

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.

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.

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

VOL. XXXIX, No. 20. [NEW SERIES.] Thirty-third Year.

NEW YORK, SATURDAY, NOVEMBER 16, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

Albumen of the serum 309
Alum in bread 302
Astronomical notes 312
Building in steel 307
Competition, Am. in Gt. Brit 314
Cotton worm, facts about the 312
Dam, French 313
Education, practical, in Russia 311
Electric light, new 304
Engine and pump, caloric 306
En line, traction, new 306
Exhibition, Mexican 305
Explosion, the Adolph 314
Fair, world's, in Australia 305
Fair, world's, in N. Y. 305
Feathers, bleaching 311
French exhibit, closing 309
Frost, effect of, on springs 315
Gas regulator, new 306
Glass, spun 315
Holes, square, drilling 311
Horticulture, progress of 312
Inventions, engineering, recent 311
Inventions, new 307
Inventions, new agricultural 309
Inventions, new mechanical 306
Iron and mild steel 305
Life, art of prolonging 303
Locomotive, Met. Elev. R. R. 310
Machine, Huckle, Swedish 308
Metal for foot lathes by hand 315
Microphone and telephone 313
Mortising machine, new 311
Parsnips 309
Patent Congress, Paris Inter. 305
Pottery, Russian 311
Progress, indications of 311
Pump, Watson, the 309
Quarries, granite, Rockport 304
Roads, to destroy 315
Roads in Baden 310
Robbery, bank 304
Schoolrooms to warm 315
Silver Jades, Comstock 311
Soap, hard, to make 315
Steam from petroleum 304
Stenography 315
Telegraph, mirror 310
Tobacco, plug, ingredients 315
Trade, Mediterranean 314
Unit of measure, mound builders 308
Vessel, torpedo, destroyer 303
Wine, to sour 315
Woolen industries, French 324
Wrench and cutter, pipe 310

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT No. 150.

For the Week ending November 16, 1878.

Price 10 cents. For sale by all newsdealers.

I. ENGINEERING AND MECHANICS. Cleopatra's Needle. Brief and comprehensive history of one of the triumphs of modern engineering, with 3 illustrations, showing the launch of the Obelisk; the mode of its erection; its appearance in position on the Thames embankment, London. In Improved Whaling Gun. The Properties of Iron and Steel. By DANIEL ADAMSON, C.E. A paper read before the Iron and Steel Institute. How testing machines impose false conditions. Endurance of iron and steel under concussive force. Thirty experiments upon plates. Annealed steel. Effects of sulphur, phosphorus, and silicon. Tensile strength of iron and steel. Drilled and punched holes. Rule to find the power required to punch steel plates. The tench test. Welding of steel boiler plates. A thoroughly practical and most valuable paper, giving results of numerous tests on Bessemer mild steel, best boiler plate, Martin-Siemens steel, crumplesteel, sub-carbonized steel, Swedish bar iron, mild rivet steel, best merchant iron, Tudhoe crown iron, etc., embracing 40 varieties of iron and steel. These experiments are illustrated by two pages of figures, showing the behavior of the metals under tension, torsion, and concussion, and the effects of punching. The results carefully tabulated, with size of specimen, permanent set induced, maximum strain, per cent of elongation, final breaking strain, bending, drifting before and after annealing, composition of specimen, and all particulars. Illustrated by 53 figures, 2 diagrams, and one page of tables. II. FRENCH UNIVERSAL EXHIBITION OF 1878.—Belgium at the Exhibition, with full page illustration. The Pavilion of Copper, with full page illustration.—The Exhibition Prizes. Names and Goods of American Exhibitors who received Prizes at the Exhibition. An Impressionist at the Exhibition. The Educational Department. The instruction of small children in Europe. The Creche, the Kindergarten, and technical schools. Bookbinding; furniture; ceramics; the porcelain stoves; textile fabrics; the machinery, etc. The American exhibit. A lively and comprehensive view of the Exhibition. III. ELECTRICITY, LIGHT, HEAT, ETC.—Surface Tension. By G. N. FITZGERALD.—Three Experiments with Telephones. By Prof. E. SACHER.—The Telephone and Terrestrial Magnetism.—The Motion of Acid on Surfaces. IV. MEDICINE AND HYGIENE.—The Proper Climate for Consumptives. Annual change of climate useless. Change of climate no benefit to tubercular consumption. The best climate for fibrous consumption. Regions recommended for catarrhal consumption. Importance of the patient's mode of life and what it should be. Bright's Disease cured by Jaborandi. Chemical lecture delivered at the Pennsylvania Hospital, by J. M. Da Costa.—Diphtheria. By W. N. THURSFIELD, M.D. Its origin and dissemination. Systematic Exercises. Their value in the prevention of disease. By EDWARD T. TIBBITS, M.D. A paper read before the Leeds and West Riding Medico-Chirurgical Society. Effects of bodily exercise. How much exercise every one ought to take. Much disease the result of overfatiguation of the appetites. Cultivation of the will a cure for both bodily and mental ills. Criminal negligence of mothers.—Detection of Blood on Dyed and Dirty Tissues. V. NATURAL HISTORY, GEOLOGY, ETC.—American Geological Survey. Geological and Geographical Atlas of Colorado and adjacent country.—The Vacuna Moth. One engraving.—How Indians Catch White Fish. VI. AGRICULTURE, HORTICULTURE, ETC.—A Model Farm in Normandy.—Agricultural Plant Feeding. By E. LEWIS STURTEVANT, M.D.—Forestry. French experiments in the cultivation of forest trees.—Rain Water Cisterns. How to build, and how to estimate capacity.—Small Greenhouses. Construction, cost, and practical management.

