Scientisic American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT NO. 87 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

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.

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, \$0 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.

Subscriptions received and single copies of either paper sold by all the news agents.

VOL. XXXVI., No. 15. [New Series.] Thirty-second Year.

NEW YORK, SATURDAY, APRIL 14, 1877.

Contents.

Illustrated articles are marked with an asterisk.) American manufactures.

Aniline black (38)

Annealing steel (39)

Annewers to correspondents

Anti-friction metal, Belgian
Beavers in California.

Belts, making sand (20)

Black surface on copper (28)

Blinds, painting (30)

Boiler, cast from (2)

Boiler, cast from (2)

Boiler tubes, asteming (11)

Boiler tubes, stopping leaks*

Breeze (47) Light conduction marked with an asterisk.)
Lathes, speed of (21).
Lead desilverizing by zinc.
Light, a brilliant (36).
Light and color, properties of
Macadamization, bituminous.
Make something, produce or
Marsh, Professor, honors to.
Money, learn the value of
Mortification and water
Nerve excitements, progragations
Niag ara suspension bridge, the
Observatory on Etna, an.
Orkans, power for blowing (4).
Paint stains, removing (35).
Patent decisions, recent.
Patents, official list of.
Perfume bottle, new*
Photograph retouching desk*
Photographs, microscopic.
Photo magic lantern slides
Platinum plating
Potassium xauthogenate
Power for raising water (8).
Printing plates, photo
Prizes, chemical.
Pumping water (43).
Railroad grader
Reward for a new invention
Rinderpest, progress of
Salimon's endurance, a
Salt from butter (46).
Saw, gumming (27).
School life and light
Screw-cutting dies (24).
Sawithsonian Instit titon, the
Snake at the Zoo, large
Snake own for ijk (44).
Sawithsonian Instit titon, the
Snake at the Zoo, large
Snake on making (30).
Stains, smoke, on marble (49).
Starch, brown (29).
Steel, hardening (22).
Stump extractor (15).
Stulpaur in coal is a stream of the process*
Soldering wire to iron (26).
Stains, smoke, on marble (49).
Sturp extractor (15).
Stulpaur in coal is a stream of the process 233 236 236 235 225 228 235 235 235 235 235 235 220 236 Breeze (47)... Brickwork black, to color (50). Brickwork, coloring (17)... Bridge, the Brooklyn 236 235 225 Bridge, the Niagara suspension.
Business and personal
Casting zine statues (42)......
Cast iron kettles (25)..... 236 235 236 235 Last iron kettles (2). Cement, Portland. Chemical experiment, sangerous Chicken houses, purifying. Cistern, building a 16). Cistern difficulty, cement (9). Clothes pins. Cistern, building a (16) 522
Cistern difficulty, cement (9) 227
Coal and coke (34) 227
Coal and coke (34) 227
Coal and coke (34) 227
Correspondence, Washington 228
Correspondence, Washington 228
Correspondence, Washington 228
Coradie attachment, bedstead* 230
Cylinder, area of a (7) 255
Dam, bursting of a reservoir 225
Dam, bursting of a reservoir 225
Engines (12) 235
Emgines, bollers for small (10, 14) 235
Engines, power of (3) 235
Engines, power of (3) 235
Expission, electrical machine 225
Exposition, Paris, America at the 231
Fact sin nature 235
Fract sin nature 235
Frot extinguisher, a new 236
Frot paris of the city of, Italy 231
Flower garden, a small 239
Forgers, good 236
Frot saw work patterns 236
Frot saw work patterns 236
Frot saw work patterns 236
Frot paris of Russia 236
Gas gauges, etc. (45) 236
Gas gauges, etc. (45) 236
Grain sampler, new* 236
Health of cities 239
Health of cities 235
Hydriodate of morphine 230 Health of cities

Heat and pressure (5)...

Hydriodate of morphine.

Inventions patented in England.

Iron, preventing corrosion on.

Lathes, proportions of (23)....

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT, No. 67,

For the Week ending April 14, 1877.

I. MECHANK'S AND ENGINEERING,—Large vs. Small Car Wheels, with 7 illustrations—Pennsylvania Railway Carriage Bridge, Philadelphia, 1 engraving.—Electrical Car Signal.—Comparative yield of Flour per Horse Power in the United States, England, France, Germany, and Hungary.

