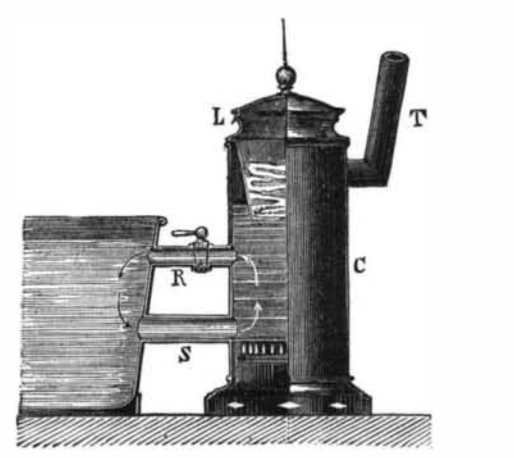
of the Yellowstone, with the spouting geysers in the valley of the Fire Hole river. Neither language nor the painter's genius and skill are adequate to describe either. The lower falls are more than 390 feet high. The walls of the grand cañon are some 2,500 feet in depth, and are colored by hues so various and brilliant that human art despairs of any attempt to reproduce them. "The wealth of red and yellow, brown and orange, pink and green, black, gray, and white fascinates and bewilders every beholder," according to Professor Marshall, "seeming to reproduce before his admiring gaze all the ravished splendors of a very gorgeous sunset, whose charms, no longer evanescent, are here not painted but dyed through and through these mighty cliffs, and made as eternal as the everlasting mountains they buttress." The geysers are even more grand and magnificent, because accompanied by much of the pomp and circumstance of elemental war in the spouting of immense columns of hot water to the height of 90 to 250 feet or more, in the shooting up of vast volumes of steam to an occasional altitude of 1,000 or 1,500 feet, and in the rumbling sound and vibrating motions that accompany the earthquake shock. There are three known geyser basins, but two of which have, however, been explored. These are in the valley of the Fire Hole already referred to, and lie to the westward of Yellowstone Lake, from which they are reached by a tolerably well worn trail. Some of the orifices of the geyser cones are twenty feet in diameter, and during an eruption a column of hot water, filling this orifice, rushes outward and upward with terrific force, and to altitudes varying from 15 to 275 feet in some cases. The cones, rims, and basins formed by the deposits from the springs and geysers are among the most magnificent of their attractions. Many of them have all the beauty of finish and brilliancy of coloring of the finest porcelain, while the waters within the rims and basins of many of the springs are so perfectly transparent that the smallest objects may be seen at the depth of forty or fifty feet.

Our purpose in referring to the park was not so much to attempt a description of its really indescribable wonders, as to call attention to the work of vandalism already inaugurated within it by tourists and visitors. Many of the magnificent structures built up by the action of the hot springs and geysers are being disfigured and destroyed by trophy-hunters and others, actuated, too often it is to be feared, by a pure love of destruction. This shameless raid upon the varied glories of the "Wonderland" should at once be stopped by the strong arm of the law. Congress ought promptly to take such action as will protect and preserve the decorations that Nature for ages past has treasured up among these "everlasting hills," and in the radiant valleys of the upper Yellowstone. A resolution was passed at the recent meeting of the American Association for the Advancement of Science, calling upon our national authorities to act in this matter. It is a subject of quite as much interest to educators as to men of science, inasmuch as the park may be justly regarded as a vast museum whose unlimited resources are capable of illustrating almost every object of thought or subject of study within the range of created existences. Let our educators and friends of education, therefore, add their voices and votes to those of the scientists in the effort to preserve from desecration, and for the high purposes of instruction, the grandest heritage of natural sublimity, beauty, and utility ever bestowed upon man.—*The Educational Weekly.*

