

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included. \$3 20
One copy, six months, postage included 1 60
Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.
Single copies of any desired number of the SUPPLEMENT sent to one address on receipt of 10 cents.
Remit by postal order. Address MUNN & CO 37 Park Row, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, \$5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

VOL. XXXIX, No. 17. [NEW SERIES.] Thirty-third Year.

NEW YORK, SATURDAY, OCTOBER 26, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

Alizarin carmine... 257
Arsenic... 262
Arsenic in sulphuric acid pyrites... 257
Astronomical observation... 250
Barrel machinery, court decisions... 256
Beehive, new... 263
Cables, telegraph, submarine... 263
Carpets, Smyrna and Persian... 264
Champagne cider resin [2]... 267
Cook, Captain... 264
Cotton worm, a cure for... 266
Creosoles, mixing [5]... 267
Elasticity, modulus of... 267
Electro-plate, Amer. in England... 265
Emigration from Canada... 257
Exhibits, agricultural, Am. Paris... 263
Fowler, Mr., crossing channel... 263
Fruit, preservation of... 263
Gas, hydrogen... 266
Gaslight... 265
Gaslight, influence of on the eye... 263
Gas wells in Ohio, remarkable... 267
Gold, intrinsic value of [1]... 267
Gold, 18-karat, compound for [5]... 267
Ink, marking... 259
Ink, white [27]... 267
Inventions, new... 265
Inventions, new agricultural... 266
Inventions, new mechanical... 262
Jute, American... 266
Labor and trade in Italy... 265
Labor in Massachusetts... 265
Lead salts and ammonia... 259
Locomotives, Am. for Australia... 265
Magnets, to harden [33]... 268
Milk test, a... 262
Mines, pneumatic appliances for... 260
Mining laws, history of... 263
Mustard congress, a... 263
Natural history notes... 266
Reagents in England... 255
Piano, Chickering, manu. of... 265
Pipes, water, best [1]... 267
Prehistoric instrument, modern... 257
Progress, proofs of... 265
Protractor, new... 262
Rapid transit, noise of... 267
Reading machines... 265
Regulator, true-time... 262
Rivers, S. A., surveys of... 260
Rubber gum, to melt [3]... 267
Sea ice, American... 259
Sea beacons, lighting... 267
Sewing machine motor, want of... 262
Shelton's, new guard for... 265
Smoke, plan to banish... 266
Stars, temporary and variable... 265
Stopper, measuring, new... 265
Stove, the Alhambra... 261
Tea and coffee, compressed... 260
Telephone, "call" for [20]... 267
Tissues, transplantation of... 260
Tools for young people... 258
Vinegar from wine and elder [19]... 267
Water, absorption and excretion... 260
Water, flow of, through pipes... 266
Wax, modeling [25]... 267

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT No. 147, For the Week ending October 26, 1878.

Price 10 cents. For sale by all newsdealers.