The Paris Exposition of 1878: Ground plan of the Main Building, 1 engraving. Regulations for Exhibitors.—Sholl's Lirect Acting Pneumatic Ore Stamps, with 2 engravings.—Performances of Steam Engines under different pressures of steam.—Interesting information about the Detroit Water Works.—Pearn & Co.'s New Pumping Engine, with 1 engraving.—Piriold's Brick Machine, with 1 engraving.—Mill for Softening Middings, 1 engraving.

Steel Making by a New Process.

II. TECHNOLOGY, BTC.—Pipes for Gas and Other Purposes, 3 engravings.

Steel Making by a New Process.

II. TECHNOLOGY, ETC.—Pipes for Gas and Other Purposes, 3 engravings.
Best methods of packing the joints.—New Rotary Filter for large water
and other works, 1 engraving.—Violet Light for Studios.—Simple
mode of Enameling Photographic Prints.—Remarkable Example of
Goldsmiths' Work.—Curious Explosion in a Water Tank.—New Mexico's
vast Coal Fields.

How to Build Cheap Boats, by PADDLEFAST. Drawings and Description for the construction of a Thirty-three Foot Sloop Yacht, Rigging, etc., with 9 illustrations.—Ice Boats on Land; how to work them.
—Design for Carved Buffet, 1 engraving.

III. CHEMISTRY, ETC.—Remarkable Oxidizing Action of Animal Charcoal, by WILLIAM THOMSON, F.R.S.E.—On the Transport of Solid and Liquid Particles in Sewer Gases, by E. FRANKLAND, F.R.S.—Composition of Petroleum, and the Proper Standard of Safety.

position of Petroleum, and the Proper Standard of Safety.

ELECTRICITY, LIGHT, HEAT, ETC — Apparatus for Illustrating the Interference of Waves. — Arrangement for determining the Vapor Tension of Water, by Professor Guthere. — Polarization of Heat Rays. — New plan for Holtz Electrical Machine. — Theory of the Bunsen Lamp. — Nevel experiment with the Singing Flame.

On the Minute Measurements of Modern Science, by Alfred Microscope to Measurements of Minute Length, with 2 engravings.

The Electrical Conductivity of Water. — Compressibility of Air and Gaves. — Dr. Crooke srecent Radiometer experiments. — Specific Heat of Boron. — Practical information for Telegraphers, on Magnets, Magnetism, etc. by Mr. Springer, of the Western Union Telegraph Company. — The Electrical Sunt, by W. H. Prefice. An interesting and useful paper. — Electro-Magnetic Induction.— Induced Currents. — Maximum and Minimum Effects of Electro-Magnetic Induction.— Induced Currents. — Maximum gand Minimum Effects of Electro-Magnetic Induction.— Static and Dynamic Inducand Minimum Effects of Electro-Magnets.—Static and Dynamic Induc-tion.—An Electrical Clock Setter.—Electrical Phenomenon at Sea.— Production of Rain by Human Agency.

ASTRONOMY.—Meeting of the Royal Astronomical Society. Theory of the Horizontal Photoheliograph. Discussion on the bright ring of light around Venus. With 2 figures. Observatory on Etna. General statement and interesting observations made thereat, by Professor Tacchini.

TACCHINI.

VI. NATURAL HISTORY.—The Portuguese Man-of-War.—Microscopic Insects in the Skin.—Spider Lines.—On the Eyes of Worms.—Appearance of Snow Fleas.—The age of the Rocky Mountains in Colorado.—New staining fluid.—Cleansing Diatoms with Glycerin.—Microscopic Examination of the Walls of Hospitals.—Examination of Volcanic Dust, by Professor Nordenskiold.

VII. MEDICINE, HYGIENE, ETC.—School Life and its Influence on Sight, by Goorge Reuling, M.D., Surgeon in charge of the Maryland Eye and Ear Institute, Baltimore. A valuable and important paper, showing the general formation of the human eye; the causes of myopia or near-sightedness among school children; directions for prevention of the disease; the use of glasses; care and preservation of the eyes, etc.

vention of the disease; the use of glasses; care and preservation of cheeves, etc.
Dr. L.A. Sayre's method for the Safe Administration of Chloroform.

—Croton Chloral for Whooping Cough.—Microscopical Researches on the Hair, by Professor Von Ebner.—Cure for Sea Sickness, by T. SKINNER, M.D.

