The Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY

At No. 37 Park Row (Park Building), New York.

O. D. MUNN, S. H. WALES, A. E. BEACH.

TERMS—Three Dollars per annum—One Dollar in advance, for four months.
Single copies of the paper are on sale at the office of publication, and all periodical stores in the United States and Canada.
Sampson Low, Son & Co., the American Booksellers, No. 47 Ludgate Hill, London, England, are the British Agents to receive subscriptions for the SCIENTIFIC AMERICAN.
☞ See Prospectus on last page. No traveling agents employed.

VOL. IX, NO. 22 ... [NEW SERIES.] ..... *Nineteenth Year*

NEW YORK, SATURDAY, NOVEMBER 28, 1868.

OPENING OF A NEW CAMPAIGN.

It appears quite evident to all who observe the signs of the times that Generals Grant and Meade are about to open a new campaign, which we trust will inaugurate glorious results. Not exactly following in the wake of these military chieftains, the Publishers of the SCIENTIFIC AMERICAN propose to begin, on the first of January next, a new and brilliant campaign in the fields of popular science, and they hope to give renewed assurance that this journal is fully up to the stirring events of the day. After a flattering success of eighteen years, the SCIENTIFIC AMERICAN will commence a new volume at the time mentioned, being the "Tenth" of the "New Series." The Publishers earnestly appeal to their friends and patrons, far and wide, to reinforce their subscription list by the formation of clubs.

They feel warranted in saying that no better expenditure of money can possibly be made than for a years' subscription to this journal, which is the only one of its class now published in the United States. The Publishers promise untiring devotion to the interests of their patrons. No department of the journal will be allowed to fall behind preceding years; while it will still be their aim to excel in every respect.

Friends and Patrons, we ask with confidence a continuation of your former patronage, and also your influence in promoting a wider circulation of this journal than it has hitherto enjoyed.

Our New Prospectus appears on our back page.

SHAPE OF LASTS, BOOTS AND SHOES.

A favorable change has lately taken place in the shape of the lasts that are employed to give form to boots and shoes. They are not only made broader at the toe than formerly, but also nearly straight on the inner side, with a right line passing through the center of the heel and the arch to the extremity of the great toe. Such lasts correspond more nearly in form to the anatomic structure of the foot. For this reform the public are indebted to Herman Meyer, Professor of Anatomy in the University of Zurich, who published a pamphlet on the Anatomy of the Foot, in relation to the Form of Boots and Shoes, to which we directed attention on page 266, Vol. VII. (new series), of the SCIENTIFIC AMERICAN. The Chinese have been ridiculed for practicing the custom of deforming the feet of their women, by subjecting them to a cramping, dwarfing operation from infancy. But nations of a more reputable civilization have for centuries been as blind to their own shortcomings respecting the feet of both sexes and all classes. Thus it has been customary to make childrens' and ladies' shoes of the form called straight—narrow at the toe, without regard to the form of the foot—so that they could be changed on the feet daily. It has also been customary to make men's right and left boots and shoes more narrow at the toe than the normal size of the foot. Ridiculous ideas respecting the shape of boots and shoes have occasionally been displayed in fashionable circles, and until recently correct ideas have not been entertained by any class. Deformity of the toes of the feet is quite common, more especially among men who have been accustomed to stand and walk a great deal. The smaller toes are usually cramped up and the large toe bent out of line, causing a deformed projection of its joint. These evils are due to the wearing of ill-formed boots and shoes. If we look at the form of a child's foot we notice that the heel is narrow compared with the front part of the foot, where the toes spread out like a fan, and the large one is separated from the second by a small space, and is also in a straight line with the inner edge of the foot. The little foot of a child is very beautiful, and very different from the same foot after having been subjected to the cramping operation of common boots and shoes for fifteen or twenty years. The ancient Greeks, so celebrated for correct ideas in matters of taste, followed nature in their works of art; hence, they have left us the most perfect models in works of sculpture. The feet of their female figures have the great toe slightly parted from the second, and straight in line with the inner edge of the foot, and fashion should conform to this standard in boots and shoes, as a departure from it exhibits an abnormal taste.

