# Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors, PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

#### TERMS FOR THE SCIENTIFIC AMERICAN. (Established 1845.)

One copy, one ycar. for the U. S., Canada or Mexico...... One copy, six months, for the U. S., Canada or Mexico...... One copy, one year. to any foreign country belonging to Postal Union 400 Remit by ostal or express money order, or by bank draft or check MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

# (Established 1876)

(Established IS/0) is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains is octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, 500 a year. for the U.S. Canada or Mexico. 8600 a year to forewan countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, iast page. Countbined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U.S., Canada or Mexico, on receipt of seven dollars. To foreign countries within Postal Union eight dollars and Mity cents a year.

## Building Edition of Scientific American.

# (Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and spiendidly llustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders and all who contemplate building this work is invaluable. Single copies 25 cents. By mail, to any part of the United States. Canada or Mexico, 82.50 a year. To foreign Postal Union countries, 83.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, stoone address, 55.00 a year. To foreign Postal Union countries, 81.00 a year.

Export Edition of the Scientific American

# (Established 1878)

Connenteneer 1943 with state of the source of the Science of the

MUNN & CO., Publishers, 361 Broadway, New York. 137 The safest way to remit is by postal order, express money order, raft or bank check. Make all remittances payable to order of MUNN draft or bank check. Make all remittances payable to order of MUNN & CO. The Resders are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

#### NEW YORK, SATURDAY, JUNE 6, 1896.

Contents.		
(Illustrated articles are a	marked with an asterisk.)	
Air locomotives, compressed* 354 Air motors, compressed 354 Bail bearings, anti-friction* 354 Brits, production, 1886	of* 33 Old folks. 35 Patent name. 36 Rain fail, beavy. 36 Science notes. 35 Science notes. 35 Science notes. 35 Science notes. 35 Science notes. 35 Temperature, difference of. 37 Trool holder*. 33 Trabe mark decisions. 33 Tube cut er*. 38	

### TABLE OF CONTENTS OF

# SCIENTIFIC AMERICAN SUPPLEMENT

## No. 1066

#### For the Week Ending June 6, 1896,

#### Price 10 cents. For sale by all newsdealers

PAG I. CHEMIGTRY.—The Chemistry of the Siemens Furnace.—By A. M. DICK and C. S. PADLEY. The Chemical Laboratories of Germany.—By A. B. PRESCOTT. University of Michigan. — Historic Laboratories.—This paper treats on some of the historic laboratories of Germany. In-cluding those at Berlin, Charlottenburg, Leipsic and Munich..... 17040

II. METALLURGY.-The Bessemer Process Again.-Reply of Jo seph D. Weeks to bis Critics.-An important brief in the Weeks Bessemer controversy.

 MISCELLANEOUS.- The Drawing of Lots in Connection with the Redemption of the Bonds of Paris.-A curlous process used in France for lottery purpose and for drawing prizes on bonds, etc.-3 illustrations 

#### THE ELEVATED ROADS AND THE RAPID TRANSIT PROPOSED EQUIPMENT OF THE NEW YORK SURFACE PROBLEM. ROADS WITH COMPRESSED AIR MOTORS.

The judgment of the Appellate Justices upon the late proposal of the Rapid Transit Commission should altogether about 132 miles of street railway in this city, be read by every citizen who is interested in the sub- and carries daily upward of 650,000 passengers, is conject of increased transit facilities. It judges the question from a broad standpoint, and shows a conservative regard for the permanent interests of the city. The court points out that the scheme, as presented for the cost of most of the great engineering works has ex- the company determined to abolish the horse car and ceeded the first estimate, and always by a large amount, introduce in its place some form of mechanical traction, and it is argued that there are problems involved in and in the interval their agents have been making an the execution of the proposed work which render the exhaustive examination of the many systems of street question of its final cost extremely problematical.

With the verdict of this court against it, the under-America. ground tunnel may be considered as out of the question, at least for many years to come. In any case it a compressed air motor which has been designed by was a scheme which would have been attended with Joseph H. Hoadley, of the engineering firm of Hoadley serious drawbacks; and were it now completed and in Brothers, who is now associated with the American operation, it would have to contend with the natural repugnance of the people to descending a flight of are informed by the Metropolitan Company that at a stairs and burying themselves in an artificially lighted private trial recently had at the Worcester works and more or less imperfectly ventilated tunnel for a before the engineers and officials the Hoadley motor quarter or half an hour as the case might be. It is showed a remarkable efficiency, as compared with any quite a question as to whether the light and air of compressed air motor which they had previously subsurface travel would not be considered to more than jected to trial. At present ten of the company's cars outweigh the superior speed of the tunnel route. It are being equipped with the new motor, and if they is a noteworthy fact that although a belt system of prove as successful in service as the experimental car underground lines is in operation in the city of London, there is a large proportion of travelers who pre-listing horse car roads will be similarly equipped. fer the surface transportation in cabs and omnibuses in spite of their slow speed of from five to six miles an hour.

