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Contents.

(Illustrated articles are marked with an asterisk.)

ccidents, happy	407	Gunpowder on E lis Island	40
Air absorbed by water, etc., (24)	409	Guns, six 100-tun	40
answers to correspondents	409	Horse grooming, mechanical*	40
attery for electric lamp (8)	409	Ice machine, the Picket	40
Battery for telegraphs (7)	409	Index to volume XXXIV	41
edbugs, exterminating	405	Ink, verdigris (14)	40
Bleaching leaves.	405	Inventions patented in England	40
Boiler economy (16)	409	Inventors nits/udged	40
Boilers for small engines (27)	409	Kerusene testing device*	40
Boilers, steam space in (4)	409	Lightning rod (10)	40
Jusiness and personal	409	Lodestone (1)	40
Centennial, aquaria at the	401	Moths	40
Centennial exposition, the	401	Mygales, the*	40
centennial horticultural hall*.399,	404	Neighbor, a dangerous	40
Centennial, illustrations of the	404	Oil, cleansing (29)	40
Centennial machinery hall	401	Paint for rough woodwork	40
Centennial, the boats at the	401	Patents, American and foreign	40
centennial, oriental cafés at the	401	Patents, official list of	41
Centennial women's pavilion	401	Photographic apparatus, new*	40
Cheese, Roquefort	403	Plethysmograph, the	40
herry brandy, home-made	403	Porcelain and pottery	40
chimneys, proportions of (25)	409	Postage, cheap foreign	40
chinese glant, another	403	Probabilities, home-made*	40
od'sstomach, contents of a*	407	Power of tugboats (22)	40
Condensers, proportions of (23)	409	Railwav to Mount Washington	40
Door fastening, barn*	402	Railway train, the fast	40
Drying house, heating a (6)	409	Reading rooms, working men's	40
clectric alarma (12)	403	Recipes, useful	40
Electric clock, rower for (11)	409	Reflector, the Balestrieri*	40
ingines and bollers for boats (26)	409	Smoke-burning grate*	40
ingines, forms of (17)	409	Soda process, the ammonia	40
ingravings and advertising	402	Spiders, door-building*	40
xhibition, electrica	402	Steam in a chimney stack (20)	40
lower cuttings, setting	409	Stone lifter, a new*	40
ly wheel and engine (3)	409	Tallow, rendering (15)	40
og norns (5)	403	varnish for plaster patterns (13)	40
as pipe, along	400	Wood bonding (10)	40
olu, the extraction of	404	Wood, behaing (19)	40
*0VEFDOFS, EVF08C0D1C (28)	409	YOULD, DEDIODZEES OF	41

# THE SCIENTIFIC AMERICAN SUPPLEMENT. No. 26.

# For the Week ending June 24, 1876.

TABLE OF CONTENTS.

- INDER OF CONTENTS. I. THE INTERNATIONAL EXHIBITION OF 1876. With 7 illustrations. —The Onyx Marbles of Mexico.—The Corliss Engines, Dimensions and Particulars, with 3 engravings.—Hampson, Whitehill, & Co.'s Engines, Penny Cut-Off and Slide Valve, 4 engravings.—Erie City Iron Works En-gines..—The Twiss Engines.—Copper at the Exhibition, from the Spanish Copper Tree.
- Copper free. 11. MECHANICS AND ENGINEERING, 42 figures. —The Length of Passen-ger Cars. —The St. Gothard Italiway Tunnel through the Alps, with 26 figures. —Contact of Driving Wheels of Locomotives on Balls, with 16 figures. —Concrete as a Building Material. —The Modern Yacht. Protec-ting War Ships from Torpedoes. —Rifling Heavy Guns.
- ting war sings from forpedoes. Kning heavy Guns.
  III. TECHNOLOG Y. New Use for Colored Glass. Obtaining Imprints of Plants. Examination of Raw Sugars, by PROFESSOR FALKE, 5 figures. Effervescing Preparation or Sodium Tartrate. Pressed Herbs.— Extin-guishing Firrs on Shipooard. How to Build Cheap Boats, No. 2, with 13 figures. A Five Dollar Skiff.
  IV. ELECTRICITY, LIGHT, HEAT, ETC.— Electric Fuses.— New Form of Hellostat.— Etheric Force.— Radiometers, Recent Observations by DR. Conor vs.
- C. CHEMISTRY AND METALLURGY.—Process for Determining Astrin-gent Matters.—Cyanide-Cyanate of Chloral.—Feldspath Mirocline.—An-desine.—Gallium, a New Liquid Metal.—New Researches on Gallium, .—A New Crystallized Organic Substance.—Methods of Clinical Research.
- NATURAL HISTORY.-Fauna and Flora of Peat Beds.-Pulmonary Respiration of Mammals.-Weapons from New Guinea.
- VII.-LESSONS IN MECHANICAL DRAWING. By PROFESSOR MACCORD.