Professor Meyer says:—"All feet are perfectly alike in the principles of their mechanical construction, and the only differences in our healthy feet are those arising from varying length and breadth. In the original form of the foot we never meet with those essential differences designated by shoemaker's 'straight or bent feet,' and still less with such variations in which the great toe lies over, or with the thickness of the ball at its root." He attributes corns, bunions, gout, chilblains, unseemly protruberances and growing-in nails to the unsuitable form of the shoes in established use.

Shoemakers and last-makers have been blind to the anatomy of the foot, and the cause of toe deformity so prevalent everywhere. Advertisements, such as "lasts made here according to the shape of the foot" are quite common. In such places lasts are made from plaster casts of the feet. The idea is wrong, as boots and shoes made upon such lasts only tend to perpetuate evils. Lasts should be made according to the normal, not to the distorted, form of the feet. The chief defect in the form of lasts heretofore has been in making them too narrow at the front of the foot, and sloping them from the root to the point of the great toe. Boots and shoes made upon such models, press the great toe upon the small ones, and the joint at the metatarsal bone is thrust out of line, so that it forms a protuberance on the inner side of the foot.

The reform which has commenced in the making of boots and shoes is more in accordance with the anatomical structure of the foot, and we hope will be productive of lasting benefits. Nature, not the whims of fashion, should be consulted in the manufacture of boots and shoes.

RECKLESS USE OF FIRE-ARMS.

Among the common vices of the day there are none more reprehensible than the reckless use of fire-arms, which seems to pervade all classes of the community. We have just read in an exchange of a bullet that came whizzing from some unknown quarter into the shop of a mechanic engaged in business in one of our northern towns; and quite recently we remember having seen another account wherein the experience of one individual in cleaning a gun was set forth. It appears that he adopted a very certain method for discovering whether the weapon was loaded or not: simply putting his mouth to the muzzle, his foot on the hammer, pushing it back, and then attempting to blow through the nipple. Before this latter performance was achieved, the individual lost his life by the slipping of the hammer (as hundreds before him have) and the discharge of the load, which, it appears, remained in the barrel. Such means as these for the end desired strike us as rather foolish; for although the knowledge is obtained, the person experimenting does not have a chance to profit by it. From all parts of the States we may read daily of accidents by the careless use of fire-arms. Only recently two ladies quarrelled in sport, and one, declaring that she was a rebel, the other, in mock indignation, seized a musket and snapped it at her; it was loaded, of course, as weapons seized by chance, or those near at hand, always seem to be; and the ball, although it did not strike anybody, passed sufficiently near the head of the fair "rebel" to give her a realizing sense of her danger.

Fire-arms are dangerous playthings, and there is much sense in Mrs. Partington's advice to the ubiquitous "Ike;" "Put it away; it might go off if it hasn't either lock, stock, or barrel." There are a number of promising young men who are, in their own opinion, remarkably skillful in handling loaded guns. The remonstrances of male friends and the objections of timid female relatives are laughed off or put aside. Guns "never go off" with them; of course not; if by any chance shock or jar enough force was contributed to fire the fulminate, the powder would obligingly refuse to ignite in deference to their dexterity. Another favorite argument with these gentry is, "they know the gun ain't loaded." How do they know it? Why, some half year ago, they fired the last charge at a crow, and of course there can't be a load in it now. Perhaps in the meantime some thoughtless person takes the musket, and placing a charge in it, puts it in the corner handy for some other reckless individual to shoot a little child with "in sport."

