to throw an engine from the track, and to throw down many buildings and destroy some lives; but every year records more violent shocks than this one, in some parts of the earth.

What would happen in New York City if one of these shocks, or, perchance, a more severe one, should be repeated there? It is enough to fill one with alarm to think of the possibilities. Huge, top-heavy church steeples, mammoth buildings with projecting cornices, tumble-down structures, which even now, without the aid of an earth jarring, collapse and destroy human life—all of these stand ready to be used as death-dealing instruments whenever capricious nature causes a slight movement of the rock in that neighborhood. The occurrence of an earthquake in New York like that which occurred in the prefecture of Gifu, in Japan, a little over a year ago, or like that of Lisbon, in 1755, would remove the city from the face of the earth. This may never come—but, again, it may. Are we doing right in defying nature? We take our chances, and the chances are, it may be said, against any such dire calamity; but, if it should come, and it may, what then?

If one will examine photographs of the Charleston earthquake, he will notice that the effects of the shock were very different upon adjoining buildings. Some buildings were completely wrecked, while their neighbors were scarcely strained; and, if one will examine the reasons for this, he will find that in most cases it was a question of mortar. Moreover, the buildings which were oldest were apt to be least disturbed—our predecessors used better mortar than we do. The same thing is noticed in the recent earthquake in Japan. The modern pottery and tile buildings were badly wrecked and destroyed, but the old temple of Nagoya stood, and was only slightly damaged.

Our engineering schools instruct their students in the difference between good and bad mortar, and our architects and builders know full well which is good and which is bad; but the all-powerful dollar is the thing striven for, and immediate utility is sought after at the expense of strength and permanency. State and national laws are enacted and private rights set aside to prevent the landing of a cholera germ, which might be the means of killing a few thousand people—mostly undesirable citizens; but there is practically no protection from falling buildings. A building is condemned, it is repaired, perhaps by painting and the placing of a few timbers; it collapses, an investigation follows, some one is to blame, but no one is found guilty, and so we are any of us liable to walk into a death trap. The man who first built the building is to blame; those who allow it to remain standing are almost as much to blame; but they reap the reward; some innocent persons suffer loss of life or limb. An earthquake shock would effectually raze these to the ground, and with an effect, reckoned in loss of life, compared with which a plague of cholera would be but nothing. I sincerely trust that we shall not have the lesson of proper and sensible methods of construction forced upon us in this disastrous manner; but we may.

The Schuylkill Valley.

At the recent meeting of the American Institute of Mining Engineers, at Reading, Pa., the president, Mr. John Birkinbine, took for his subject "The Industrial Progress of the Schuylkill Valley Region." Iron was first made in Pennsylvania in 1692, and the first successful iron enterprises were the Bloomery forge, 1716, and the Coalbrookdale blast furnace, 1720. In 1731 pig iron was sold at the latter furnace for £5 10s. per ton. From 1720 to 1740 a number of furnaces and forges were established in this district. The Warwick furnace was built in 1738, and remained active for 130 years. It was 32 ft. high, with a bosh 7½ ft. to 9 ft. diameter, blown with wooden bellows, and producing twenty-five to thirty or even forty tons of iron per week.

The present Warwick furnace—referred to later on—is 70 ft. high, 16 ft. diameter at the bosh, and averages 750 tons—maximum, 875 tons—of pig iron per week. With the remodeled furnace, powerful blowing engines, and new hot blast stoves, still better results are anticipated. None of the present industries are over fifty years old. The Pottstown Iron Co.'s works have grown from a small plant, employing 200 men, to one which now requires 2,000 men to operate its blast furnaces, steel works, rolling mills, etc., and turns out about 1,000 tons of product daily. These works were pioneers in commercially manufacturing fertilizers from slag. At Birdsboro a forge was established in 1740, and one of the first rolling mills in the country, and a nail factory, were in operation before the revolutionary war. In this neighborhood is the Cornwall charcoal furnace, 150 years old, the oldest now standing in the country, and near it is the Cornwall bed of soft, magnetic iron ore, from which 12,000,000 tons have been taken out. Near Pottsville was the furnace which first introduced the hot blast, and first successfully produced anthracite pig iron, and also the first American blast furnace in continual operation on anthracite fuel alone for three months.

