ter bearing or knife edge of each lever is an 8 inch I-beam running transversely, and 12 inch longitudinal I-beams, each 15 feet long, rest upon these 8 inch beams. There are, therefore, four transverse beams, each beam resting on two of the scale levers. The other ends of the scale levers, provided with knife edges, communicate by vertical links with a transverse lever, one of which levers answers for two main levers. For each pair of transverse levers, which nearly touch in the center longitudinal axis of the scale, is a second lever, this time a longitudinal one, of which there are two. The two ends of these levers almost touching, operate a single transverse lever, which runs out to the weighing beam and is connected thereto in the usual way by links and knife edge pivots. From the original scale levers, which directly bear the weight of the platform to the weighing beam, there is, therefore, a series of three separate multiplications.

The weighing beam is of the peculiar type used only on the largest scales. The sliding poise reads directly to the large units, whose designations are engraved on the beam. On the poise is a subsidiary weighing beam, with its own smaller sliding weight, by which a reading to divisions of ten pounds is obtained, by inspection, which can by the eye be still further divided if desired.

Links are applied to prevent oscillation of the platform in either direction, but allow it perfect freedom of vertical motion.

The platform is 12 feet wide and 15 feet long. When loaded to itsfull capacity the scale undoubtedly represents the greatest concentration of weight under the circumstances on any portable scale ever built in this country. The platform is made of 3 inch oak, and on it are placed four chocks or blocks for the gun to rest on. Each chock has cut out of it a portion of a circle of 60 inches diameter. These chocks are spaced equally distant, each of them coming directly over one of the transverse I-beams, and, therefore, directly over the central knife edges of the scale levers. This is of itself a very interesting feature, and it has been found that however the weight of the gun is borne, whether by any pair of chocks or by all at once, the weight is given with precisely the same accuracy. To test the capacity, three guns were placed on it at once, making a total of 150 tons, which it weighed without difficulty.

As a practical illustration of what the scale would do once when a gun was resting on it and had been weighed, one of the officers of the Arsenal stepped upon the platform and while there he was weighed. Although the scale was loaded with thousands of pounds in the shape of the gun, the officer was weighed to within one pound of his known weight. A paper dollar bill placed on the end of the scale beam, when the scale is adjusted, is sufficient to disturb its equilibrium.

The object of making the scale so short was to enable it to be run across the building and off the main division of the floor, behind the row of columns seen on the left of the cut. A pair of channel beams, flat sides upward, are laid across the building for it to roll on. As we illustrate it, the scale holds a 12 inch gun weighing 52 tons.

Paints for Ironwork.

At a recent meeting of the Association of Engineers of Virginia, Mr. S. Wallis gave the members some interesting and valuable hints respecting the protective painting of structural ironwork. He recommended that the first coat should be of red lead ground in raw linseed oil, used within two or three weeks after mixing, and kept thoroughly mixed while in use. This coat dries in from 24 to 30 hours. If the finish is to be black, the next two coats should be made up from a paste composed of 65 per cent of pigment and 35 per cent of raw oil. The pigment is to consist of 65 per cent of sulphate of lime, 30 per cent of lampblack, and 5 per cent of red lead as a drier—the whole thinned to a proper consistency with pure boiled oil. If the finish is to be in red or brown, the paste should be composed of 75 per cent of pigment and 25 per cent of pure raw oil: the pigment to consist of 55 per cent of sulphate of lime. 40 per cent of oxide of iron free from sulphur and caustic substances, and 5 per cent of carbonate of lime as a drier. The sulphate of lime is to be fully hydrated. At American prices, this paint will cost, ready for use, about 60 cents per gallon. Lead paints are not recommended for finishing coats, on account of chalking; neither is zinc, on account of cracking. Graphite paint does not dry well in linseed oil, and is not impervious to water. Its color is steel gray.

Coloring Lantern Slides.

At a recent meeting of the Royal Society of Dublin, Sir Howard Grubb in the chair, Dr. J. Alfred Scott described a method, which he said he had devised, for coloring lantern slides, referring to that class of slides that are produced on photo-gelatine plates. The description of his method is in close accordance with that of Mr. G. M. Hopkins first published in the SCIENTIFIC AMERICAN of March 11, 1893. Dr. Scott will no doubt be glad to award the priority to Mr. Hopkins.