# The Scientific American Supplement is a distinctive publication issued weekly; every number contains 16 oc-

# THE END OF THE VOLUME

The presence of the index at the close of this number of the SCIENTIFIC AMERICAN will remind our readers that we have reached the end of another volume, the thirty-fourth of the present series. It is not because we fall into that proverbial failing of all humanity which believes the last ac complished work to be the worthiest that we confidently believe that the now finished volume is the best we have even issued. The assertion is fact-fact in theory, because newspapers as a rule reverse natural laws, and grow better as they grow older; and fact in practice, because the contents of the many pages say so.

Few occurrences of any note in the world of Science or invention have happened during the past six months, but that and an institution to which the United States owes so large our readers have been fully posted thereupon. In great engineering works we have described and illustrated the massive anchorage of the East river bridge, the Metlac viaduct in Mexico, the St. Charles railroad bridge in Missouri, the La Vanne aqueduct in France, the New York Elevated and. the projected Underground Railway, the Callowhill street the false economy which, for the purpose of making political bridge in Philadelphia, besides many others. Few new ma- capital, has induced some of our lawmakers to contemplate chines of any importance have appeared in the world during crippling the resources of the Patent Office. The speech in the entire six months, but we have published full accounts thereof. Among the more prominent are the Brayton oil engine, the Allen governor, Manes' rotary furnace, Stirling's locomotive-reversing gear, Dean Brothers' pumps, the new Eiglish multiple drilling machines, and scores of other fresh and novel inventions. The valuable papers on Practical Mechanism-more reliable and more thoroughly practical aids to the workman than have ever b\_fore appeared-have been continued. Hundreds of trade secrets and useful recipes, gleaned from every possible source, have been gathered. The principal scientific discoveries we have fully discussed. Edison's supposed new electric force, Galton's new theory of heredity, the manufacture of dynamite, electrical organs, wells as a source of power, the magnetic spectrum, are a few of the principal subjects under this heading. Lastly, we have published many beautiful illustrations of the Centennial Exposition, with descriptions of prominent exhibits. These descriptions, with illustrations, will be continued through the following volume

#### THE SCIENTIFIC AMERICAN SUPPLEMENT

The regular weekly issue of the SUPPLEMENT as a distinctive publication, for a special subscription price, has enabled us to supply our many friends with an immense pal branches of science. It would be difficult to find any has not been brought to the reader's notice.

The first volume of the SCIENTIFIC AMERICAN SUPPLE-MENT has been illustrated by about one thousand three hun. dred figures and engravings.

The International Exhibition has formed, and will during the year continue to form, one of the principal features in both of our papers. We have already given in the SUPPLE-MENT over one hundred engravings, showing the progress up to date. The next volume will be full of illustrations of new and remarkable exhibits. In presenting the details of this great enterprise, we are specially assisted by able and experienced men of science; and in addition, we aim to avail ourselves of whatever is interesting and reliable, as observed by cotemporaries.

The series of letters on Mechanical Drawing, by Professor MacCord, have proved acceptable to thousands of persons. About one hundred and thirty illustrations have so far been given. The series will be continued in the next volume of that they show how any person, even the unskilled-the poorest persons, those who cannot afford to buy instrumentsmay learn to draw.