The practicability of the use of anthracite coal in place of charcoal was proved in 1840 by Mr. David Thomas, the first president of the Institute, and the use of bituminous coal naturally followed. Anthracite coal was not shipped in any quantity until 1820, but the output of the Pennsylvania anthracite fields has now grown to exceed 40,000,000 gross tons per annum, for the mining of which $40,000,000 per year are paid in wages. The Pottsville shaft is 1,586 ft. deep, but this is kept in reserve, and no mining is done. The collieries now at work go as deep as 900 ft., and some produce 375,000 to 450,000 tons of coal per annum, having coal breakers which cost $75,000 each, and can handle 2,000 tons of coal. There are nine veins of coal, six of which are persistent, and have a thickness of 6 ft. to 33 ft., while the Mammoth vein occasionally exceeds 100 ft. in thickness. The resources of the Schuylkill Valley appear to be far from exhaustion. The annual production approximates 15,000,000 tons of anthracite coal, 600,000 tons of pig metal, and an equal amount of rolled iron and steel, much of which is converted into bridges, roofs, machinery, stoves, hardware, etc., and to these must be added the glass, paper, textile, and other industries, which render this one of the most important mining, manufacturing and industrial districts of the United States.

Statistics of the Running of a Watch.

Watches were formerly highly esteemed, and the greatest care was taken of them, but since they have become cheap, they are ruthlessly submitted to all causes of destruction (falls, dust, sudden changes of temperature, magnetism, etc.), and the owners are sometimes astonished at their refusal to run. Yet, as compared with any sort of a machine, an ordinary watch is a marvel. A few figures will make this understood. The spring actuates the barrel, the motion of which is transmitted through three wheels to the escapement, whose wheel strikes the anchor or the cylinder of the balance wheel at an average rate of 8,000 blows per hour (with differences of from 3,000 to 4,000, according to the system). Another gearing retards the motion transmitted to the hour hand in the ratio of 12 to 1. All the motions of the watch are discontinuous, and are effected in little equal jumps, the number of which exceeds two hundred million a year in certain watches. Those who are careful about preserving their watches have them cleaned every two years, that is to say, after 300 or 400 million impacts. At the end of twenty years a well made watch, and one that has not been destroyed prematurely, must undergo a change of a few pinions, but it is after several thousand million of the little jumps that we have spoken of, and after the escapement wheel has made tens of millions of revolutions. If to this we add complications such as the chronograph and watches giving the date and repeating the minutes, we remain astounded at their possibility. As for the distance traveled by the exterior of the balance, that is so unexpected that all our readers, we think, will admit the result only after having verified the calculation.

The balance of a 19 line watch measures on an average 0·66 of an inch in diameter upon the regulating screws. It makes 5 oscillations of one revolution and a half per second, say a travel of 15·5 inches per second, 20 miles per day and 7,500 miles per year in round numbers. Now watches that give the perpetual date are provided with a wheel that makes one revolution in four years. During this time the balance will have made the tour of the world. The small amount of power utilized for the running of a watch is no less extraordinary. According to the *Journal Suisse d'Horlogerie*, a watch spring weighing 30 grains is capable of running a watch forty hours. At the rate of 72·5 foot pounds available per pound of steel we shall have 0·29 foot pound for forty hours, or 0·00725 foot pound per hour. One horse power develops in one hour 543·75×3,600=1,957,500 f. p. A watch requires then,

$$\frac{0{\cdot}00725}{1{,}957{,}500}=\frac{7{\cdot}25}{1{,}957{,}500{,}000}\text{ f. p.}$$

in other words, a one horse power would suffice to run 270 million watches, or probably all the watches that exist on the globe. And, again, it is the escapement that consumes the greater part of such power. In fact, the escapement wheel sets itself rapidly in motion and undergoes an abrupt stoppage, which, according to the principle enunciated by Lazare Carnot, always occasions a loss of live power, or, as we would say to-day, a waste of energy. The resistance of the air to the motion of the balance and the coiling and uncoiling of the hair spring also occasion losses. What remains for the gearing and the arbors? Not much, assuredly. And all this mechanism, placed under various conditions of position, temperature and air pressure, manages to run at less than a second variation, about, per day.—*La Nature.*

IN August last the planet Venus was visible in the day time at San Diego, Cal. A California correspondent writes that he was one of many who witnessed the phenomenon, and says it was especially noticeable, as the planet could be seen with the sun almost shining in one's eyes.

Correspondence.

Another Brooks Comet.