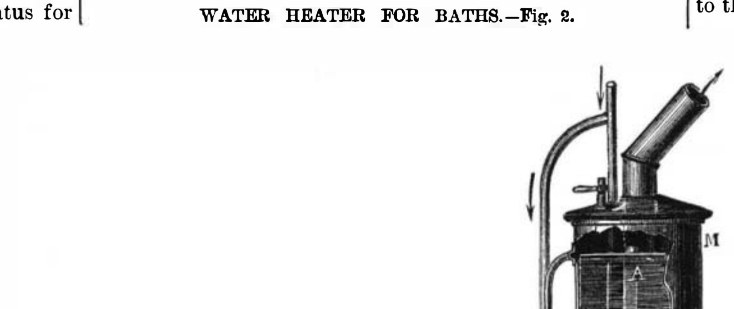
WATER HEATER FOR BATHS.

The annexed engravings represent a simple apparatus for heating water for bathing purposes. The heating device, in Fig. 1, is a small stove surmounted by a flue, A B, leading to the chimney. Surrounding the flue and fire chamber is the water reservoir, M N, which communicates with the bath tub faucets. Cold water enters this vessel in the direction of the arrows.

A still simpler construction is shown in Fig. 2. The bath tub communicates by two tubes, R, S, with a cylinder, C, which is filled with water and heated by lamps or a ring of gas burners underneath. In the upper portion of the cylinder is a receptacle for warming towels, linen, etc.



WATER HEATER FOR BATHS.—Fig. 2.



WATER HEATER FOR BATHS.—Fig. 1.

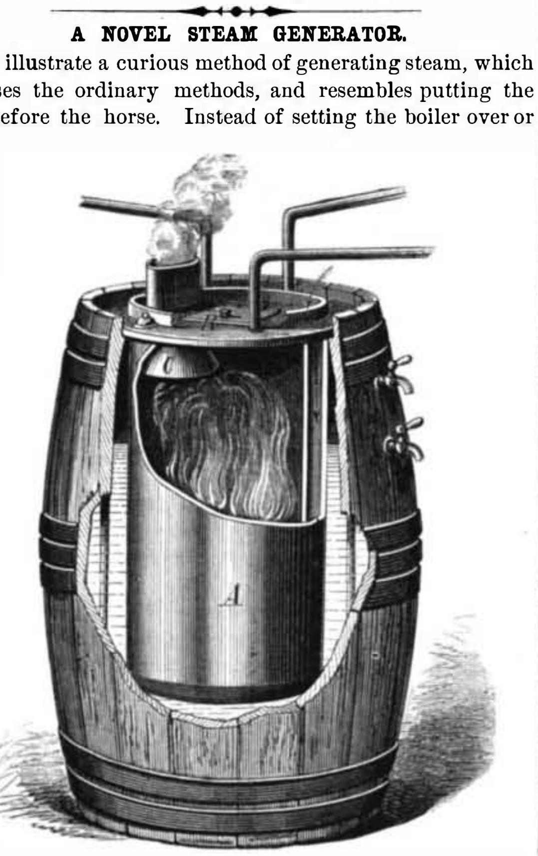
A Blue Printing Process.

The following process, says *Photo. Wochen-Blatt*, may be recommended for printing purposes: Float Saxe or Rive paper for from four to five minutes in a solution of citrate of iron. A tolerably well saturated solution may be obtained by stirring the salt for a considerable time on the boil. The sensitized paper is then dried in the dark, and exposed under the negative till a feeble yellowish trace of the lines of the picture is visible on the paper. In summer five or ten minutes will be found sufficient, and in winter from thirty to fifty for the printing. The prepared side of the paper must be then drawn gently (for a few seconds) over a tolerably strong solution of red prussiate of potash, when with great rapidity there is developed a blue picture, which should be quickly passed through pure spring water, and, if not then sufficient ly strong, placed again for several seconds in the above solution, and then for a short time thoroughly well washed. An over-exposed picture develops so quickly that there is hardly time to wash it before the lights begin to tone.