Another useful series of articles is entitled "How to Build Cheap Boats." It is accompanied by illustrations of particulars. The series embraces nearly one hundred and fifty engravings, and illustrates the method of boat building, from Whitehall row boat, costing fifteen or twenty dollars: also sail boats, their rigging, etc., with details:

A number of the most important engineering works and structures have been illustrated and described in the SUPPLE-MENT. Among these are the great Jetty Works of Captain Eads, at the mouth of the Mississippi river, by which the seven-foot bar has already been removed to a depth of twenty feet. The illustrations include a complete plan of the works, details of the construction, and measurements and particu-

for the most part, standard in its character, and worthy of preservation for future reference.

For the convenience of readers, the first volume of the SCIENTIFIC AMERICAN SUPPLEMENT, twenty-six numbers, January-June, 1876, has been bound in paper covers, and may be had at this office and at news stores throughout the country, price \$2.50. Sent by mail to any address.

#### \*\*\*\* INVENTORS MISJUDGED.

The inventors of this country owe Hon. J. H. Bagley, of New York, a debt of gratitude for a very excellent speech, recently made by him in the House of Representatives, in their behalf and that of the Patent Office. A defense of a class a proportion of its material prosperity might well have been looked upon as a superfluity; but Mr. Bagley on one hand has discerned that, among certain people, inventors, through no fault of theirs, or rather through their misfortunes, are receiving unmerited odium ; and on the other, he is aware of cludes careful research, showing the self-supporting nature of this branch of government service, and the advantages which it has secured, and besides pays a noble tribute to the class for whom the Patent Office is mainly intended, and by whom it is solely maintained. There are a few points in the discourse which Mr. Bagley touched lightly upon, but which deserve more extended remark. We note that he specifies the grangers as being among those most strongly prejudiced against inventors, who, as they imagine, by securing patents, act in direct opposition to public interest, and engender monopolies. If such a notion is prevalent, it is, to say the least, an ignorant one; for without the labor of the inventors, it may well be asked, what would that of modern agriculturists be? If any Western farmer, who is now complacently surveying his hundreds of broad acres of waving grain, and reckoning the profits of his crop, were informed that his harvest had to be gathered with scythe and sickle, without doubt he would protest that such would be impossible, and that all his gains would be swallowed in lost time and injured over-ripe crops. Doubtless he would admit that his reapers and mowers, not to say the machines he used for planting and plowing and cultivating, are worth in direct saving a good round sum. If every granger who objects to patents will make a calculation of this kind amount of additional detailed information in all the princi- for his individual case, and then multiply it by the number of those who use improved machinery, he will fresh subject of note or interest in the scientific world that find that the value of the inventor's work for a single season's crop probably approaches, if it does not exceed, every cent the inventors have ever earned. He will also discover that the profits are directly turned into the pockets of his class in such a proportion that the inventor's gains are utterly infinitesimal; and if he will look into the future, and consider that these profits will accrue to his posterity for ever, while the returns of the inventor cease, certainly within half a century, perhaps he will see how little basis there is for charges of monopoly and extortion, so freely hurled at men because they ask an absurdly meager return for the benefits they give.

There is another point, based on sound truth; and it is, in a very great number of cases, the inventors are not those who reap the chief reward. There are plenty of wideawake sharp people, who know a good thing when they see it, and are ready to snap at it, with cash in hand. These are constantly on the watch for new inventions; and during the period, when the inventor has secured his patent and is lookthe SUPPLEMENT. The peculiarity of these instructions is ing about to see how best to realize returns, they are down upon him like hawks If, as is too frequently the case, the inventor is in financial straits, the offer of cash for an idea of which he, least of all, correctly knows the value is generally a potent temptation. The patent is assigned for a song ; Smith's device becomes famous, but Smith gets no profits. Brown, who has purchased it, revels in a plethoric bank account, while Smith gets empty fame diluted with the humble scow, costing three dollars, up to the graceful abuse as a monopolist. If Brown happens to be dishonest, and, with Smith's idea as a basis, swindles-and farmers and agricultural implements are peculiarly favored as object and means in this regard-Smith shoulders the odium. No one thinks of denouncing the mere agent; it is the inventor and the grinding patent system that are blindly vituperated. Of course inventors have a right to sell their property to whom and for what they choose; but, as Mr. Bagley, with much truth, suggests, if they would be more persistent in introducing their devices into public use themselves, they

tavo pages, with fiandsome cover, uniform in size with SCIENTIFIC AMERI-CAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscriptiors. Single copies, 10 cents. Sold by all news dealers through-out the country.

