AN IRON WATER TOWER.

We present an illustration of an iron water tower which has recently been erected at Fort Dodge, Iowa, by the Chicago Bridge and Iron Company, of Washington Heights, Chicago, Ill. It is a good example of iron water towers which are in pleasing contrast with the ordinary ugly wooden tank. With a water tower like the present, the tank itself can be placed at such an elevation that the water is supplied at sufficient pressure for a reasonable fire duty. The tower is 116½ feet high from the foundations to the top of the tank. It is surmounted by a mast whose curved upper end supports an electric light at a distance of 147 feet from the ground. The diameter of the tank is 25 feet, and it is provided with a hemispherical bottom, supported at four points by the horizontal girder at the tangent point of the hemisphere.

The cylinder is 20 feet in height, so that the vertical height of the tank is 32½ feet, the capacity of the tank is 104,000 gallons. The tank is supported by four columns, each composed of two 15 inch channels, with horizontal struts of 7 inch channels. The brace rods are respectively 1, 1⅛ and 1¼ inches in diameter. The tower is

AN IRON WATER TOWER.

40 feet square at the foundation. The cornice is of galvanized iron, and the roof is a cone of sheet metal. One objection which has been made to metal tanks is their liability to freezing, but it would seem that this objection was fully counterbalanced by the liability of the wooden tank to leak unless it is kept supplied with water. Tanks of this kind are considered by the makers to be very valuable for fire duty, as the same pressure can be obtained as with a stand pipe, with a smaller cost of maintenance. From an æsthetic point of view the iron tower has certainly marked advantages over the ordinary wooden affair.

The Fossils of the National Museum.

A catalogue of the types and figured specimens of fossil animals in the United States National Museum has been recently completed, says Science, and comprises type material representing 3,644 species, distributed as follows: Invertebrates, Palæozoic, 1,155; Mesozoic, 1,024; Cenozoic, 1,312; Vertebrates, 163. The fossil plants are not yet fully catalogued, but it is known that they represent more than 2,000 species, over 500 of them being contained in the "Lacoe Collection" alone. There are in round numbers 500 Palæozoic and 1,500 Mesozoic and Cenozoic species. Every type or figured specimen is made conspicuous by attaching to it a small, green, diamond shaped ticket, or a white ticket bearing the word type. Should any specimen be separated from its label, this ticket will draw attention to the fact that the specimen is a type and must be cared for.

Some Facts About Boilers.

An exchange says: What a tremendous force is struggling to tear a boiler to atoms! Take, for example, a horizontal tubular boiler of ordinary proportions, 60 inches in diameter by 16 feet long, containing 83 inch tubes. Such a boiler has a surface area of 40,716 square inches. Suppose this boiler is operated with a working pressure of 100 pounds per square inch, which is not at all uncommon. The boiler does, therefore, sustain a total pressure of 4.071,600 pounds, or more than 2,035 tons. Do we realize what this means? The boiler has resting upon it the equivalent of a column of granite 10 feet square, and 254·5 feet high, only 50 feet less than the height of the Statue of Liberty. Put it another way. The boiler is holding up the equivalent weight of 22,620 persons, all robust athletes, foot-ball players, each weighing 180 pounds. Let us look at the matter from a slightly different standpoint. The best authorities agree that the ordinary draught horse, working eight hours a day, exerts an average force during that time of 120 pounds. Now, this force acting to disrupt the boiler longitudinally is 226,200 pounds, so that to produce an equivalent stress, it would be necessary to hitch up to each end of the boiler a team of 1,885 horses. Who would drive such a tandem? Has the Jehu yet been found?