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(Illustrated articles are marked with an asterisk.)

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ELEVENTH ANNUAL MEETING OF THE INSTITUTE OF ELECTRICAL ENGINEERS.

The American Institute of Electrical Engineers held their eleventh annual meeting in Philadelphia, beginning Tuesday morning, May 15, under the chairmanship of Prof. Edwin J. Houston, who was elected president of the society. The president's address was devoted to "A Review of the Progress of the American Institute of Electrical Engineers," and traced the work of the society during its decade of existence. Prof. Wm. A. Anthony spoke on "Light Distribution and the Use of Lamps." After the proceedings of the day were over, receptions were tendered the society by the Manufacturers' Club, by the Engineers' Club, and by the Electrical Section of the Franklin Institute. On Wednesday other papers were read and discussed. One was on "Some torage Battery Phenomena," by Prof. W. W. Griscom. He maintained that in this country storage batteries were worked to too close a margin. In Europe they have succeeded; here they have failed. Prof. Francis B. Crocker and C. Howard Parmly, of New York, presented a paper on "Unipolar Dynamos for Electric Light and Power." "Tests of Closed Coil Arc Dynamos," by R. B. Owens; "Relative Advantages of Toothed and Smooth Core Armatures," by Alton D. Adams, were among the papers read. In the evening the annual dinner was given. Thursday was devoted to various excursions and pleasure trips. The meeting was largely attended, nearly one hundred members sitting at the dinner. The papers were printed and copies distributed among the members, so as to enable better discussion to be given each one. The standing of the institute and the permanent form given to its volumes of proceedings operate to make its annual meeting one of the events of the year.

THE BICYCLE AS AN EXAMPLE FOR IMPROVEMENTS IN TRANSPORTATION.

For many years man has attempted the construction of a successful road machine to be propelled by the rider. The first signs of real success came in the application of crank propulsion to the old velocipede. The next development was the introduction of elastic tires of India rubber. Then came the last and greatest improvement, the pneumatic tire. Mean while the proportions and details of the machine were constantly changing, until the wheel of to-day was evolved, with its ball bearings wherever possible, and with air-inflated tires. The mere business of making and selling bicycles will soon be, if it is not already, one of the leading industries of the country.

Where he has to propel himself, man naturally has done everything to facilitate the work. The principle bearings of a bicycle, all except those of the chain gearing, work on hard steel balls, running with a minimum of friction and readily adjustable for end shake. The old solid rubber tire enabled the average rider to make high speeds; the modern pneumatic tire adds three or four miles an hour more to his rate. But while man has effected these improvements where his own individual exertions are concerned, does it not seem as if he had neglected to extend his ingenuity to horse, steam, and electrically propelled vehicles? An impression that the bicycle has engrossed all the time of the constructor and inventor of improvements in vehicles is created—the carriage and the rail car seem awaiting their turn.

The lessons of construction taught by the bicycle are valuable as much in their exclusion of the unsuccessful as in their lessons of achievement. It has been found that a machine with some twelve finely adjusted, apparently delicate ball bearings can, without repeated oiling or attention, be driven for hundreds of miles through dusty roads. It has been found that lightness of structure is made possible by the pneumatic tires, which prevent destructive jarring; every time a bicycle noiselessly glides past a rattling carriage, whose wheels rotate on thickly greased axles, and where every stone and inequality in the road opposes progress, seems to tell the story of the superior construction of the bicycle. Yet we are content to rest with the development of the man-propelled vehicle. It certainly is time something was done for the other.

A few solid rubber-tired carriages, still fewer pneumatic-tired vehicles, are seen upon our roads and streets. The pneumatic sulky used on the race track is a side issue. Roller or ball bearings are a rarity among carriages and on railroads. It is unquestionable that if it could be done, a veritable revolution in steam and electric transportation might be brought about by the further application of these improvements. It seems absurd to suggest a steam railroad car on pneumatic tires. But light short cars could certainly be carried on elastic tires of some kind, which would do away with the greater part of the noise and injurious jarring of iron wheels against steel rails.