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the Supple copies of any desired number of the Supplement sent to any address on receipt of 10 cents.

#### Crystallized Osmium.

MM. Ste. Claire Deville and Debray have recently obtained osmium in a crystallized state, by making an alloy of the element with tin and treating it with nitric acid. All the tin is separated, and the residue of osmium is finely crystallized. The density of osmium is found to be equal to 22.477. and is greater than that of any other known body.

lars, by Chief Assistant Engineer Corthell.

The great St. Gothard tunnel through the Alps, Switzerland, has been illustrated by many figures. Among these the drilling machines and the compressed air locomotives have been engraved and explained.

In the Department of Mechanics and Engineering, a large number of valuable practical papers, by experienced writers, have been presented with illustrations; the same may be said of all the principal divisions of science, such as Chemis. try, Metallurgy, Technology, Electricity, Light, Heat, Sound-Geology, Mineralogy, Natural History, Astronomy, and Medicine: The latest and most interesting intelligence has been sought out and presented.

just completed volume of the SCIENTIFIC AMERICAN SUPPLEpages each. Thus the yearly issues of the SUPPLEMENT,

would obtain much more sympathy and much greater profits.

Much, however, of the opposition to inventors and their patented devices arises from the misconceived idea that the patent laws are intended solely for the benefit of inventors. Now, as we have repeatedly explained, such is not

the case. True, they hold out an inducement which has for its object to make people invent; but that inducement is a monopoly closely limited in point of time, and during the existence of which the inventor developes his idea. Consequently, at the end of the protected period, the invention becomes public property in its improved and not in its crude form. Therefore it is obvious that to denounce the

In the matter of quantity, estimated in book measure, this patent system is merely to denounce that which insures great benefits to every one, at an absurdly small cost. As MENT contains the matter of over three thousand five hun- for the means whereby the patent laws are enforced, the dred book pages, or more than seven volumes of five hundred | fact is undeniable that, in this sad period of official corruption, the Patent Office stands forth pure and unblemished. costing only five dollars, will equal fourteen ordinary book Instead of its appropriations being exceeded, as is the case volumes. The exceeding cheapness of our publication will in some departments of the government, it has a balance be appreciated if we consider that all this reading matter is, of nearly \$900,000 to its credit in the United States Treasand \$63,216 for miscellaneous matters; and seven and a half low the City Hall would also be ruptured, as that effect has times more work was done than in 1865. Had the salary followed less extensive explosions. and expense account kept pace with the work, the expense in 1865 would have been over \$2,000,000.

#### -+++ A DANGEROUS NEIGHBOR.

resolution into the House of Representatives to remove the ror of allowing so large a quantity of gunpowder to be stored | hands. The best woman's work is in the other buildings, powder magazine, now located on Ellis Island in New York Harbor, on the ground that an explosion of the powder there stored would destroy or seriously damage an immense number of buildings in New York and Jersey City. Ellis Island is used as a storehouse for powder for vessels of war, and no ship is allowed to come up to the navy yard until the contents of her magazine have there been discharged. At the present time about one hundred and thirty tuns of powder are stored on the island, some of which is old and not up to the full standard of strength.

Authorities differ greatly as to the elastic force exerted by powder at the moment of its explosion. Robin estimates it at 1,000 times the pressure of the atmosphere, or 15,000 lbs. per square inch. Rumford, on the other hand, placed it as high as 54:470 times atmospheric pressure. Other experimenters vary between these extremes. We take, as our present rough calculation, Robin's estimate, because of the possible deterioration of the powder; 130 tuns of the explosive occupies about 4,900 cubic feet, or would form a pile of 17 feet cube. On each square inch of surface of atmosphere bounding this mass, supposing the latter to be suddenly rendered gaseous, there would therefore be, as above noted, a pressure of 15,000 lbs., or a total pressure of nearly 4,000,000,-000 lbs. As the vibrations due to this sudden pressure radiate equally in all directions, like those of light and heat, it necessarily follows that the intensity of the force diminished in proportion as the circle of its radiation increases in diameter. Taking the direct distance from Ellis Island to New York city as one mile, an explosion on the former, by the time it reached the nearest walls, would be distributed over 172,846,080 square feet of surface, and therefore the mechanical effect of the shock on the houses first attained would be some 22 lbs, to the square foot of surface. This is equivalent to the wind pressure of a heavy storm traveling at the rate of 65 miles per hour ; but in lieu of being a continuous blast, as in the case of a tornado, there would be a sudden shock, due to the condensation of the wave of air generated in the explosion, followed by a reflex and weaker shock due to the rarefaction of the wave, followed by other and shorter vibrations. The result, therefore, would be a jar like that of an earthquake.