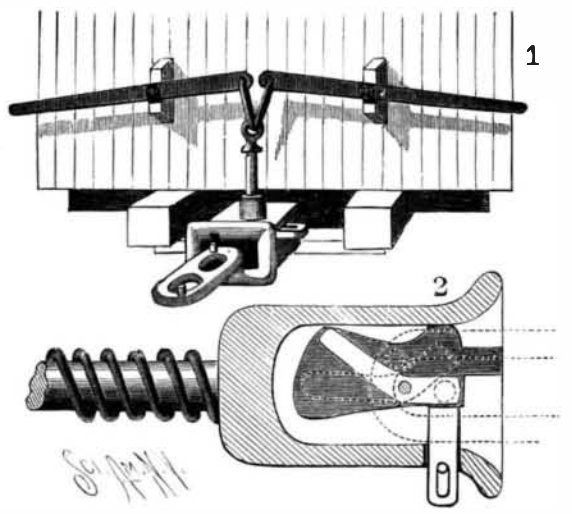
But when we investigate the energy stored up in such a boiler, the facts are still more astounding. Not long since, a boiler having dimensions substantially those of the boiler already referred to, exploded with disastrous results, and as it had been in use but a few years, and was in excellent condition, there was good reason to believe that the bursting pressure did not fall short of 500 pounds. Assuming this to be the case, and that the water level stood at the ordinary height, we find that the water had latent in it in the form of heat the enormous quantity of 299,834,371 foot pounds of energy, while the available energy in the steam is 16,821,499 foot pounds, in comparison with a negligible quantity. When the boiler let go, the heat was transformed into mechanical energy, which was expended in wrecking the plant. The immensity of these figures is beyond our limited comprehension, and the only way by which we can get some idea of their meaning is in making comparisons. How many pounds of gunpowder in exploding would liberate the same energy? The combustion of one pound of average gunpowder generates 250,000 foot pounds of energy. The energy set free, therefore, by the exploding boiler is only rivaled by the explosion of 1,290 pounds of powder.

The boiler weighed 9,000 pounds. If all this energy could have been utilized in projecting the boiler vertically, the resistance of the air being disregarded, it would have been driven to a height of 6⅔ miles, with an initial velocity of 4,760 feet per second, or 54 miles a minute. Our far heralded express trains, of which we boast so much, would be left out of sight. Imagine this energy expended in imparting momentum to a cannon ball weighing one ton and hurled vertically. It would rise 30 miles. Contrast the pressure at which boilers are usually worked with those exerted by great winds. A hurricane blowing at the rate of 100 miles an hour exerts a pressure of 49·2 pounds per square foot, while with steam boilers a working pressure of 100 pounds per square inch, or 14.400 pounds per foot, is considered quite ordinary. Why, then, should we wonder at the awful devastation wrought by a steam boiler explosion!

AUTOMATIC CAR COUPLING.

The automatic car coupling herewith illustrated has been patented by Mr. William Herrick, of Marshall, Minn., and for further information address Mr. Joseph Kent, at the same place.

The hollow coupling head has a recess formed in its upper side, in which is pivoted a horizontally swinging cam whose outer end can swing beneath, and from under, the lower end of the coupling pin hole. The coupling link is flat and has on one side of each end an upwardly extending lug or pin, so placed that when the link enters the coupling head the lug will enter a groove in the under side of the top wall of the head, and bear against the inner arm of the lever, throwing it into the position shown by dotted lines and allowing the pin to drop into locking engagement with the link. The pin is operated by a pair of vertical levers, fulcrumed at the end of the car, one on each side. When it is desired to release the coupling, the pin is raised by said levers and the link drawn out, which latter operation will cause the outer arm of interior lever to be thrown beneath the pin hole, whereby the pin will be held in the proper position

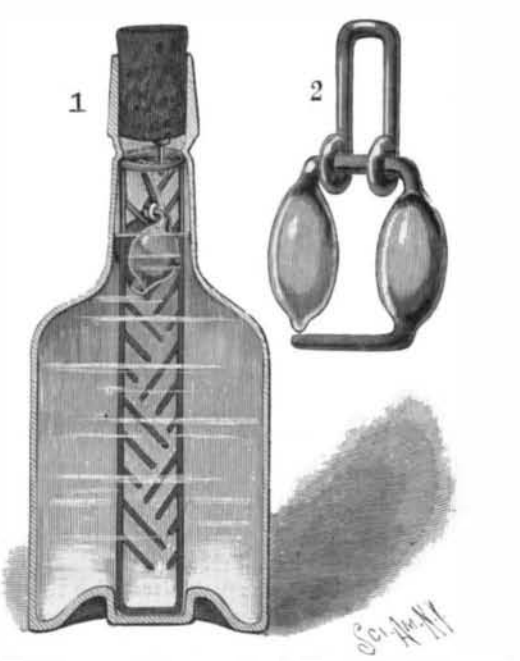


HERRICK'S AUTOMATIC CAR COUPLING.

ready for another coupling. When it is desired to leave the pin in the raised position, the car not being withdrawn, it is done by pushing slightly inward the sliding plate, which is operated through the side of the coupling head.

INDICATING DEVICE FOR BOTTLES.