Men ought to know that powder and ball cannot be dodged, and that as a rule it is unsafe to point a crooked stick in the shape of a gun at any one. A life once lost by such means as those discussed, ought to be sufficient warning to the whole community for a century; and yet it seems to be of little avail, for every day the long list of persons killed by the careless use of fire-arms is lengthened. Men go shooting, and pull their guns through brier and brake with the hammer at full cock, and call it an "accident" when their friend in front of them is blown to pieces by their carelessness; others take guns out in boats, lay them across the seats, from whence they fall to the bottom of the craft, and in a great many cases explode. This is also called a "remarkable occurrence." It is time that such folly, and worse than folly, should cease. If the only evil that resulted from the reckless use of fire-arms was the death of the fool-hardy individual in fault, it would be no matter; but the case is generally the other way, and innocent persons are maimed for life, if not killed outright, by men playing with loaded pistols, and snapping muskets, presumedly empty, at other people's heads. If public opinion is not enough to restrain persons from a careless use of fire-arms, some legislation ought to be had upon the subject; for as the matter now stands, by far too many persons are yearly killed in this way.

OXYGEN, OZONE AND ANTOZONE.

Oxygen is the most abundant substance in nature, and it plays the most important part in the chemical changes which take place in the organic and inorganic kingdoms. It is the active agent or combustion and fermentation. It attacks and decomposes the hardest steel; it maintains the fire upon the hearth, the light in the lamp, and the warmth of the human body. Every one should have some definite knowledge of its nature and properties, as it forms the very breath of man's nostrils. Oxygen is one of the six permanent gases; it was discovered by Dr. Priestley in 1774, and called dephlogisticated air. It is insipid, colorless, inodorous, and permanently elastic under all known pressures and temperatures. The lightest gas is hydrogen, compared with which oxgyen is sixteen times heavier; its specific gravity being 16—hydrogen 1, and 100 cubic inches of it weigh 34.24 grains. The air of our atmosphere contains four constituents; namely, oxygen 21 parts, nitrogen 79 parts, some carbonic acid and ammonia; the two latter are variable, the two former constant. The nitrogen is passive, remaining in an unchanged condition in the air; but the oxygen, the active agent, is ever being consumed and renewed. Water absorbs a portion of it, the rate being three cubic inches of oxygen to 100 cubic inches of water. It is thus fitted for the respiration of fishes; the blood of these creatures in circulating through the gills being aerated by the free oxygen dissolved in the water. It is drawn from the atmosphere into the

lungs of mammals, their blood is aerated by it combining with carbon, and then it is expelled in carbonic acid—a gas composed of two equivalents of oxygen and one of carbon. If the oxygen were suddenly extracted from the atmosphere, every living being would die within the space of five minutes. The air most conducive to health contains only oxygen and nitrogen in the proportions given above; all mixtures of other gases with the atmosphere are injurious in proportion to their quantity and nature. Carbonic acid gas, which is expelled from the lungs and also produced by combustion and fermentation, escapes into the atmosphere and acts as a poison when inhaled in large quantities. The quantity of carbonic acid gas thrown into the atmosphere is continually increasing with the increase of human beings, and the vast quantities of fuel which they consume for manufacturing and commercial purposes. It has been calculated that a thousand millions of human beings annually consume 2,000,000,000,000 pounds of carbon, which multiplied by three will give about the quantity of carbonic acid thrown into the air from this source alone. Still all the carbonic acid which now flows into the atmosphere, forms but a small portion of the great aerial ocean. On the tops of mountains and on the ocean it only constitutes about one-fortieth per cent. in weight of the whole atmosphere. Thus diluted, it does no injury to any person, but in cities and in apartments where there is not a free circulation of air it exists in much greater quantities. The only remedy for this evil is a greater supply of fresh air. What are called disinfectants and deodorizers have no effect upon carbonic acid.