Such would be the probable effect did the whole quantity of powder, as above stated, explode at once; but this is not at all likely. Confined as the explosive is in barrels and copper tanks, the blowing-up of a few receptacles would scatter others, and these would either be thrown into the water, as the island is quite small, or might be exploded separately, thus producing a series of light and inconsiderable shocks.

Reducing the result first quoted one half, to allow for powder scattered and unexploded, we still have a mechanical effect of 11 lbs. to the foot on buildings a mile distant, equivalent to the simultaneous explosion of 65 tuns of powder. That amount is very nearly the same as blew up at Erith, near London, England, in 1864, the effects of which were at the time carefully noted; so that from the record of these we can obtain an approximate idea of the results in the vicinity of New York. A circle swept from Ellis Island with the radius of one mile includes only a small part of Jersey City, and an even less area of New York; the first and most disastrous effects would therefore be felt by the shipping in the harbor, and probably few buildings would be left standing in the included city portions. The mechanical intensity of the shock varying inversely as the square of the distance from the center, it follows that, by the time the concussion reached the City Hall in New York, its force would be reduced to less than 3 lbs. per square foot of surface. This would be sufficient to overthrow steeples and probably all of the exceptionally high buildings included in the area. At a corresponding distance from the Erith explosion, the earth heaved and trembled, men were thrown violently out of bed, not a door nor a pane of glass was left her own work, and some spirited etchings which give some whole, and walls were cracked and shaken. Even the more substantial buildings in lower New York would also be badly jarred, owing to the duration of the shock, which, despite

These results are based on merely theoretical considerations, and on the presumption that a simultaneous explosion of 65 tuns at least would occur. They are of course subject to modifications of circumstances, but are not without the Mr. Hardenbergh, of New Jersey, has recently introduced a limits of possibility. Thus they will suffice to show the erso near to a populous district. If some magazine reasonably near the navy yard is of paramount necessity, there are other situations in the lower part of New York Bay which might be used without incurring anything like the danger; and the peril might still further be lessened by dividing the amount stored, and isolating the portions so that the blowingup of one part could not determine the explosion of the rest.

#### ----THE CENTENNIAL EXPOSITION.

Unless the reader is specially interested in agricultural matters, and therefore has an object in deferring visiting the Centennial until the autumn, when the displays of live stock and fall products will take place, we advise him to make his pilgrimage to Philadelphia now. Nearly everything is in order, and the finishing touches are being pushed forward with great rapidity. No such crowds are present at this time as will be toward the close of the six months: and when the magnificent distance, which is to be traversed merely to pass through the various aisles and from building to building, some twenty-five miles in all, is realized, it will be perceived that sight seeing on such a gigantic scale during hot weather will savor strongly of hard work. To those who are able to spend some time in Philadelphia and so view the Exposition leisurely, the heated term will be of minor inconvenience; but others, whose holiday is limited, will find their enjoyment greatly increased if they will take advantage of the moderate weather of the present month.

For the benefit of the latter, a few hints as to how best to see the display in the shortest time may prove serviceable. The mistake of most people is trying to see too much in too short a time; and this is attended with very disagreeable results. When the mind is on the stretch, the body is not nearly so sensitive to fatigue; and consequently the visitor may never feel that he has overtaxed himself until after the day's work is over, when he will be admonished of the fact by illness, which may incapacitate him for the following day: a serious matter when one's time is limited. Still it is by no means impossible to get a good general idea of the show in two or three days; and this period, we have no doubt, will comprise all that can be afforded by the majority of people coming from a distance to Philadelphia.