The device shown in the accompanying illustration, whose object is to indicate with absolute certainty if anything has been added to the primary contents of a bottle or vessel, or if the same has been filled a second time, has been patented by Dr. Johannes Meyer, of 110 Pennsylvania Avenue, Brooklyn, N. Y. The bottle is provided with a floater and a guiding scale, preferably of glass, of the form shown in Figs. 1 and 2. The floater consists of two links, the lower of which is provided with two airtight bulbs, and the guiding scale is a lattice construction, consisting of a top ring to which is attached a long downwardly extending U-shaped strip, the base of which rests in a pit at the bottom of the bottle, the upper ring being held snugly beneath a circular inwardly projecting rim, formed in the neck of the bottle. The guiding scale, which may be made of any material, is provided with a series



MEYER'S INDICATING DEVICE FOR BOTTLES.

of downwardly inclined step bars of variable length, so arranged that a zigzag passageway is left between them from the top to the bottom of the scale. When the bottle is filled, the floater is placed in the scale and lies on the surface of the liquid. As the contents are withdrawn the floater will fall through the scale, and while it will pass easily downward, it will became entangled in the many bars of the scale should an attempt be made to withdraw it, either by pouring in additional liquid, or by shaking the bottle, or by introducing an instrument. It will thus be impossible to remove any of the original contents of the bottle without detection. To prevent the floater from rising to the bottom of the bottle, should it be inverted during shipment, a glass rod is attached to the bottom of the cork, which prevents the floater from entering the scale until the cork is removed. When the bottle is emptied the floater lies doubled up in the pit at the bottom of the bottle.

Science Notes.

Nature tells of a tale of a pair of rooks, evidently young birds, that strove in vain to build a nest. The wind each time blew the foundations down while the rooks, which fly far for nest materials instead of taking those close at hand, were away. At last, despairing of building a home by legitimate means, they fell upon a completed nest of another pair while the owners were absent, tore it to pieces and built a nest foundation that would stand in the wind. Then they made a superstructure in the clumsy and inexperienced way that young birds always do.

A recent paper in the Comptes Rendus described a self-registering thermometer balance, containing either gas or saturated vapor, by MM. H. Parenty and R. Bricard. The two arms of a balance carry respectively a barometer and an air thermometer, both dipping into the same mercury trough. At constant temperature, and with varying atmospheric pressures, the alterations in the weights of the two arms caused by the movements of the mercury are identical, and the balance remains in equilibrium; but an alteration of temperature causes a motion of the beam, which can easily be made self-registering. For a small range of temperature the sensitiveness of the apparatus is considerably increased by substituting a volatile liquid for the gas. The device also readily acts as a temperature regulator.

Among the current inventions recorded in the scientific papers is that of an instrument by an English inventor for accurately measuring the quantity of light given out by a star, stars being designated as of the first down to the twentieth magnitude, according to the intensity of the light from them. By this new device the rough designation of magnitude is represented by numbers, which give the exact ratio of one star to another in light-giving power; the star Arcturus, for example, being estimated by this means to give seventy-five and three-quarters times the light of Regulus. The amount of light which reaches the earth from the stars varies according to the state of the atmosphere, and it is claimed that this instrument will be of valuable service not only in astronomy, but in meteorology also.

It is a curious coincidence that while the hundredth anniversary of Edward Jenner's first successful vaccination in the little Gloucestershire village where he practiced is being celebrated throughout Europe, the town of Gloucester is suffering from an epidemic of smallpox, which has already cost hundreds of lives and which is due to the town authorities being opposed to vaccination. The dean and faculty of the Medical School of University College, Bristol, having consented to receive and permanently locate the valuable collection of mementos of Edward Jenner, known as the "Jenner Relics," it is desired to raise by public subscription the sum of £1,500 in order to defray the cost of purchase from Mr. Frederick Mockler, of Wotton-under-Edge. Each subscriber of one guinea and upward will receive, when the list is complete, a silver medal, and to subscribers of not less than half a guinea a bronze medal will be presented, commemorative of the Jenner Centenary, May 14, 1896.