STEAM FROM PETROLEUM.

A recent article in one of our daily papers, entitled "Steam from Petroleum," evidently the production of an over-sanguine inventor or an imaginative reporter, has brought us a number of inquiries concerning the use of petroleum as a fuel.

The theoretic calorific power of ordinary petroleum is about 16, of anthracite coal 13, of bituminous coal 15; that is to say, a pound of petroleum, with perfect combustion, will raise 16,000 lbs. of water 1° Fah., a pound of anthracite coal 13,000° lbs. water 1°, etc., but the heating effects depend so largely upon the methods of combustion that, in ordinary practice, these theoretic values are but little considered, the estimation in which they are held as working agents being determined by the practical economies resulting from their use.

The extreme wastefulness of the methods of using coals has long exercised ingenious and scientific minds in endeavors to find some remedy; but the best results thus far obtained by the improved Siemens and Ponsard gas furnaces and the pulverized fuel process show a utilization of but 20 to 25 per cent of the total heat of the fuel—a great gain certainly over the 7 to 8 per cent utilization in the ordinary reverberatory furnace, but still far short of the object aimed at.

On the discovery of petroleum in America the attention of metallurgists was at once directed to it in the hope of finding a fuel possessing important advantages over coal, and in every direction methods were devised for its application to metallurgic purposes; but its constitution and character were so little understood, so little known of the peculiar treatment demanded for the development of its powers as a fuel, that most of the proposed methods proved worthless.

After the elimination of the majority of these, several remained which possessed, in a greater or less degree, certain points of value. It had been determined, for instance, that the oil should be reduced to a fine spray or atomized, as it is called; that a jet of steam impinging upon a drip of the oil and conveying it into the furnace was the most effectual agent for this purpose; and that an exceedingly large amount of air was required to combine with the gases to insure complete combustion.

These points were thought to cover all the requirements, and various styles of apparatus were designed to carry them into effect, and were experimented with in various places. The results of some of the most favorable workings, as reported by Boards of Naval Engineers, showed economies of from 38 to 68 per cent over the use of anthracite coal in the generation of steam, and the further advantages of great reduction in weight and bulk of the fuel, in labor of firing, and in quick attainment of high temperatures.

As might be expected, however, of these early attempts, the apparatus was, in all cases, imperfect, the conditions necessary to complete combustion not yet understood, nor the dangerous character of the fuel fully provided against; therefore, notwithstanding the economies shown, the incomplete combustion with its accompanying offense, the difficulty of controlling the temperatures, and the occasional explosions and fires which alarmed both owners and insurance companies, led, on all sides, to the temporary abandonment of the new fuel.

Further investigations, however, here, as well as in England and France, determined that the steam jet as used, though apparently indispensable for atomizing or scattering the oil into spray, greatly interfered with its combustion by abstracting heat from the flame, and that, to be effective, to permit perfect combustion, it should be superheated to so high a degree that it would vaporize the oil on contact. The amount of air required for smokeless combustion—52 volumes to 1 of petroleum vapor—and the fact that they should be thoroughly mingled, were also ascertained.

Within the past few years so good an account has been made of this knowledge that all indications strongly point to the general substitution, in no very distant future, of petroleum for coal in the manufacture of glass, of iron, steel, and other metals, and for the formation of steam.

Prolonged workings in puddling and heating furnaces have demonstrated that by its use double the number of heats, as compared with coal results, can readily be obtained in a given time and with an economy of full 50 per cent with coal at \$5 per ton and oil at \$10 per barrel. In crucible furnaces, wherein a higher temperature is required and less of the calorific value of coal is utilized than in any other metallurgic operations, the advantages of the new fuel, as demonstrated in Pittsburg in the manufacture of steel for the East River bridge, are still more decided.

Under boilers an average evaporation of 14.98 pounds of water from 212° Fah. has been obtained from 1 pound of the oil, which had a theoretic efficiency of 17.5; and another instance is given of an evaporation of 16.77 pounds of water from 212° by a pound of oil, 17.52 theoretic value.