This process of blue printing is of great importance to engravers, who restore by it the stencil for the pantograph. Also for enlargements, wood engraving, etc., it is very useful, and can be worked at a fabulously cheap rate. By washing the picture when finished in water, to which a little ammonia has been added, it will appear more of a violet tint.

A NOVEL STEAM GENERATOR.

We illustrate a curious method of generating steam, which reverses the ordinary methods, and resembles putting the cart before the horse. Instead of setting the boiler over or



in the fire, the fire is placed over and in the boiler. The barrel in the illustration is cut away to show the interior construction of the generator. A is a sheet iron cylinder closed at both ends and fitted to a cast metal barrel head, B, the lower part being immersed in the water contained in the barrel. A brisk fire is lighted in the cylinder and kept supplied with fresh air by the flue indicated by the arrows. The funnel, C, acts as a stove pipe. An opening in the barrel head gives access for fuel. The bent pipes shown rising from the barrel carry off the steam generated to any point. Very little heat is thus wasted and a head of steam is quickly secured. This ingenious device was patented through the Scientific American Patent Agency, by T. F. Butterfield, of DeWitt, Iowa.

Astronomical Notes.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, January 19, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises............	6 08 mo.	Jupiter rises..............	6 47 mo.
Venus sets.............	8 18 eve.	Saturn sets................	8 55 eve.
Mars in meridian..........	5 29 eve.	Uranus rises...............	7 21 eve.
Mars sets.................	0 04 mo.	Neptune in meridian.....	6 16 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Sirius rises..............	5 42 eve.	Altair sets	6 18 eve.
Procyon rises.............	5 17 eve.	Fomalhaut sets....	6 53 eve.
Regulus rises	7 20 eve.	Algol (2d mg. var) in merid.	7 03 eve.
Spica rises	11 58 eve.	Capella in meridian	9 10 eve.
Arcturus rises............	11 00 eve.	7 stars (cluster) in meridian	7 43 eve.
Antares rises.............	4 08 mo.	Betelgeuse in meridian....	9 51 eve.
Aldebaran in meridian ...	8 32 eve.	Rigel in meridian.........	9 11 eve.
Vega sets	7 30 eve.		

REMARKS.

Mercury rises 1 h. 13 m. before the sun, and 48′ north of the sunrise point. He will begin to advance, or move eastward among the stars, January 21. Venus is a large crescent. Jupiter rises 34 m. before the sun, and 2° 54′ south of the sun's path. Uranus is approaching Regulus in right ascension, and is now ½° east and 8′ north of the star. Neptune commenced advancing among the stars January 16. Algol will be at minimum brilliancy January 19, 9 h. 23 m., evening; also January 22, 6 h. 12 m., evening; for Washington time, subtract 12 m., for Boston, add 12 m. By an oversight the time of minima, etc., of Algol, last week, was given for Boston. Regulus is occulted by the moon this evening. This is the only bright star occulted this month. It will not be visible north of 16° south latitude. At Rio Janeiro it takes place 1 h. 30 m. after sunset, the moon being ½ hour high, and near the full.

Professor Tyndall on the Development of Bacteria.

Professor Tyndall has recently addressed a letter to Professor Huxley in which he details the results of experiments on the development of bacteria which he thinks settles the question of spontaneous generation, to the destruction of that hypothesis. Fifty flasks containing various organic infusions were sterilized by boiling. Twenty-three were then opened in a hay loft, and the remaining twenty-seven (with special precautions that the air should be uncontaminated by his own presence) were opened by Professor Tyndall on the edge of an Alpine cliff. Both were then placed in a warm room, with the result that twenty-one of the twenty-three flasks opened in the hay loft became speedily filled with organisms, while all the flasks opened on the edge of the precipice remained as clear as distilled water. This furnishes remarkable evidence of the influence of the air on the development of the bacteria, but biologists will hardly acquiesce in Professor Tyndall's rather sanguine assertion until his no less positive opponents, and most especially Dr Bastian, are heard from.