As every visitor will naturally prefer to plan his own visit, it is superfluous to offer suggestions for a programme here. Still, we may point out that to hurry is but to waste time, and that the few days will be most agreeably spent if the first be quietly devoted to such parts of the Exposition as it is intended to study, while the mind is fresh and unwearied. Then the subsequent observation of objects to which no particular thought is given becomes a kind of relaxation. It will save much time to procure a good map, giving the names of localities.

#### THE WOMAN'S PAVILION.

Perhaps the most interesting object-if we may be so ungallant as to use the word—in the woman's edifice is the lady engineer. We do not recollect ever having seen a woman manage a steam engine before ; but if Miss Allison may be taken as an example, there is no doubt but that the fair sex is quite competent for the duty. In fact, the lady herself suggests very truly that there is a good field for woman's work in taking charge of the thousands of small motors used in minor manufacturing operation. She thinks that an engine is not half so hard to manage as a baby, and most, of her sex at least, will agree with her. Miss Allison has regularly studied engineering and science, and runs the machine entrusted to her in a manner which elicits general admiration. We wish we could speak as highly of the rest of the woman's display in general; but it must be considered, as a whole, to be disappointing. Still, there are many excellent articles in it which will well repay a visit to the building. Queen Victoria sends a beautifully spun napkin, pleasant glimpses of home life in the royal family. The English princesses contribute some really fine specimens of embroidery. This handiwork of royal fingers silently preaches a lesson of industry which, to judge from the conversation of those who gather about the cases, is invariably heeded. No doubt, however, her Majesty would find a world of amusement, could she overhear, as we did, certain naive remarks of the rural damsels, whose impression appears to be that queens do nothing but wear gold crowns and sit on thrones. If we were asked as to the prevailing characteristic in all the woman's work exhibited, we should unhesitatingly say: patience. And that quality is shown in as high a degree in the embroideries and, to the masculine mind, incomprehensibly intricate patchwork as in the elaborate productions of the Japanese artists in the celebrated collection of bronzes, in the Main Building. If patience always yielded beauty, then our woman's work would be transcendent. But it does not; and therefore while we may recognize the deft persevering fingers, in the innumerable worsted pictures, hair chains, feather and shell ornaments, and marvelous pieces of knitting, let us not be asked to call them beautiful. We will make one exception (we dare say there are others which

ury. Its expenses last year were \$459,730 for salaries, survive. The iron water mains in the part of the city be- there are nine hundred stitches, are embroidered on white and rose-colored satin. No wonder it took eighteen months to complete.

> Leaving out fancy work, woman's labor is but poorly represented. There are few inventions, where there might be many. We notice some dish washers and a life-preserving mattress, which, it is said, is to be officially tested, and there is a fine collection of medicines prepared and put up by fair and those who are inclined to belittle her part in industrial labor may see the evidences of her skill in the superb coloring of the famous Doulton pottery and in the wonderful Gobelin tapestry-there is one gem of this needle work in the Art Gallery, which only near inspection distinguishes from a painting; in the intricate meshes of the Belgian point lace, in the nice shading and coloring of the German cotton velvets, in the manufacture of the delicate Swedish silver work, in the Italian mosaics, in the decoration of the fragile Bohemian glass. And this is only the beginning. In Agricultural Hall are wines of all kinds prepared by woman, in Memorial Hall her finestworks of nictorial art are displayed: and in among the buzzing machinery, she is tending looms spinning raw silk into thread, making and putting together the intricate mechanism of watches, and converting coarse leather and cloth into the daintiest of shoes. The severest criticism that can be made on the Woman's Pavilion is that its contents show woman's amusements, not her work.