Besides carbonic acid, other organic emanations from putrescent bodies—animal and vegetable—pass into the atmosphere. That the entire atmosphere does not become corrupt is a subject of wonder. The Creator has endowed it with the property of purifying itself, and recent chemical discoveries have thrown much light upon the subject. About twenty years ago, it was discoverd by Professor Schonbein that when electric sparks were passed silently through air, the oxygen was changed in nature but not in essence. It received the name of ozone from its peculiar odor, and much was then said and written upon the subject to no profit. Its character is now better understood, and it possesses such intensely oxidizing and bleaching powers that substances upon which common oxygen produces no effect are rapidly oxidized in contact with air which contains only a small portion of it. It unites with putrescent substances, and it has been called "one of the great scavengers of nature." Permanganate of potash contains ozone, and when dissolved, it is called ozonized water, which has of late been much used in medical practice as a deodorizer. Ozone in the atmosphere is said to be promotive of health, and it is therefore a most important condition of oxygen. The explanation given by chemists of the change which oxygen undergoes in becoming ozone, is that it is pollarized and broken up into two states, called ozone for the negative and antozone for the positive. Dry ozone will not dissolve in water, but when a certain quantity of oxygen is converted into ozone, another portion is changed into antozone, which is soluble in water and forms the peroxide of hydrogen. There are several antozonides, but much has yet to be learned respecting this polar condition of oxygen. It is remarkable that ozone is changed into common oxygen by simply submitting it for a short period of time to a temperature of 500° Fah.; and it is further remarkable that ozone and antozone have the power of neutralizing each other in contact and evolving ordinary oxygen in a pure state. According to Faraday, oxygen is the most magnetic of all the gases, and its various changes of character may be due to its electric or magnetic condition.

RECUPERATION OF THE GLOBE.

The skill and cunning of man is continually busy in turning out machinery whereby the labor of the world is accomplished speedily and successfully. It seems at the present time that there is hardly a trade, or a branch of one, that is not in some way furthered by silent and skillful tools. Amid all this material cause and effect are we in any danger of overlooking the processes nature carries on in the bosom of the earth, and upon its surface, for the rejuvenation of its exhausted forces, and for the sustenance of man as well? The achievements of mind are great, and the ingenuity of our countrymen is of world-wide celebrity; the subtle efforts put forth by Nature are not only interesting, but also inspiring in many senses.

When the thoughtlessness of man would exhaust the generous soil that feeds him, the trees shed their leaves, the trunks fall to the ground and decay, brooks trickle in and moisten the earth, birds drop seeds in their flight, and lo! in a little while the herbage springs rank and luxuriant, coarse grass grows heavily, and the soil fattens and waxes mellow under its rich food. Forests may in time wave over acres of such places, only to be cut down by the axe of the invading settler and turned to account in the economy of the world. Damp, mold, and mildew, convert the acid bark and the fatty woods into a manure or muck that makes the earth throb with renewed vigor.

Are there not new mines also forming? In the dark and silent laboratory of nature, fathoms below the surface of the earth, who shall say what wonders are now transpiring for the future benefit of mankind? It is not wholly idle speculation to dwell upon these subjects, for we read daily of the discovery of silver, of gold, of antimony, coal, oil, and a long list of innumerable other substances, all useful to man. These nature has been slowly gathering in for ages, until the adventurous foot of man roaming through the wilderness strikes upon the hidden treasure and forthwith distributes it to the world. By what mysterious affinity or construction some soils bear gold, others diamonds, and yet others silver or rubies, no man can say; for neither gold nor diamonds have as yet been made artificially, and although the component parts of these minerals and gems are well known, there is wanting Nature's own process of amalgamation to make their production at will a matter of no mystery.

While man exerts his ingenuity to tear down the mineral rocks, or open up the bowels of the land and rend from thence the lumps of coal which are built up from the decay and waste of previous centuries, all over the known world, other mines and other fields and forests are springing forth, or being slowly enriched by ceaseless and never-ending natural operations. Whatever waste goes on is renewed again; if this were not a fact, this generation of men would have starved, and future races would find nothing wherewith to build or sustain life.

THE LABOR MOVEMENTS.

The universal disturbance in and unsettled condition of all classes of laborers and mechanics is attracting much attention among thoughtful persons. The machinists of this city—as intelligent and orderly a set of men as can be found—have asked an advance of 25 cents per day on the former rate paid them, alleging that the prices of all kinds of provisions, &c., have increased at such a rate that they find it impossible te support their families in respectability and comfort. The car drivers and conductors have also come forward and demanded an increase of 50 cents per day, and at the present writing many of the lines have granted the advance. These men work fifteen hours a day for the paltry sum of $1 50, or 10 cents an hour, and are obliged to be on duty in all sorts of weather, hot and cold, without cessation, the week round; certainly justice demands that their labor be valued at higher rates.