THE PROPERTIES OF LIGHT AND COLOR.

through colored transparent substances, or by reflecting it orange, and yellow, such as are produced by vermilion and from colored surfaces, is utterly erroneous, and proceeds chromates of lead, are photographically inert, and give simply from ignorance of the nature of light. It has been blacks. The blues are the most active, most of all being beproved by Isaac Newton, and since his time by innumer-ing ultramarine, next the violet lakes. But even the red carable experiments of various kinds, that pure white light, mine takes well, as it has a violet shade; but among the such as comes from the sun to us, contains all the colors, as blues, those bordering on green take least, and hence foliage well as heat and chemical activity, and that they may be tends to give dark effects, which are only slightly corrected separated, or the light analyzed, by simply passing it through by using bromine. 4. In using as negatives strips of colored a prism of a transparent substance. The possibility of such glass to print in sunlight, much depends on the shade and a separation has been understood only since the adoption of intensity of the color. In general, the chemical effect folthe vibratory theory, which also explains the nature of the lows the prismatic series from red to blue; but the most efcaloric, luminous, colored, and chemical rays. According fective blue glass is always found to be far inferior to the to this theory, the vibrations, when at comparatively low velocity, manifest themselves as heat only; when the vibrations are rapid enough to produce four hundred and fifty blue glass: it cannot possibly have any not already possessed billion waves per second, they become visible as red light. Five hundred billions produce the sensation of orange, five hundred and fifty billions that of yellow, and so on through green, blue, and violet, the latter resulting from eight hundred and fifty billions of vibrations per second. Vibrations still more rapid are invisible to the human eye, but their blue glass would probably get the credit which exclusively existence is demonstrated by their chemical action, in the same way as the invisible vibrations below four hundred and fifty billions per second manifest themselves as heat only.

Densely transparent media retard the light, and this retardation will affect the rapid vibrations more than those of slower velocity: and under certain circumstances such media will cause light to be deflected from its course in such a way that the most rapid vibrations will be most deflected and the slowest least. This is the principle of refraction, by which split up, is the fundamental principle of the spectroscope, tervening time is short, and a large amount of work must by which the nature of various luminous and illuminated needs be done, those who propose to contribute should realsubstances can be determined.

only show this color. Human faces, for instance, have in people's money to his benefit. this light a ghastly, death-like appearance.

An ordinary gas, lamp, or candle light is not a pure

spectroscopic colors. The blue cobalt glass, for instance, chemically active violet rays at the extreme end of the prismatic spectrum; but on the contrary, this part of the specand of course in all its functions, such as heat, chemical action, etc., is far below the original unchanged solar light.

in order to moderate the intensity of the light for the eyes that is necessary is to photograph the solar spectrum, to do stitutions and radically absurd. the same with a surface painted with a number of various the utmost diversity in the results, according to the nature its excellence.

of the pigment: much greater than the differences in shade The idea that anything can be added to light by passing it | would lead us to expect. As a general thing, the pure reds, sunlight alone, pure and simple. And this fact is sufficient to settle the question about the special virtues claimed for by sunlight. However, if people are induced by its pretended curative properties to take sun baths, which they otherwise might neglect, they may be often benefited by the sasubrious influence of the radiation of the mighty orb, an influence which cannot sufficiently be appreciated; but the belongs to glorious old Sol.

THE AMERICAN EXHIBIT AT THE COMING PARIS EXPOSITION.

Thirteen months now remain between the present time and the opening day of the French International Exposition. We believe that our manufacturers, from their experience at the Centennial, and at previous world's fairs, fully appreciate the value of these exhibitions as advertising mediums; light can be separated into its caloric, chemical, and lumi- and therefore it is unnecessary for us to dwell upon their adnous rays of different colors. The refraction of light, permit- vantages in that direction. The prominent consideration ting the examination of the colors into which it has been now relates to speedy preparations of exhibits; and as the in ize the fact that there is no time for delay. Our people have The apparent colors of objects are caused by their reflect- a proclivity for leaving things to the last moment, and then ing rays of vibrations of certain velocities, and neither redoing prodigies of execution. While perhaps many individflecting nor absorbing others; and the hues of transparent ual displays are thus produced, fully as good as they might colored objects are similarly produced. They pass only have been had more time been taken to their elaboration, certain rays, and absorb the others; and the reflected or still, collectively, a nation's exhibit organized in a hurry is transmitted color is then called the color of the object. In order to perceive such a hue, it is essential that the light by is an example directly in point; and it is certainly to be which it is illuminated contains that color; and this is di- hoped that the country will not be misrepresented in Paris rectly demonstrable by illuminating objects with light of after a similar fashion. The matter is one which appeals to one color, when objects of all other colors will appear black every manufacturer or inventor who intends to exhibit, and or gray. Such a light can, for instance, be produced by to him individually. It relates to work which every exhibburning alcohol in which common salt has been mixed; this iter should see to himself, and not wait in the expectation produces a pure yellow flame, and objects of whatever color, that the government is going to boost him into the show by when seen by daylight, if illuminated by such a flame, will paying for his transportation, or otherwise misdevoting the