# THE BOATS.

The Exposition is notably rich in nautical objects, and in models especially. Every class of vessel can be found, from the full-rigged sloop of war, in the navy department, down to the fishing smacks, which Massachusetts contributes in a collection of probably five hundred. There is a model of the old frigate Constitution, and of a lightship, the latter complete in every part. An ingenious Yankee has rigged a chicken bone with a set of sails, and only close inspection shows the curious conceit. The famous Merriman dress, in which Captain Boyton swam the English channel, is also exhibited. Foreign visitors are displaying much interest in the ice yacht, a superb full-rigged specimen of that vessel, with her sails set, being prominently located in

# MACHINERY HALL.

In this building, work has rapidly been carried forward. The immense Krupp 61-tun gun is now in position, and several industrial operations, intended to be exhibited in progress, are fairly under way. In the French section, a toilet soap manufactory is in full blast; near by, an immense press is striking off American flags on continuous webs of cloth; an india rubber factory prepares and purifies the crude material. A set of workmen are busily engaged in making cocoanut sugarplums. Two paper mills are also hard at work; the Coventry silk loom is weaving silk bookmarks in wonderful rapidity; and the great Walter press, at certain hours, strikes off its thousands of the New York Times

#### THE ORIENTAL CAFES

have recently all opened, and are by no means the least interesting part of the general display. One is Turkish, and all its attendants are genuine Mohamedans. Here one may have delicious coffee made in the Turkish fashion (that is, in a kind of paste with water, and boiled thick), rose conserves. any number of curious sirups, and real Turkish tobacco in a real Turkish pipe. Prices are cheap; for \$1, a taste of almost all the Turkish delicacies can be had. The Tunis café is conducted on curious principles. It involves a touch of the harem. It is not so large as the Turkish building, nor so ornate in its style. An individual, posted outside the door after the fashion of itinerant showman, yells at you to enter. You pay 25 cents to a person supposed to be an Arab, although he looks more like a German, and are served with a cup of muddy coffee, and permitted to stare at five musicians. One torments a venerable violin, another bangs a pair of cymbals, the third has a nondescript instrument resembling a lute, and the remainder, a woman and a small boy, drum with their fingers on kettledrums. The music is painful to an advanced degree; and the woman occasionally intensifies the discomfort of the deluded visitor by dancing, if a variety of postures deserves that title. Altogether the show is not uninteresting: but one experience will probably satisfy the most curious of visitors.

Another curious building is devoted to the sale of Hungarian wine. The attendants are dressed in the national Magyar costume. Wines of excellent quality may be

comparatively low pressure, would be (because of the quantity of powder) of long duration. In general, it may be concluded that a complete rebuilding of all New York below the City Hall would become necessary.

At four miles, windows and doors would be smashed, ceilings thrown down, and weak structures injured. The concussion would be violently felt as far up the Hudson as Tarrytown, and the report would be heard at Poughkeepsie, and possibly at Philadelphia. The report of the Erith explosion was heard 94 miles away, a greater distance than that which separates New York from the Centennial buildings. Every church within a radius of 25 miles of Ellis Island would suffer from cracked walls and windows; and if the disaster occurred at night, every gaslight in the cities of New York, Jersey City, and Brooklyn would be extinguished.

The loss of life due to falling buildings would probably be great. People in the streets in the lower part of the city would be thrown down, and many probably rendered deaf. Far less extensive explosions have overthrown horses and ripped off their shoes, a curious result of the inertia due to the differing specific gravities of the animal and the metal. tasted in moderation, at quite low prices.

#### THE AQUARIA.

Professor Frederick Mather is busily preparing the aquaria in Agricultural Hall. The display is to be made in thirtyfive large tanks, one of which is 23 feet long by 7 wide. and 4 feet deep. The collection is not yet complete, but will be in a short time. The British Commission has despatched a large tank to Bermuda, to obtain angel sharks and other curious fish. Later in the season, when trout and salmon begin to spawn, the hatching process will be illustrated. Several specimen of forcing apparatus are already on exhibition. There is a tank filled with terrapin; and in one aquarium are gathered hundreds of small specimens of Califor nia salmon, which have been artificially hatched. We shall allude to this very interesting portion of the Exposition in detail hereafter.

THE most active prolongers of youth are wholesome food, pure air, regular habits, and plenty of exercise for both we do not recall) of a quilt: a wonderful quilt, intricate and mind and body. With these, added to a contented disposi-It is likely that not a bird within fifteen miles radius would yet artistic. Fifteen hundred rosebuds, in each of which tion and a good temper, Father Time may be long defied.