I. ENGINEERING AND MECHANICS.—Lighthouse illumination. By J. R. WIGHAM. A paper read before the mechanical section of the British Association. Description of Galley Head Lighthouse, Ireland. The use of gas for lighthouses, with an improvement. The combined gas and electric light for lighthouses. A mode of lighting sea beacons from the shore, 4 figures. A New England Silver Mine.
II. ARCHITECTURE AND BUILDING.—Cottages. Practical hints on accommodation and arrangement of points to be guarded against; foundations; drains; light; and ventilation.—Window Sashes and Panes. The styles in use, with their merits and demerits, 3 fig. res.
III. FRENCH UNIVERSAL EXPOSITION OF 1878.—Captain Boyton at Paris. Description of his swimming apparatus, with the interesting trial at Paris, and 2 illustrations.—Terra Cotta Vases, with 1 illustration.—French Hatters.—Solree of the French Association for the Advancement of Science, 1 illustration.—Fasade of the Swiss Section, with 1 illustration.—Baville's Tool Holders, for Lathes, Planing Machines, Shaping Machines, Slotting Machines, etc., with 24 figures.—Oscillating Stone Crusher, 1 figure.—Cement Testing Machine, 1 figure.
IV. TECHNOLOGY.—The Carbonization of Wool and Woolen Cloth. Frenon's and Lix's methods. Joly's process. Carbonization by gas.—Beer.—Waste Waters from Wool Scouring, Fulling, etc. By ED. NEUMANN.—Economic Evaporation, 1 figure of apparatus.—New Dye. Alizarine Carmine.—Bleaching of Textiles.
V. CHEMISTRY AND METALLURGY.—Estimation of Manganese, Lead, Copper, Zinc, and Nickel, and their Alloys. By A. RICHE.—A New Test for Glycerin. Glycerin in beer, in water, in wine, in milk, in treacle.—Preparation of Metallic Chlorides.—Action of Chlorine.—Metallic Arsenides. Silver, gold, copper, lead, nickel, cadmium, iron, and zinc arsenides.—Heat by Chemical Action.—Atmospheric Ozone.—Atmospheric Hydrogen Peroxide. Action of Iodine upon the Oxides and Carbonates of the Alkaline Earth Metals.—Formation of Quartz.—Alloys of Aluminum and Gallium.—Meteoric Breccia, St. Catherine, Brazil.—Formation of Hydrocarbons by the Action of Water.—Guaiacum as a Test for Copper.—Piney Tallow.—Manufacture of Plaster.—Petroleum Soaps.—Coal Dust.
VI. ELECTRICITY, LIGHT, HEAT, ETC.—Temperature of Flame. By F. ROSSETTI. Luminous and non-luminous gas flames. Flame of Stearin Candle. Flame of a Lactell Lamp. Flame of a Petroleum Lamp. Alcohol flame. Mixture of gas and air. Mixture of gas and nitrogen. Mixture of gas and carbonic anhydride.—The Electro-magnet a Receiving Telephone.—The Province of Mathematics. From the address of President SPORTRISWOOD, before the British Association.—Manifold Space. From President SPORTRISWOOD'S address.—Measurements in Physics. From President SPORTRISWOOD'S address.—Apparatus for Varying the Intensity of Currents.
VII. MEDICINE AND HYGIENE.—The Art of Preserving the Eyesight. From the French of ARTHUR CHEVALIER. No. XI. Conclusion. Advice on the Hygiene of the Eyes, with one figure. Reunion and Restoration of Divided Nerves.—Gastrostomy in Stricture of Oesophagus. With report of a successful case by Prof. F. Trendelenburg, of Rosstock. By W. HIGGSON, M. D. 1 figure.—A Simple Test of the Quality of Drinking Water.—Hydrophobia.
VIII. AGRICULTURE, STOCK RAISING, ETC.—The Agricultural Products of Cyprus.—Newfoundland.—Measuring the Height of Trees, with 2 figures.—Herefords, Cotswolds, and Berkshires. Cotswold Buck, with 1 illustration.—Cow Milking Apparatus, with 1 figure.—Pears.

FLOW OF WATER THROUGH PIPES.

Very frequently some one who has a pump, or cistern, or spring, wishes to know how much water will be discharged through a pipe of a stated size under a given head, or how large a pipe is necessary to fill a certain vessel or reservoir in a required time. Most of the calculations to this effect are made by rule of thumb; the rest are generally so buried in formulas that nobody can find out anything about them without first going to college, and then possibly going crazy. It may, then, be interesting to run over the following simple rules for determining the above-mentioned elements.

In the first place, this can never be known exactly, except by actual measurement; because all pipes are not equally smooth inside nor evenly laid to begin with, and some get crusted over with mud or scale. It is always best to allow 5 per cent margin, so as to be sure and have pipes large enough. It must be borne in mind that larger pipes cost less proportionately than smaller ones; as a very trifling increase in diameter counts up very rapidly in the amount of area and discharge.*

We want to make some very simple "sums" with the following elements: head or pressure, length of pipe, and diameter.