The Oroheliograph.

M. le Commandant de la Noë lately presented a curious looking panoramic instrument to the Photographic Society of France, which he called "Oroheliograph." In a few words, it consists of a camera, the place of the ground glass forming the base, and the lens looking up perpendicularly to the sky. Over the lens is placed a silvered mirror, half globe-shaped, completely circular on its plan and parabolic through its vertical section. The result is that an image of all surrounding objects reflected from this half-ball-shaped mirror is received by the lens always in focus thereon, and transmitted thereby upon the sensitive plate underneath, with its surface forming a right angle with the axis of the lens and circular mirror; by this means a circular panoramic view of the horizon is obtained, as seen from the station the oroheliograph occupies.

The instrument shown to the Society is the first rough model, and the proof exhibited showed some astigmation which would be corrected.

Mr. W. Harrison, in a letter to the *British Journal of Photography*, states that the vertical lines are true and sharper than the horizontal ones; this is caused by the use of a defective reflector silvered on the exterior, which will, however, be obviated. The curves were calculated by Colonel Mangin, of the Engineers. The instrument is considered of value for military reconnaissances, and the angles and heights can be measured from the views taken at two or more stations.

New Tests for Milk.

For the analysis of milk, Professor Lehmann, of Munich, proposes the following: A weighed quantity, say 9 or 10 grammes of milk, is diluted with an equal weight of water, and poured out in a thin layer upon a porous plate of burnt clay, very dense and fine-grained. The water of the milk, as well as the milk sugar, albumen, and a portion of the salts dissolved in it, are absorbed by the clay plate, while the total amounts of fats and casein in the milk remain on the plate in the form of a thin skin or film. This film is easily removed with a horn spatula, and then dried and weighed. If it is desired to determine the fats alone, this film may be extracted with ether, and thus the two most important constituents of milk very quickly determined. In many cases it is sufficient to know the total weight of the principal solid constituents of the milk, hence also the amount of water, for which scarcely two hours are required. —*Public Health.*

The Hoosac Tunnel.

This tunnel, near North Adams, Mass., which was completed some time ago so far as to admit the passage of trains, was found to need an extension at the east end in order to prevent the downfall of the rocks upon the track from the cliff at that end of the tunnel. This facade and buttress have just been completed, and the tunnel and track are pronounced in prime order, and ready for all the business which may seek to pass through the great bore. The artificial façade is constructed of granite, some of the blocks weighing from four to five tons each. The arch extension is about 25 feet, and the façade about 60 feet long by 40 feet high.

The Springfield *Republican* says: "Only one track is laid at present in the tunnel. The trains are run by telegraph, passenger trains being allowed ten and freight twenty minutes to pass. Three lights, equidistant, are affixed to the sides of the tunnel, dividing the distance into four sections. The lights are for the purpose of enabling the engineers to regulate their speed, and they are required to maintain a uniform gait the whole distance. At the central shaft two lights are displayed, to indicate when the summit is reached and the grade declines—which it does each way to afford drainage, being sixty feet lower at each portal than at the central shaft. As the trains plunge into the impenetrable darkness the time is recorded, and again when they emerge, by operators situated at either end of the tunnel, and forwarded to the general dispatcher at North Adams. The passage seldom varies a minute. The tunnel is never occupied by two trains at the same time, and no train is allowed to enter until the preceding train has made the exit. No equal distance of the road outside is traversed with so uniform speed, nor with so much safety, the track, which cannot be excelled, being perfectly straight. The roof of the tunnel is considered perfectly safe, not a piece the size of a walnut having been detached for a year, and about a mile and one third of brick arching having been built to sustain all doubtful localities, in sections from ten feet upward. Still, the roof is under constant examination by men on top of an elevated carriage, which is propelled along the road. Admittance to visitors is strictly denied. Occasionally the tunnel is so free from fog and smoke that, standing at the central shaft, daylight can be discerned at both portals, showing about ten feet in diameter, but usually light can be discovered in only one direction, that from which the wind comes, the current driving the smoke before it up the shaft, and leaving the other half of the tunnel motionless and usually dense with smoke and fog. A floor composed of oak, fourteen inches thick, let into grooves cut into the rock on a steep incline, prevents any pieces detached from the sides of the shaft from falling on to the track. At the summit of the mountain the opening of the shaft is inclosed by a stone wall twenty-feet high."