The friction of car wheels is greatly diminished by roller or ball bearings. By every improvement in the direction of preventing jarring, lightness of construction would be favored. The whole system of transporting passengers in vehicles operated by steam or electricity is subject to radical modifications. The rail car, as now used, is open to criticism in many respects. Possibly the whole system of operating railroads may yet be changed. But it is hard to believe that the lesson taught by the bicycle cannot be of use to the railroad engineer. Elastic tires, light construction, almost frictionless bearings, should have some place in his economy.

Planet Notes for June.

BY H. C. WILSON.

Mercury will be "evening star" during June. On the 22d he will be at his greatest distance (elongation) east from the sun, and will set about an hour and a half later than that body. This month will be a good time both for daylight and evening observations of this planet. Its phase will be gibbous during the first half and crescent during the last half of the month. The moon will pass by Mercury on the evening of June 4, conjunction in right ascension occurring at 10 h. 32 m. central time.

Venus will be "morning star," rising about two hours before the sun. She is getting around toward the farther side of her orbit, so that her brightness is decreasing considerably. At the same time her phase is becoming more gibbous. At the beginning of the month 0·67 and at the end 0·76 of her disk will be illuminated.

Considerable has been said lately about the dark part of the disk of Venus being visible, just as the dark part of the new moon is visible. Several observers claim to have seen the complete outline of Venus' disk a few days before she disappeared in the rays of the sun this past winter, when her crescent was very narrow. We may say, I think, that this visibility is not from the same cause that renders the dark part of the moon visible, viz.: Reflected earthshine. Venus is more than 100 times as far as the moon from the earth, and, therefore, would receive less than the ten-thousandth part of the light thrown upon the moon. The most probable explanation is that Venus has a dense atmosphere, possibly more extensive than that of the earth, so that her twilight is longer, and extends far enough into the dark hemisphere to become visible from the earth as a complete ring of light when the crescent of direct illumination is small. The observer discerning the outline of the dark part of the planet, by this faint ring, would naturally have the impression of seeing it all.

Mars will be at quadrature, 90° west from the sun, June 17, and will be in position to be observed after midnight during this month. Mars will move northeast during June, from Aquarius across a little corner of Pisces into Cetus. The phase of the planet will be smaller this month than at any other time in the year, only 0·84 of the disk being illuminated. Mars will be in conjunction with the moon, about 3° south of the latter, 48 m. after midnight, June 25.

Jupiter and *Neptune* are not to be seen during June.

Saturn is making the turn of the loop in his apparent path among the stars of Virgo. He will begin to move eastward after June 21. The amateur should not fail to make the most of these summer months in the study of this planet. The surface markings on so bright a planet are almost as likely to be seen with a small telescope as with a large one. The moon will pass by Saturn, 4° south of the latter, June 12, at 2 h. 41 m. P. M. central time.

Uranus will be in his most convenient situation for observation during June, being near the meridian during the evening hours. He ought to be easily found by means of stars α and μ Libræ. Look about 1° 30′ west and 30′ north, *i. e.*, 3 diameters of the moon west and 1 diameter north, of α, for a star with a dull green disk a little brighter than the star μ.—*Popular Astronomy.*

Archæological Notes.

Prof. Waldstein, in giving his report to the managing committee of the American School of Classical Studies, at Athens, on the excavations made at Argive Heræum in 1893, under his direction, mentions a number of important results.

The work was directed upon the uncovering of the site of an ancient temple, perhaps the oldest in Greece. At one time 240 men were engaged. They found a portion of the temple wall a little over three feet in height by about forty-five feet in length. Very interesting specimens of bronzes, engraved stones, and pottery were unearthed. Vestiges of other buildings whose use is not yet determined were found below the temple terrace. Some indications point to their being the houses of the attendants of the temple. A portico which had at least nineteen pillars along its center, some of them found *in situ*, was uncovered.