At a meeting of the Academy of Natural Sciences of Philadelphia, Prof. Oscar Carter recently gave an account of an interesting discovery made about a mile from Three Tans, Montgomery County, Pennsylvania. In a sandstone quarry at that place an iron tree was found embedded in the rock 10 feet below the surface. The tree is about 18 feet long and 8 inches in diameter. It has been completely turned to iron, or rather to the iron ore known as brown hematite. Prof. Carter accounts for the phenomenon by the fact that the shales and the sandstones in that neighborhood are covered with red oxide of iron, and sometimes with brown hematite. It is presumed that the iron ore was reduced by organic matter, and that it was made soluble in water containing carbonic acid gas. As the water holding the iron in solution came in contact with the tree, the iron was precipitated on the tree, and there was an interchange of vegetable and mineral matter, so that the rocks were relieved of their coloring matter and the tree took it up.

A correspondent of one of the daily papers, says the English Mechanic, calls attention to the condition of the tomb of the famous and illustrious Edmund Halley (1656–1742), known all the world over as the discoverer of the "Halley comet." He lies interred in the old portion of the beautiful churchyard of Lee, near Lewisham, not far from the parish church. Edmund Halley's resting place is marked by a plain massive sarcophagus of gray sandstone, containing a long Latin inscription, which, however, has become so obliterated that it can now scarcely be deciphered. In addition to this, the monument is in several places fast crumbling to pieces, in spite of the fact that the tomb was "Restored by the Lords Commissioners of the Admiralty, March, 1854," as an inscription in front of the monument intimates. "I therefore," he says, "venture to suggest that the time has now arrived for a renewal of the restoration of the great astronomer's grave, so that it should present a decent and worthy appearance for generations yet to come."

AN IMPROVED SIGNAL LANTERN.

The signal lantern shown in the accompanying illustration has been patented by Mr. John T. Casey, of 250 Lafayette Street, Germantown, Philadelphia, Pa. The object of the invention is to provide a lantern which shall contain both a red and a white shade, so arranged that either a white or a red light may be shown as desired, and the change made with greater speed and certainty than is possible with existing lamps.

The lamp consists essentially of a lower body portion, which contains the oil reservoir, the base of the body being flared and perforated for the supply of air. The oil cup is provided with the usual burner, and it carries a ring or casing in which is fixed the base of a white shade of the usual pattern

Around the oil cup is arranged a cylindrical red shade, which is made vertically adjustable about the same. This shade is held in a metal frame consisting of a top and bottom ring connected by vertical strips. The top ring of the frame is provided with small projecting lugs or guide strips which travel in vertical slideways which run from the dome of the lantern down to the outside annular ring which embraces the top of the lower body of the lantern. The red shade frame is provided with a vertical rack for raising and lowering the same, said rack being operated by means of a pinion and wheel attached to the lower body of the lantern. The top edge of the body of the lantern is snugly embraced by a stout ring, upon which are securely fastened a set of outwardly bowed ribs which serve to protect the shades and to carry the top dome. Extending from the dome to the lower ring are vertical slideways which receive the lugs on the red shade frame and serve to guide the same in its vertical movement. The lower ring with the attached ribs, slideways and dome is hinged horizontally to the top edge of the lower body of the lantern and is provided with a suitable latch, so that the upper half of said lantern may be swung open for lighting, cleaning, etc. In operation, if the brakeman desires to

CASEY'S IMPROVED SIGNAL LANTERN.

show a white light, by means of the rack and pinion he lowers the red shade entirely within the lower body of the lantern; if he wishes to show a red light, he raises said shade until it completely incloses the white shade, and fills the space between the body and dome of the lantern, as shown in the above cuts.

In constructing this lantern the inventor has sought to provide: First, a lantern to do the work of two ordinary lanterns; second, to provide a lantern exactly the same in size and shape as the present standard railway lantern; third, to provide a lantern which can be lighted in the severest storm; fourth, to provide a lantern with a burner which will allow the turning up or lowering of the light from the outside without removing the shades or any part of the lantern.

The Shrinkage of Iron.

The action of fluid cast iron in the mould is somewhat curious. When poured into a mould in a state of fluidity, cast iron, and especially what is known technically as "very gray," expands at the moment of solidification, thus giving a sharp impression in the mould. The expansion, slight but very noticeable, extends until in the process of cooling the iron attains the stage of red heat. Contraction then takes place, with the result that the cooled iron is noticeably smaller than the mould. In making patterns for iron castings, therefore, pattern makers commonly allow about one-eighth of an inch per foot for shrinkage. The shrinkage in castings, however, is by no means a constant quality, but varies materially with the proportion existent in the pattern and the character of the metal used—as much as one-tenth of an inch per foot being allowed when casting beams and only one thirty-second of an inch with large cylinders.