There is much being said about the necessity of a large appropriation from Congress, and the organization of a cumwhite, being deficient in blue rays, and has an excess of red, prous body of officials to secure a suitable exhibit from this orange, and yellow; a white object cannot, by such a light, country. We need neither. The gentlemen who prepared be distinguished from a yellow one; light blue cannot be their display at our Centennial can do it again, and need no distinguished from green, and dark blue looks almost black. official help. Our diplomatic officers in Paris should be able In regard to the nature of colored objects, whether painted to look after the interests of American exhibitors there; and or dyed, and of transparent media, such as colored glass or the organization of the national contribution, so far as it liquid solutions, the analysis of their colors by means of the may be found conducive to timely despatch and compliance spectroscope shows that what we call simple colors are in with the regulations of the Exposition officials, may be done most cases complex. Only those colors are pure and simple on this side of the ocean. There is no need of any approwhich we obtain by the prismatic refraction, namely, the priation, save the small sum requisite for the purposes above specified. It is an agreeable assumption, doubtless, that our which is now called mazarin glass, is proved by the spectro-manufacturers are actuated by high patriotic motives in scope not to owe its violet shade to the very refrangible and sending their productions across the Atlantic, and that consequently such self-abnegation should be fostered and rewarded. But, unfortunately, such is wide of the fact. trum is totally absent from light passed through blue glass. Those who contribute do so because they believe that, di-The special shade of the mazarin glass is caused by the fact rectly or indirectly, they are going to gain by it; and therethat its blue is tempered by a considerable quantity of the fore, if the people are to pay under such conditions, it is just less refrangible red rays at the other or caloric extremity of as sensible for Congress to pass a bill for the liquidation of the spectrum, and even with a trace of orange. Its blue is, the expenses incurred by manufacturers for advertising in therefore, of less chemical activity than the prismatic blue, this journal, or in any of the other mediums which they select for informing the public as to their business. The mistake—too commonly made—is that, because foreign govern-We have gone into the details of these rather elementary ments appropriate large sums and appoint commissions matters for the purpose of exposing the ignorance of those headed by high dignitaries, this country must follow their who ascribe to the glass a special chemical or curative in- example. The distinction is ignored that, in the old world, fluence. Some photographers have used blue glass long ago, the paternal government acts for the people, and that the government orders that such a display be gathered, and pays of the sitter, without robbing it of too much of its chemical for it all of its own motion. Here the people are the rulers; activity; and those photographers who possess common and if any display is made, it is done by the people for their sense or experience know that, far from adding to the effect; own benefit. It is for the people to say what part they will of the light, the blue glass is an impediment, and the neces- take in the Exposition, and to act thereon; and therefore for sary time of exposure is rather extended by its use than our contemporaries to spur the government on in the maxotherwise. It is strange that such errors can prevail for ter, as if the people's servants were absolutely in control of years, when a simple experiment can settle the matter. All the people's actions, is both contrary to the spirit of our in-

It is urged that, because France made a good show at our colored pigments, and also to expose a sensitized surface Centennial, international comity requires that we should under a series of colored strips of glass. The writer of this | make as fine a display at her Exposition. Let those who hold article did this more than thirty ago by the Daguerrean pro-this view, then, see that such an exhibit as they will be proud cess, and satisfied himself about the following points: 1. The of is made, and let them pay for it. If money is necessary chemical effect of the prismatic spectrum extends, foriodide to help inventors who have not the means to forward their of silver, from beyond the violet to the blue. 2. When bro- productions—and that is the least objectionable use to which mine is used in connection with the iodine, it extends to pecuniary assistance can be devoted—let it be raised by popwithin the green, while the yellow and red rays appear to ular subscription. A display thus prepared will be more have no effect on silver compounds, but may possess it for truly representative than any other which could be gathered; other substances. 3. In photographing pigments there is and every subscriber will have a direct personal interest in