Near by, an intricate building, which contained a number of rooms, offers a rich field for further study. Already a beautiful torso of a draped female figure, three marble heads, and other fragments have been taken from it. Terra cotta plaques, ceramics, bronzes, engraved gems, and glass scarabs were discovered in other parts of the same building. Parts of the entablature of a Doric building, with traces of colors, reds, blues, and greens, were also found. On the whole, Prof. Waldstein feels that further excavation on this site will undoubtedly lead to very valuable results. The inscriptions have been given to Prof. Wheeler for study.

The ruins at Delphi have yielded some important treasures in the past year. It is believed that among the remains of buildings some of the walls of the temple of the Pythian Apollo have been found. An archaic statue of Apollo in very good preservation had been used for building material. It is of more than natural size, in standing posture; the face is flat and triangular; the limbs are stiff and angular, the arms hang close to the sides and the fingers are closed. The hair falls in cylindrical locks upon the shoulders. It suggests Egyptian work, so different is it from the graceful Apollos of later time.

M. Homolle believes that the Treasury of the Athenians at Delphi, of which Pausanias wrote, has also been uncovered. He and his assistants are piecing together architectural fragments and sculptures which he hopes to prove belonged to that famous building. The sculptures show the grace and precision due to sharp and delicate execution. The building must have been small, though larger than the largest of the treasuries of Olympia. If M. Homolle can establish the correctness of his theory about this structure, he will give a most important date in the history of art.

A mound at Marathon has been so thoroughly investigated that there seems to be no doubt that it was erected over those who perished in the battle with the Persians.

Vases in black and red figured decoration, "Attic-Corinthian" and "Proto-Attic," point to the fact that not only was there a celebration after the funeral rites, but that probably annual celebrations were held on the field.

The British school working at Megalopolis is clearing the parliament house or *Thessilion* of the 10,000 Arcadians. It is a most interesting type of an early Greek building. The "columns radiate from the center, so as to obstruct as little as possible the view from all parts of the house, while they still preserve in their plan the lines parallel to the sides of the building necessitated by the structure of the roof."—*Condensed from American Journal of Archæology.*

Hard Water.

BY SIR BENJAMIN WARD RICHARDSON, M.D., F.R.S.

In many fashionable and, in many respects, beautiful and healthful watering places, much inconvenience is experienced from the hardness of the water. I could point to two famous seaside towns where real injury to health is the result of the hardness of the water. The visitor arriving there for change and rest finds himself for a few days much improved, owing to the change of air and repose from work. Then he becomes low-spirited, is dyspeptic, feels himself distended with gases in the stomach and intestines, sleeps indifferently, is constipated, passes a large quantity of pale urine, is somewhat hysterical, and declares that the place, much as he may admire it, does not suit. Sometimes he feels pain in the stomach, rising up on the left side to the shoulder, and speaks of his liver being sluggish. He takes alteratives, but they do not relieve him, and he leaves, condemning the place for some fault he does not understand. In nine cases out of ten, all these symptoms are due to hardness of the water, and to nothing else.

The favorite sea resorts where this fault occurs ought to know this fact. Brighton ought to know it; Eastbourne ought to know it; Bournemouth ought to know it. These towns spend large sums on means admirably intended to make their visitors comfortable; but they fail in this one particular, vital as it is. They fail also without any reason, for they have the means at their command for remedying the evil at once, if they would only take the lesson. The governing body of every town where the water is hard should send a committee to the city of Canterbury to learn the simple method of softening the water by the Porter-Clark process on a large scale. Canterbury is not a fashionable watering place, but it has set the example of rendering healthful one of the grand necessities of life—drinking water. The inhabitants of that city have all their water supplied to them at four degrees of hardness, and the result is excellent in every way.

Hard water produces the temporary symptoms named above. It does more: taken for a long time, it causes derangement in the function of the kidney, and is very favorable to the deposit of stone in the bladder. It also interferes with the proper infusion of vegetable substances, like tea and coffee, and causes incrustation of vessels in which water is boiled. For ablution and for baths it is very objectionable, and it gives to the laundress much unnecessary trouble. So much the more important is it, therefore, that in all places, but in resorts of health particularly, it should be properly softened and made a surer means of cleanliness as well as of constitutional invigoration.