The great disparity between the practical effects of oil and coal—so much in excess of the difference in their calorific powers—is explained by the wasteful consumption of the solid coal, as above noted; while the combustion of the oil is very nearly or quite perfect, and is completed within the furnace, thus securing for the work from 85 to 90 per cent of its total heat.

The intensity of the oil flame, too, is a most important factor in the economy, assuring a temperature of nearly 3,500° Fah., in a properly-constructed furnace. This heat and the exceptional purity of the flame—there being no residual ashes or sulphurous gases—also insure purer iron in-

the puddling and melting, and better welding in the heating furnace, and the present unusual advantages to workers of glass.

The dangers ordinarily attending the use of this new fuel have been overcome, in one instance at least, by an ingenious and simple device that has been approved by those underwriters who have had it brought to their notice, thus removing an objection which has operated seriously against the earlier adoption of the process.

Coal tar and the residuum of petroleum are also utilized in this manner by liquefying them by heat or mixture with the oil, so that they will flow readily, but the residuum of ashes from their combustion is objectionable in some cases. Coal oils also are capable of being used with good results by this method, but the supply of petroleum will not, for a long while at least, be likely to become so limited or its price so high that economy will require any of these substitutes.

It is not, by any means, to be supposed that science and ingenuity have been exhausted in bringing the petroleum fuel process to its present strong position: it is yet in its infancy, and, as attention is drawn to it, will be improved in many respects. Because of its youth and the little experience with it, and its former unsatisfactory performance, it has been slighted by manufacturers; and because it will revolutionize the present methods of furnace-firing, it will for a considerable time be successfully opposed by the workmen, who like not to be forced out of their well-worn ruts, and who usually control such matters in the majority of iron works.

There are many rival inventors in this field striving to pass one another in the race, but most of them seem to be almost hopelessly out with their crude and unpractical appliances and ideas; and to this class, judging from inspection of the furnace, etc., at the Brooklyn Navy Yard, and from general observation, belongs, in our esteem, their designer.

Quite recently the inventor of perhaps the most perfect system for using this fuel has applied it to the manufacture of polished sheet iron, with results superior to any before attained in this country.

It would be difficult, we think, to name any process which, even at its present stage of development, is more worthy of the attention of all those manufacturers to whom cheaper fuel is a matter of any importance.

ANOTHER NEW ELECTRIC LIGHT.

During the past week the Electro-Dynamic Light Company of New York have exhibited an electric light which is, to say the least, very promising. The apparatus employed was the Sawyer-Man electric lamp, the joint invention of William E. Sawyer, a well known and successful electrical inventor of this city, and Albon Man, of Brooklyn. As we hope soon to lay before our readers a complete description of the lamp, with illustrations of its mechanism, we will merely remark in this connection that the lamp is inclosed in a hermetically sealed globe of glass, filled with nitrogen, and appears to differ from the common mode of exhibiting the electric light in non-supporters of combustion, mainly in the addition of a slender pencil of carbon, which completes the circuit between what would otherwise be the two carbon poles, and by its incandescence furnishes light, in the place of the ordinary voltaic arc. An essential feature of the invention is an ingenious device for dividing the current, and for maintaining a constant uniform resistance in the circuit, whether the lamps are on or off. The light exhibited was steady and brilliant.

A REMARKABLE BANK ROBBERY.—SCIENTIFIC SAFEGUARDS NEGLECTED.

The robbery of the Manhattan Savings Institution, Sunday morning, October 27, was one of the most daring and successful burglaries ever effected in this city. By some means unknown the burglars entered the bank building after the departure of the night watchman, at 6 o'clock, compelled the janitor to surrender the keys to the vault and secret of the combination of the lock, opened the vault, and spent nearly three hours of broad daylight in breaking open the inner safes and rifling them of their contents. They carried away something like three million dollars' worth of bonds, chiefly registered, and perhaps a hundred thousand dollars in negotiable paper and cash.

The most remarkable feature of the affair was the circumstance that an institution having the reputation of being one of the soundest in the country should prove to have its treasures so poorly guarded. The fact that the combination of the outer lock of the vault was intrusted to a feeble old man living in the same building is scarcely less astonishing than that the directors of the institution should have availed themselves of none of the well known electrical and mechanical appliances for defending their safes, not only from the assaults of burglars, but even the unauthorized entrance of those who had them in charge, except during banking hours. It is but another evidence of the amazing indifference of most men not scientifically educated to the scientific aspects of modern life, and the means which science provides for extending the scope and security of life and property. Here were men of reputed culture and sagacity intrusted with the care of the savings of thousands, who must have known of the existence of chronometer locks, by means of which the vault would have been closed against even the over-trusted janitor who held the combination, during all hours not devoted to regular business. They must have known also of electrical appliances, by means of which