To the Editor of the Scientific American:

On the morning of November 19 I discovered a new comet, in the constellation Virgo. The discovery position was right ascension, 12 hours 56 minutes 40 seconds; declination, north, 12° 59'. Motion, slowly northeast. The comet can be seen in telescopes of moderate size. WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y., Nov. 25, 1892.

Fog Lighting in London.

A good deal of silly talk has been heard of late from various quarters respecting the imminent decadence of the metropolitan gas industry; and some of the trade union leaders in particular have tried to make out that there is less employment to be had in gasworks than heretofore, on account of the imaginary falling off in the consumption of gas. All this airy nonsense disappears at the first touch of such a reality as that which recent meteorological influences have put in evidence. A downright dingy, dirty, wretched week of weather, such as we seem to get in London more frequently than ever, makes everybody fly to gas for light and comfort. Not only in the streets, but in the railway stations, when it becomes a question of carrying on business under the worst conditions, the "light of luxury" is left alone; and the reliable friend of the townsman is brought forward as though nothing else had ever been heard of. Although the experience is not a very enjoyable one, it is instructive to make a pilgrimage through a mile or two of the most frequented of the London thoroughfares when at midday it is impossible to see across the street. Here and there a huge industrial or commercial establishment—a printing house or factory for the manufacture of fancy goods—looms grandly through the thickened atmosphere, radiating light from roof to basement.

The best effect, however, is produced by the shops wherein high power recuperative lamps are hung over the doors, or along the front, or where clustered Argands or flat-flame burners strongly illuminate the goods exposed in the windows. These places irradiate the neighborhood in a style unapproachable by other means. As for the wider street crossings and the railway yards, one longs, in the absence of a sufficiency of high-power gas lamps, for a few good "flares" of the Lucigen type. The sparse electric arcs are utterly ineffective at such times. They seem lost in the upper air; and a curious effect is produced by the unusual prominence of the glowing carbon spark, which gives the most powerful arc the aspect of a rather poor incandescent lamp. As to the latter, their lower tone helps them to penetrate the air that enwraps them like a dirty blanket; but the pleasant fiction about a nominal 8-candle lamp being to all intents and purposes equal to a flat-flame gas burner is utterly demolished by the inconsiderate atmosphere. All these are old truths; but it is just as well to keep them in the front when occasion serves.—*Jour. of Gas Lighting.*

Railroads of the World.

The Census Office has issued a bulletin giving statistics of the railway mileage of the world in 1890. It shows that out of a total railway mileage for the world of 370,281 miles the United States have no less than 163,597 miles, or 44·18 per cent of the whole, and that the railway mileage of the United States exceeds by 3,493 miles the entire mileage of the Old World, Europe's 136,865 miles, Asia's 18,793 miles, and Africa's 3,992 miles making an aggregate of but 159,655 miles. It is interesting to note the astonishing growth of the railway mileage of the United States from the census year of 1830, when there were less than 40 miles of railways, up to 1890. In 1840 the figures were 2,755 miles; in 1850 they had risen to 8,571 miles; in 1860 the total had swelled to 28,919 miles. The census of 1870 showed the mileage to be 49,168 miles; that of 1880 placed the figues at 87,724 miles; while the eleventh census figures give the astonishing total of 163,597 miles.

The following shows the mileage of the world by countries: Germany, 25,969 miles; Austria and Hungary, including Bosnia, 16,467; Great Britain and Ireland, 19,939; France, 22,586; Russia, including Finland, 18,728; Italy, 8,117; Belgium, 3,218; Netherlands, 1,887; Switzerland, 1,929; Spain, 6,127; Portugal, 1,280; Denmark, 1,223; Norway, 971; Sweden, 4,915; Roumania, 1,580; Servia, 327; Greece, 440; Turkey in Europe, Bulgaria, and Roumelia, 1,097; Malta, Jersey, and Man, 68; United States, 163,597; British America, (Canada), 13,322; Newfoundland, 115; Central America (Guatemala, Salvador, Costa Rica, Nicaragua, and Honduras), 559; Mexico, 5,344; United States of Colombia, 231; Cuba, 1,056; Venezuela, 441; Republic of San Domingo (eastern part of the island of Hayti), 71; Puerto Rico, 11; Brazil, 5,779; Argentine Republic, 5,129; Paraguay, 149; Uruguay, 470; Chile, 1,926; Peru, 994; Bolivia, 106; Ecuador, 167; British Guiana, 22; Asia, 18,798, of which British India supplied 15,837; Japan, 907; China proper, 124; Africa, 3,992; Australia, 11,137.

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