How to Soften Water at Home.—The above opusculum suggests to me to describe the late Mr. Alderman Hallett's mode of softening water on a small scale. It is very practical. Place near together two two-gallon stoneware casks. Fill one with the hard water, a half pint of lime water being first put in. After standing twenty-four hours the supernatant water will be as clear as at first, and at the bottom of the vessel will be found a precipitate of chalk. The shape of the vessel is best if cylindrical, with the tap-hole a short distance up the side. This form of vessel allows the process to be completed within twelve hours. The second cask (or vessel) is provided to insure a reserve of softened water while the other is being treated. No weighing of lime is required. The lime water is obtained by putting into a stoppered bottle fresh caustic lime, and water is to be poured on it to fill the vessel. In a few hours the upper part of the fluid is quite bright, and is saturated with lime. The charge of caustic lime need not be renewed oftener than every two or three months. If it is objected that the quantity is small, more vessels can be used, or larger ones, so as to meet the requirements. There is also an advantage in having the water only stored a day or two during hot weather, since on standing it soon ceases to have a brisk taste. Persons who are liable to irritation of the mucous membrane from hard water quickly derive benefit from the continued use of this softened water for drinking purposes.

The softening process might easily be adopted by laundresses by using large casks; the saving in soap would well repay them for a little trouble.

1 cwt. lime will do the work of 20¼ cwts. soap.
Cost of 1 cwt. quicklime, 8*d.*
Cost of 20¼ cwts. soap, £47 1*s.* 8*d.*

There is, therefore, very little question that the adoption of some such mechanical means of mixing, combined with a rapid filtering of the separated chalk, is soon paid for through the large saving in soap alone.—*The Asclepiad.*

Destructive Fires.

Several disastrous fires have lately taken place by which property to a large amount has been destroyed. On Sunday, May 12, soon after the morning service was over, a fire broke out in the organ loft of the great church of Dr. Talmage, Brooklyn, N. Y. In a very few minutes the entire edifice was in flames, which spread with astonishing rapidity to the adjoining buildings, one of which, the magnificent new hotel known as the Regent, was soon destroyed. Several dwelling houses were also damaged. The fire in the church was supposed to be due to a spark from one of the electric attachments of the organ. The loss on the church is $350,000. Loss on Regent hotel, $850,000. Loss on other buildings, $150,000.

On May 15 a fire kindled by boys underneath the grand stand of the Boston Baseball Club set fire to that structure, which created such an intense heat and spread so rapidly to adjoining buildings that three fire engines had to be abandoned and were lost in the flames. The adjacent buildings were mostly dwellings of wood, and the fire licked them up with amazing swiftness. Nearly twenty acres were burned over, embracing over a hundred buildings, rendering five hundred families homeless. Loss, $500,000.

May 12 the barrel house of Emery's refinery in Bradford, Pa., took fire, presumably by spontaneous combustion. The loading racks and five oil tank cars standing on a side track of the Buffalo, Rochester & Pittsburg road were also burned. A dome of the iron tank was shot up into space 300 feet, and came down with a crash an eighth of a mile away.

Search Lights and Torpedo Boats.

A test of the value of search lights for naval purposes was lately made at the naval station, Newport, R. I. It was arranged that during the evening of the 15th inst. the torpedo boats Cushing and Stiletto should endeavor to enter the harbor while search lights should be employed in detecting them if possible.

The Cushing was painted nearly a black, while the Stiletto was left a dark green. The test took place at 9:30 in the evening. The boats entered the range of the search light and passed to their anchorage while the officers were still looking for them at the entrance to the bay. For ten minutes the boats were in the open channel, but the deep color of the vessels blended with the color of the rocky shores so they were not detected.

In general, the search lights may be depended upon to show up the presence of vessels at a distance, but in this case there was a failure.

Remedy for Onion Maggot.

Half a pint of kerosene is well mixed with a pailful of some dry material, preferably wood ashes, but sand, sawdust, or even dry soil will do fairly well, and after the plants are well up and the trouble is at hand a sprinkling of this mixture along the rows about twice a week during the time the fly does its work will be found a sure preventive.