Subsidiary to the great Hoosac Tunnel is that of North Adams, nearly two miles west of the former. This work, too, has just been completed. This is described as a skew arch, and the work is spiral; the abutments are parallel, but not at right angles, crossing the road diagonally. The stones are dressed spirally, and three or four patterns to each individual block had to be furnished the cutters, and no two stones are alike. The continuation of the tunnel is 65 feet in diameter, 26 feet inside of the completed work, with a plain façade of 40 feet high and 50 feet long, and immense wing walls; the coping is surmounted with an iron sidewalk and fence 75 feet long. This structure is a substitute for the dangerous old Furnace Hill bridge.

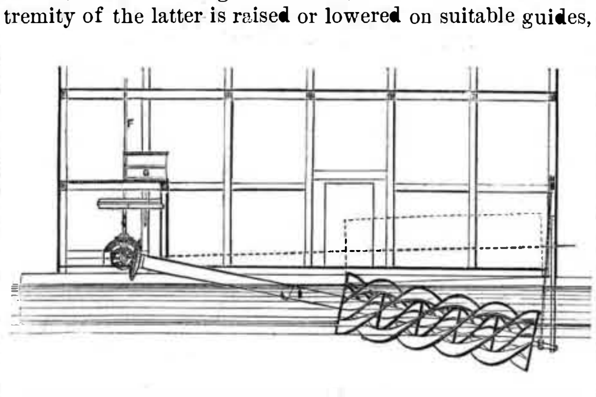
Progress of the Metric System.

At a late meeting of the American Metrological Society Prof. J. E. Hilgard, of Washington, in an address on the "Progress of the Metric System," stated that the United States had not yet been formally constituted a member of the International Bureau of Weights and Measures. The preliminary steps had been taken toward this end, and the matter now rested at the disposal of the Senate Committee on Foreign Relations. The French Commission is busy in preparing the new standards of weight and measure. This is a work requiring extreme accuracy to obtain uniform results. The manipulations are of extreme delicacy. Special apparatus and tools have to be invented and made, and months elapse in their construction. These difficulties will be eventually overcome, and the progress already made is a guarantee that standards of uniformity and accuracy will be made for distribution among the nations which take part in the convention.

In regard to metric standards for the United States, Professor Hilgard said that the standards for separate States had been tendered to each, and were very generally accepted. About thirty States have received their standards and placed them on exhibition in public places where they will be accessible for reference. These standards consist of two metres, a kilogramme, a half kilogramme, a litre and a half-litre. Professor Hilgard mentioned that, when the original iron metre, now eighty years old, was compared with the modern standard, it was found that its difference was less than a thousandth of a millimetre. The trial was made when the iron metre was sixty-seven years old, and it is conclusive in favor of iron for this use, as its changes are so exceedingly small. But a comparison between our standards was less favorable. The iron metre was compared with the standard yard, the latter being of bronze, made to be used at a temperature of 62° Fahr. These differed by the 4000th of an inch, which is a very sensible alteration. Several new methods of making quick approximate comparisons between yards and metres have been considered by Professor Hilgard. Two of these he mentioned. Divide a yard into four equal parts by bisections. Then put together three of the four parts and divide that length into eight parts by bisections. The addition of one of the eight parts to the yard will give a metre within a fraction. Another method, which is preferable on many accounts, is to divide 45 inches into eight parts, seven of which will be a metre very nearly; the 45 inches can be easily obtained by adding a fourth to the yard. It is designed to make the old standards useful by inserting little silver plugs which mark upon them the metrical divisions.