Head means vertical distance every time—vertical distance between the level of the water in the reservoir above and the center of gravity of the discharge orifice below. Some think that when pipes discharge under water the head is less than if they discharge into open air; but no one who is posted allows more than 1/8 difference. Thus if a reservoir 120 feet above the standard level discharge 10 feet above this standard, through a pipe whose discharge orifice is 50 feet below water, the head is 110 feet all the same. Some parts of a pipe may have greater head than others.

Another thing worth noting: it does not make a particle of difference whether the pipe is level, inclined upward, or inclined downward, as far as the quantity of water discharged is concerned, the length and head remaining the same.

It is essential that the upper end of the pipe be sufficiently immersed to let it fill well; and there will be a certain amount of head lost in overcoming friction. The upper part of the head may be said to produce velocity, and the lower part to overcome friction; we may divide the whole into the "velocity head" and the "friction head."

A pipe might be so laid as not to have any bursting pressure upon it, by putting it all upon the "hydraulic grade" line—a line drawn from the true velocity head to center of gravity of the discharge end. In such case it would have on it only the weight of the water, upon its lower side. The bursting pressure on any point is determined by its vertical distance from this inclined grade line. It is curious that if a full flowing pipe be tapped at any point on its upper side, the water will rise to this inclined hydraulic grade line, and not to the level of the reservoir. If the discharge be stopped the jet will rise above the grade line; or if there be an obstruction between the reservoir and the jet the latter will fall.

Wooden pipes have about 1 1/4 the frictional resistance that equally smooth cast iron ones have; corroded iron pipes double that of new smooth ones. Our formulas following are for smooth new cast iron pipes, more than four diameters long. (All dimensions must be in feet.)

We will multiply the head by the diameter. Add the length to 54 diameters, and divide this into the first found product, and take the square root of the quotient. Forty eight times this square root is the velocity in feet per second. If we multiply this by the area we get the discharge in cubic feet per second; and we can turn this into U. S. standard gallons by multiplying by 7.48.

Thus we have a 4 inch pipe 962 feet long, with a discharge 60 feet below the surface of the reservoir. How much water will flow through it?

60 x 4 = 240; 962 + 54 = 1016; 240/1016 = 23.6; sqrt(23.6 x 48) = 33.6; 33.6 x 48 = 1612.8; 1612.8 x 7.48 = 12065.5 gallons per minute.

There is another rule which we will try, to see how nearly the results agree: Multiply the fifth power of the diameter by the head, and divide (as before) by the length plus 54 diameters. 376 times the square root of this will give the discharge in cubic feet per second.

376 x sqrt(23.6^5 / 1016) = 5967 cubic feet per second = 35,802 cubic feet per minute = 267,172 gallons per minute.

Bends do not materially affect the discharge if they have radii longer than five diameters of the pipe.

To find either the area of pipe, or the mean velocity, or the quantity discharged, when the other two are given, we work out permutations of the formulas used above. Thus the area necessary for a given discharge and velocity = discharge divided by the velocity; the mean velocity equals the discharge divided by the area; the discharge equals the area multiplied by the velocity.

A COCKNEY PLAN TO BANISH SMOKE.

In a long article showing how London fogs are a purely local product, due to the heat, smoke, surface, emanations and sewer gas of that sadly afflicted city, the London Medical Examiner seriously proposes to get rid of the evil by collecting the smoke and sending it out to sea. It says:

* Thus, an increase of 1/8 in diameter gives nearly 1/4 more discharge; 1/4 more diameter, almost 1/2 more discharge, etc.