When any metal in a fluid state is poured into a cold mould, solidification commences at the outside. As the cooling is continued, the castings, therefore, would consist of a rigid outside envelope containing a soft interior. If, therefore, the condition of a small piece of such metal in the center of a square be considered during cooling, it will be seen that the contracting force existing on each side of the square will be the same. A cube or sphere of cast iron contracts in cooling in a uniform manner throughout its mass. If two squares be placed side by side, forming a rectangle, on each half of the sides, the contracting forces are as before, but on the ends, there being no rigid division between the two squares, both parts exert a unit of contracting force. The result is that the contracting force of the ends is equal to that of the sides, or, on a unit of length, the contracting forces are double as great on the ends as on the sides.

In casting, therefore, thin strips, the shrinkage of the length is very great, while in the thickness it is scarcely appreciable. A square plate shrinks little in thickness, but equally in width and breadth; a flat disk shrinks little in thickness, but equally in all diameters. A thin ring shrinks more in diameter than a thick one, and so on. When it is known that iron with different shrinkage from that generally employed is to be used in a foundry, the patterns are altered to meet the changed conditions. Silicon, unless in excessive quantities, gives a gray, soft iron which has the minimum shrinkage. In many cases a judicious mixture of iron will give the desired result without extra expense in pattern making. Charcoal iron has usually a higher melting point than that of less pure iron made with coke. It sets more quickly in the mould and contracts more, so that an extra allowance for shrinkage must be made in all patterns employed. It will be seen from the above that pattern makers require special technical skill as well as knowledge of the iron to be used in casting for their patterns. There are few employments which require greater specialized knowledge of rather a wide range than that of pattern making.—Invention.

The Life of the Steel Rail.

Mr. J. F. Wallace, writing in the Engineering Magazine, states that while it is true that there has been a steady and uniform decrease in the price of steel during the last quarter of a century, the average standard weight of rail for main lines has at the same time increased from 60 lb. to 99 lb. per yard, and the quality has materially depreciated. As an example of the deterioration that has taken place in quality, he states that during the past year he has relieved from a main track on tangents rails that weighed 75 lb. to the yard which had been in the track only five years; whereas, in the same district, and under precisely the same traffic conditions, there still remain in the track 60 lb. rails that have been in service for over fifteen years, which it was not considered necessary to renew this season. While this may be an exceptional case, he considers the steel rail which was furnished by the manufacturers fifteen to twenty years ago about 50 per cent. better than the rail now manufactured. This is not intended to apply to special high class rails, which may be furnished by a few rolling mills under superior specifications, but to the ordinary rail supplied to and purchased by the majority of railroads.

Nut Culture.

There is much encouragement to plant our native nuts and some of the foreign ones. As a rule, our indigenous trees are good bearers, and in Mr. Van Deman's opinion they produce nuts of better quality than foreign ones. The chestnut is receiving the most attention now, and there are a few well-marked native varieties of value. Although they are smaller than the European varieties, they are of better quality and very productive. The best are Delaney, Excelsior, Griffin, Hathaway, Morrell and Otto. Rocky hillsides and other places unsuitable for tillage can be used with profit for nut trees, and they can be set about buildings and in pastures. The European varieties seem more profitable. It seems to be a rule that the more pubescence the nut has, the better its quality. European varieties are more fuzzy than the Japanese, and less so than the American sorts. The most prominent of these are the Paragon, Numbo, Ridgely and Hannum. Japanese chestnut trees have a more dwarf habit, and the nut has a bitter skin. They graft quite readily on American seedlings, and the best varieties introduced are Alpha, Early Reliance, Grand and Superb. Among the hickories, the best nut tree is the pecan, a native of our Southern States, and the shell bark hickory, common throughout the Northeastern States. A firm in Pennsylvania ships more than twenty tons of hickory nuts every year. The nuts should be planted in rough places four feet apart each way and thinned as they grow. Seedlings are variable, and so they must be grafted. The principal varieties are Hale's, a larged thin-shelled sort, Leaming, Curtis, Elliott and Mulford. Among the walnuts, our native butternuts may, perhaps, be improved, but the so-called English walnut is the best of the family, although it is difficult to grow as far north as New York. There is no doubt that nut trees are hard to graft and to bud. Evaporation should be prevented until the sap begins to flow. When the sap starts the grafts should be put in underground. The scions should be cut so as to have the pith all on one side, or, if necessary to graft above the ground, they should be covered well to prevent all evaporation possible.—Garden and Forest.