A NEW TIDE MILL.

The annexed engraving exhibits a novel form of ship-mill designed to be driven by tide or current power. It consists simply of a series of spiral wings arranged near the end of, and at an angle of 45° to, a shaft. The outer extremity of the latter is raised or lowered on suitable guides,

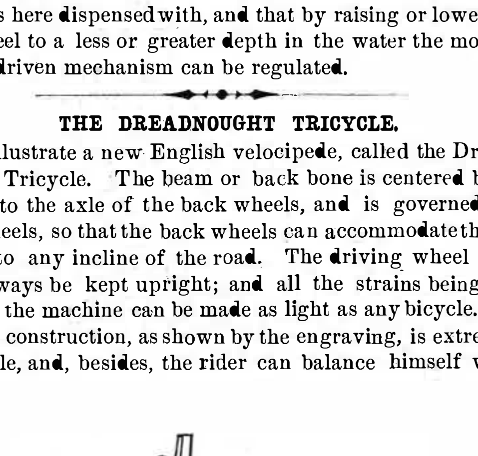


and from the inner one the rotary motion of the shaft is imparted to suitable bevel gearing. The outer end of the shaft is lowered so that an angle of 45° is formed, this being considered as best adapted to allow the screw most advantageously to intercept the passing water.

It will be noted that a second tank or ship for storage of water is here dispensed with, and that by raising or lowering the wheel to a less or greater depth in the water the motion of the driven mechanism can be regulated.

THE DREADNOUGHT TRICYCLE.

We illustrate a new English velocipede, called the Dreadnought Tricycle. The beam or back bone is centered by a slot on to the axle of the back wheels, and is governed by side wheels, so that the back wheels can accommodate themselves to any incline of the road. The driving wheel will thus always be kept upright; and all the strains being removed, the machine can be made as light as any bicycle. Its general construction, as shown by the engraving, is extremely simple, and, besides, the rider can balance himself with



scarcely any difficulty whatever. The English still seem to be much interested in velocipedes, and the improvements in their construction are very numerous. The excitement quickly died out in this country, though it will probably, before long, be again brought over from England. The illustration is from the *English Mechanic*.

Fish Culture.

There are now twenty-seven States whose Commissioners of Fisheries receive, hatch and distribute the eggs of fishes furnished by the United States Fish Commission. About 4,000,000 eggs of California salmon were thus distributed in October. Congress has appropriated $5,000 toward preparing ponds near the Washington Monument for breeding the carp, a European species being regarded as desirable for introduction here. The Wisconsin Fish Commissioners report a large amount of work, having hatched and distributed 1,736,000 lake trout, 6,295,000 whitefish, and smaller amounts of brook trout and California salmon. The question whether our lakes will prove fitted for California salmon will soon be determined. The hatching has been successful with about 90 per cent of the eggs. The Fish Commissioners of Maine report an unusually large quantity of salmon, principally due to the efforts at fish culture, in most of the rivers of the State. Several ponds have been stocked with black bass, as an antidote to pickerel. In the Mattawamkeag River, 80,000 shad fry have been placed.—*Tribune.*

Anti-Fire Construction.*

One of the indispensable requirements of architecture is stability—permanence. And yet of all the buildings ever erected, how few still remain! Even that achievement of engineering skill, the Eddystone Lighthouse, which has bravely resisted the power of the Atlantic for one hundred and twenty years, is at last undermined and must fall. The elements in their unceasing action sooner or later triumph over the proudest works of man. Of the elements at work in this destruction, there is none so active, so successful, as fire. With what fiendish relish does it lick up the combustible, and ruthlessly tumble the residue in shapeless ruin! History teems with its work of desolation. The cities of the Old World have all sadly suffered by its ravages: I will refer to some of them.