"We shall perhaps be thought visionary in our views, but we hope the day will come when London smoke will be dealt with like London sewage—collected from each house and sent out to sea. The expense would be doubtless great, and the difficulties considerable, but the benefits would be still greater, smoky chimneys and dangerous and unsightly chimney pots being abolished forever. For every fire the requisite amount of draught might be secured by a simple arrangement and independently of length of flue or height of house. The smoke would necessarily have to be drawn away by steam fans, and discharged at different points on the sea coast, according to the direction of the wind. The laying of the street flues would not involve a quarter of the trouble or expense incurred in the main drainage works, and the alterations necessary in each house would be of less account than the annual taking up the drains, which is necessary in so many of our tenements. The only great difficulty when the pipes were once laid would be in the matter of sweeping, but we should imagine that this would be easily surmounted. The proposal we have made is certainly a bold one, and not likely to be seriously discussed for years to come. But let the mind dwell for a moment on its certain results. Think of the clear and pure atmosphere, of the final abolition of the London fog, of the flowers that would bloom at every window, and the creepers that would flourish on every wall. Think of the health that would be infused into all, whether dwelling in squares or alleys, of the clean faces, of the Paris-like houses, of the untarnished spoons. Why, the whole expense might be saved in a year or two out of washing bills and the cost of repairing the Houses of Parliament. But whether this great reform be ever adopted or not, this thing is certain, that without it there can never be any such thing as an 'Ideal London.'"

All very well, a Yankee would say, if London must be a great smoke factory; but wouldn't it be easier to stop making smoke? The pipes that would carry the smoke away might be put to a better use in bringing into the city the means of securing heat without smoke. The fuel now wasted by imperfect combustion and smoke-making would supply gas enough to heat the entire city, with a blazing fire in every room; and the saving of fuel would soon pay for the pipes.

It will be many years, however, before the conservative Londoner will be willing to give up his coal fire, no matter how offensive and wasteful; so that, if ever got rid of, London smoke will most likely be banished by improvements in household methods of coal burning. To a very large extent the smoke might be done away with by the adoption of existing American stoves and improved grates for fireplaces; yet there is large room for the improvement and adaptation of these for the special work there required of them. Hitherto it has been slow work for an American invention to win recognition in England; but the conditions are rapidly changing. American "notions" are making their way even in London. And we have no doubt that our American inventors could do a good thing for themselves, as well as for London, by turning their attention to the smoke problem there.

DECISION OF THE COURTS RELATING TO BARREL MACHINERY.

A very important decision concerning barrel making machinery has just been handed down by Hon. H. H. Wheeler, United States District Judge, who presided at the United States Circuit Court in the Southern District, several months since.

The case was entitled The American Barrel Machine Company vs. Lowell M. Palmer, but the real defendants were the well known barrel machine manufacturers, Messrs. E. & B. Holmes, of Buffalo, N. Y., whose patents were assailed in this action. The complainant is a Massachusetts corporation, and the suit has been pending about four years.

The patents owned by the complainants were originally granted to Wm. Trapp for "improvement in barrel machinery," and to John Tilley for "improvement in machines for chamfering barrels," the former being virtually for finishing the ends of barrels, ready for the heads, by placing the barrel in a revolving cylinder and applying by hand howeling and chamfering tools while the barrel is revolved; the latter patent is for two rotary truss rings for holding barrels during the same operation, in collars movable laterally to receive and release the cask, with peculiar shaped knives operating to cut the croze and chamfer in the barrel. Nearly all of this work is done by the Holmes patent automatically after the revolving cutter heads are adjusted, the knives for dowsing and crozing the barrel being run very rapidly.

Judge Wheeler's decision is as follows:

The claims of the patent are in two parts, one for the truss rings, the other for their combination with the knives. Upon the evidence, it also satisfactorily appears that the truss rings were known and used before, and that Tilley was not the first inventor of them. The knives were probably new in form and mode of cutting, but the defendant does not make use of any knives, either of that form or that operate in that mode. The defendant's cutting machines cut in the same direction with reference to the staves, but that does not infringe the patent. Tilley did not, and probably could not, obtain a patent for the mere direction of cutting. The defendant appears to make use of the truss rings, but not of the tools. He would infringe the first claim, but that is not valid. He does not use the combina-