The sewing girls and workwomen, generally, have also petitioned for an advance, and have been met in some cases with a ready accession to their appeals; in others they have received the cold shoulder. The Shylocks who get rich from the efforts of these hard-worked and poorly-paid females are proverbial for their meanness and want of principle the world over, and with such a record it is not to be wondered at that they refuse to acknowledge the propriety of the pitiful sums asked for by the operatives. That no person of average health and stature can support life on $2 50 per week, in a fit condition to stand the duty required of them, is a proposition that none will dispute; and we see no reason, except the most despicable avarice, for a non-compliance with the workwomen's appeal. We trust it will not be in vain; and we hope that all the trades at variance with their employers will find their remedy in an amicable and speedy adjustment of the disputed points. Certainly, the sympathies of the community are much prepossessed in favor of the orderly and quiet manner in which the proceedings, so far, have been conducted. Intimidation and threats are unheard of, and the conduct, generally, of the trades on strike, is in marked contrast with similar movements in former years. It augurs well for the spread of intelligence and correct ideas among mechanics that they have abandoned mob law and violence generally. The laws of supply and demand are one thing, and hunger, cold and nakedness, are others; and it is of no use to tell the needy that the value of their services is regulated by inevitable laws. As we previously remarked, we hope that the delay to the interests of the country and private individuals will be speedily and amicably adjusted. Our working classes should bear in mind that they cannot safely attempt to speculate upon the necessities of the Government. In common with all of us they have a strong interest in its success, and its permanence very much depends upon the fidelity of the working classes. Unless they are willing to bear their share of the national burdens they will very soon find themselves deprived of the necessary means to bear their own.

THE COAL QUESTION AGAIN.

The *Herald* of the 13th contains a statement in the form of a letter from a correspondent at Wilkesbarre, Pa., that anthracite coal, which is sold at $11 per tun in the cities of New York and Philadelphia, is sold at the mines for $2 50, and charges complicity upon the companies who transport it to market, they having the whole control of the trade. If this statement be susceptible of proof, it is certainly a singular solution of the coal question, and places it on a very plain basis; the authority we quoted further states that the miners are not overpaid, and that in effect collusion and combination of the lines of railroad between the mines and the principal markets is the key to the exorbitant prices demanded. This the public have long suspected, and the statement about the three hundred and fifty steamers is mere haphazard work. The *New Ironsides* is quoted as burning two tuns of coal per hour—lying still, we suppose; for in reality she burns more in active duty. She is rated at 1600 horse power, which at 4 pounds of coal per horse per hour (a fair average) would give 6400 pounds, and the three hundred and forty-seven steamers in Government employ are charged with burning a million and a half tuns per annum; this is exaggerated, as a little plain figuring will convince anyone. Although there may possibly be the indicated number of steam vessels on the navy register, they are not all in service at once, and it does not seem at all possible that the quantities mentioned are actually required; for these same ships, previous to the war, were engaged in passenger and merchant traffic, and their consumption then, together with that of the foreign trade to Southern ports, would bring the amount of coal used before the war much higher than that now required. Such reckless statements go far toward helping the parties who keep up the price of coal to sustain their demands. The fact that foreign coal cannot be imported at paying rates is well proved by that able and fearless paper, the Philadelphia *Press*, and we hope and look for a speedy reduction in the price of this article of prime necessity. Speculation in the essentials of life is at all times reprehensible, but never more so than when the poor are oppressed beyond measure, and when lives are lost and health injured by reason of the high price of fuel. The paper dealers had to abandon for a time their designs in consequence of the very unfavorable light they were placed in by the Press of the country, and we are confident that the same power has only to make itself heard on this question to effect a reform.

THE Adriatic Mills in Worcester, Mass., are driven by a Corliss engine, which has a belt on it 30 inches wide, 114 feet long and double throughout.

A SPECIMEN of glass work, turned and finished in a lathe, was lately shown at the Great Exhibition, London.