GREAT FIRES OF THE WORLD.

The great fire of London, in 1666, burnt for three days, destroying 13,200 houses, including many fine public buildings. The loss by this fire, if computed by present values, would amount to at least $100,000,000.

The city of New York has suffered by at least three great fires. One in 1835 destroyed 600 warehouses, which together with contents were worth $20,000,000. Another in 1839 destroyed property to the amount of $10,000,000; and a third in 1845 destroyed 300 stores and dwellings, valued at $6,000,000. Charleston in 1838 suffered by a fire which destroyed 1,158 buildings, covering 145 acres. Pittsburgh, in 1845, lost by fire 1,000 buildings, valued at $6,000,000. Albany, N. Y., some years since lost in steamboats and buildings $3,000,000. St. Louis, in 1849, lost $3,000,000 in steamboats and buildings. Philadelphia, in 1858, lost 300 houses. In 1845 two thirds of the city of Quebec, comprising 2,800 houses, were swept away by fire. The city of St. John's, Newfoundland, repeatedly damaged by fire, was nearly all destroyed in 1846, when 6,000 people were rendered homeless. Troy suffered severely in 1862. Portland, in 1866, lost $9,000,000, including the loss of 1,600 buildings. Chicago, in 1871, and Boston, in 1872, were devastated to the extent of more than $200,000,000; and quite recently a devastating fire has almost entirely destroyed the city of St. John, N. B. But these marked fires do not alone measure the work of destruction; much is due to the smaller fires, which make up by their frequency what they lack in proportions. Constantly at work, little by little, year by year, the aggregate of ruin they accomplish is fearful.

ANNUAL LOSSES BY FIRES.

A record kept by the New York *Insurance Chronicle* shows that the loss by fire in the United States and Canada in 1876 was $75,000,000, and in the previous year it was $86,000,000. This record is trustworthy, as far as it goes; but I am assured by competent authority that the loss during the last ten years has not been less than $100,000,000 per annum, not including the two extraordinary fires of Chicago and Boston. What a fearful havoc! Is there no remedy?

The losses in the United States and Canada during the last twenty-five years aggregate an amount which would have sufficed to have rendered all the buildings approximately fireproof. A few figures will show this. The United States census for 1870 gives the value of the real estate of the country, but not the value of the buildings alone. This, however, may be approximated. From an estimate made upon the property within certain limits of the city of New York, the value of the buildings was found to exceed considerably the value of the ground built upon. The buildings in the rural districts, however, are of much less value than the land, perhaps not half. A fair average for the two—city and country—would perhaps be one third the value of the real estate. The census for 1876 puts the value of the real estate at about $9,900,000,000, one third of which, $3,300,000,000, then, is the value of the buildings.

This result may be tested by estimates upon another basis. It is shown in the last report of the National Board of Fire Underwriters, page 27, that the insurance effected during the last five years averages about $5,170,000,000 per annum; and it is shown by the records of the New York *Chronicle* that not more than half of the losses by fire are covered by insurance: hence the $5,170,000,000 insured is only half of the insurable property of the country; or, the value of the property of the United States and Canada, liable to loss by fire, is not less than $10,340,000,000. This is the value, not of the buildings alone, but of the buildings and their contents. To ascertain what portion of this is invested in buildings, it is shown by the New York Board of Fire Underwriters in their last report, page 23, that in an average of the losses for the past eighteen years, the portion on buildings was about one third of the whole. Taking this as authority in the matter, one third of $10,340,000,000 is $3,447,000,000 for the value of the buildings in the United States and Canada, which cannot be far from $3,300,000,000 for the United States alone, as before shown.

Of the $100,000,000 annual loss, one third may be taken as that which was invested in buildings; and, had the buildings been of a character to resist the flames, a large part,

* A paper read at the recent Convention of the American Institute of Architects by R. G. Hatfield, F.A.I.A.