hard finish breaking off from the inside of the blocks, the material not having been thoroughly dried. When the fire was extinguished, it was found that the ordinary slate had crumbled to a serious extent, while the plastic slate was uninjured. The concrete blocks were apparently unchanged.

The next test was made with the house. This was a small building about 8 feet square, and the same hight. It was built near the factory chimney, with a flue running into the chimney. The walls were 7½ inches thick, and an inside wall, also 7½ inches in thickness, was built on one side, a hole being made in the outer wall on that side, so that a thermometer could be inserted. The walls were made of solid blocks. The roof of the building was composed of wooden rafters, covered with solid blocks 4 inches thick, and having blocks, 2 inches in thickness, suspended from the bottoms of the rafters. The floor was constructed in a similar manner. A large fire was made in the house with logs soaked in oil, and was allowed to burn for 50 minutes. After the fire had been burning for 20 minutes, the inner wall had hardly become heated through. The space between the two walls was filled with steam after the fire got well under way. During this test a large block of concrete with three holes in it had a piece of wood put into one, some paper into the other, and a handful of shavings into the third. The holes were then closed with cement, and the block was thrown into the fire, a bucket of oil being also thrown in immediately afterwards. After the fire was extinguished, a workman, reaching into the building, chipped away pieces of the floor and ceiling blocks. The beams were thus exposed, and they were found to be damp and scarcely warm to the touch. The large block was broken open and its contents were found to be in a similar condition. After this test, the visitors were shown a floor, built of these blocks, and weights were put upon it to prove its strength.

The blocks with which the foregoing experiments were made are composed of cement, consisting chiefly of the hydraulic lime of Teil, which is said to combine great strength with lightness. The blocks used for partitions have been found capable of resisting a crushing force of 800 pounds per square inch, and the weight of these blocks, 4 inches in thickness, is 11 pounds per superficial foot.

We should have stated that the fire was quickly extinguished by water at the conclusion of the tests, and that the blocks showed no signs of cracking, under this severe proof.

Those who have carefully perused the foregoing statements will see that these tests are not conclusive as to the fireproof qualities of the material. As a general rule, buildings do not take fire immediately after completion, and before the cement is dry. It would be interesting to see an experiment with this concrete after it had been thoroughly dried.

THE RIBBON POST.

The Ribbon Telegraph Post Company, of Manchester, England, have recently introduced a light and graceful form of iron pole or pillar, constructed as represented in the annexed engraving, extracted from *Iron*. The ribbons are made around a mandrel, which is provided on its exterior with spiral intersecting grooves. The latter form a receptacle for the ribbons, which are wound on by machinery, without twist or strain, and in such a manner that the gradual decrease of the pole is compensated for. The first series is put on from right to left, beginning at the bottom; the next, in the reverse direction, commencing at the top. The latter ribbons, of course, overlap, and are, at this stage of the operation, temporarily secured to those beneath them by bolts fitted in holes previously punched in both, so as to coincide exactly at the points of intersection.

The core of the mandrel is then removed, causing it to collapse, when the pole is withdrawn and placed upon a cylindrical bar, ready for the insertion of the angle irons. These, previously punched, are secured by rivets to the intersections of the ribbons, the temporary fastenings being taken out. The cap, the nature of which depends necessarily upon the uses to which the pole is to be devoted, is then put on; and the base, consisting of various forms, strengthened with extra iron and inserted, for some little distance, with the ribbon and secured to a plate which affords a strong support, is added.

The strength of poles thus constructed is said to be very great. Two, without angle irons, measuring 10 feet by 8 inches, supported a weight of 10 tuns without sinkage, deflection, or collapse. The total weight of a telegraph post 31 feet long is about 434 pounds.

On rocky ground, these posts can be fastened directly to the surface of the rock; no lightning conductor or earth wire is required, since the poles are themselves conductors; no ladders are needed; they offer small resistance to the wind, and are ornamental and durable. It is suggested that they may be advantageously used as substitutes for the heavy iron pillars or clumsy wooden supports frequently employed in the construction of conservatories, porches, etc.

THE OHM.—The term "ohm" is derived from the name of the celebrated electrician who first ascertained the laws of electrical resistance, and is a measure of resistance of which it is the unit, in the same way as we use the inch or yard in the measure of length. The "ohm," as a unit of resistance, was adopted by a committee of the British Association, many years ago, and is now the acknowledged standard of resistance throughout the world. The ohm represents the resistance of about 210 feet of copper, wire No. 16, or galvanized wire No. 8, unexposed to disturbing causes and in a temperature of 60° Fah.

TO pass our time in the study of the sciences has, in all ages, been reckoned one of the most dignified and happy of human occupations.—*Brougham.*

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