The construction of the tunnel being out of theques. tion, attention will naturally be directed to the ele-; 147th Street and Lenox Avenue will contain a 500 vated roads; for in the extension and improvement of | horse power Greene-Wheelock engine and a Minerva air this system is to be found an alternative scheme which would provide the city with greatly improved facilities 5,000 cubic feet. The compressed air motor is being at a comparatively early date. We have good reason adopted in preference to trolley or cable traction, not to believe that these roads would have been extended and improved before this if the city had shown any to securing a service which shall be free from the interdisposition to grant the necessary permission. The ruptions to which the cable and trolley systems are company have more than once professed themselves to liable. be ready to make the much needed alterations and additions, and about the time that the question of attention, not merely by the company which is makbuilding the Broadway tunnel was submitted to the ing the experiment, but also by the engineering world Appellate Justices, the officers of the Manhattan Ele- at large. Engineers in the United States have been so vated Roads again manifested a commendable desire, fully occupied with the development of electric traction to meet the convenience of the public by extending their system and quickening their service. Certain nomenal-that comparatively little attention has been plans and promises were made to the mayor of the paid to other methods of traction which utilize the city, all of which would seem to indicate that the oil, gas, and compressed air motor. As compared with company was desirous to make a reasonable provision the cost of the electric and cable systems, the comfor the needs of the 200,000,000 passengers who annu- | pressed air and gas motors which are being increasingly ally serve to swell the dividends of this very successful used in European cities are said to be showing remarkmonopoly. It was not suggested that the proposed ably economical results. Chief Engineer Pearson, of extension was to be made in any way dependent upon the rejection of the Broadway tunnel scheme; and a purpose of personally inspecting the working of some proposed outlay which was considered expedient in the of the more important plants that are operated on the face of a powerful competitive scheme must be doubly expedient now that this scheme has fallen through.

their expressed desire to extend their system, the next, proved very successful in the mines of the Susqueand immediate step should be to place their proposal banna Coal Company, Glen Lyon, Pa. The chief before the Rapid Transit Commission-a commission engineer of the company, Mr. J. H. Bowden, states that was created for the express purpose of receiving that the cost of operating this plant is between 1 and such suggestions. If there is any doubt as to the legal 1% cents per ton per mile, and that, with the introducstatus of the commission, there are other means by which the proposals of the company can be made known to the citizens and passed upon by them.

The matter is an urgent one, and there can be no possible excuse for a lengthy delay upon the part of the company. On the other hand, any proposals that the city of St. Louis has been visited by that scourge may be offered should be judged with the sole object of the Mississippi Valley, the tornado. It was on the in view of the city's best interests. If the elevated evening of March 8. 1872, that the ever memorable roads have been enormously profitable, they have also cyclone carried death and destruction through this been enormously useful; and if their recent overtures ill-fated city; and to-day the citizens are again occuthrough the mayor have been made, as we believe, in pied in the sad task of burying the dead and caring for

The Metropolitan Traction Company, which controls templating an important change in the motive power of a large portion of its lines. About 32 miles of the system are at present operated as cable and underground trolley lines, and the plant is of the latest patits judgment, was very incomplete, and that the data tern and thoroughly up to date; but the greater part upon which the estimates were based was insufficient |-fully 100 miles of the lines-is still worked by the to give them any reliable value. It is pointed out that slow and objectionable horse car. Several months ago car traction which are being operated in Europe and

> It has been determined to make a thorough trial of Wheelock Engine Company, of Worcester, Mass. We which was recently tested, it is likely that all the ex-

> The air will be carried in two cylindrical steel tanks placed between the trucks and beneath the floor of the car, and they will be charged at an initial pressure of 2,000 pounds to the square inch. The power house at compressor, the reservoir capacity of the plant being merely from motives of economy, but also with a view

> The operation of these cars will be watched with close -and it has had a growth and a success which is phethe Metropolitan Company, is now in Europe for the above systems.

On another page will be found a description and If the officers of the elevated roads are sincere in illustrations of a compressed air locomotive, which has tion of a better type of coal car, he expects to make a still more economical showing.

#### The St. Louis Disaster.

For the second time within the present generation good faith, they should be at once accepted and the the wounded that have been smitten by this worst

Selected Formulae Engineering Notes Biectrical Notes Miscellaneous Notes The Insignia of the Russian Empire The crowing, flag, scepter, etc., which were used in the recent coronation of the Czar3 en- gravings Some Mariners' Myths	17037 17037 17037
V. ORDNANCEAutomatic Firing GunsBy HIRAM STEVENS MAXIMILIntroduction of riflingA continuation of Mr. Maxim?simportant paper on automatic firing guns, in which the subject is treated bistorically and practicallyII illustrations	
VI. PHOTOGRAPHYThe Toning of Bromide PrintsBy J. PIKE. -Full formulas for working the process	17036
<ul> <li>VII. STEAM ENGINEERINGCompound Marine BollersBy COL. N. SOLLAN, Director of Naval Construction of the Italian navy -? illustrations</li> <li>An Old Newcomen Steam Engine -An interesting description of an old steam engine which has been in operation since 1/45-6 illustrations. The Link Movement EngineA description of a peculiar com- pact steam engine3 illustrations.</li> </ul>	17033 17033
VIII. TECHNOLOGYThe Measurement of High Temperatures An important paper illustrating and describing thermometers, pyrometers, thalpolasimeters, etc., as well as thermo-electric pyrometers, optical pyrometers, etc10 illustrations.	
1X. TRANSPORTATION.—The Crystal Palace Exhibition.—Ran- dolph's steam coach.—Description of an interesting steam coach of 1872.—5 illustrations Economy of Mechanical Traction for Street Railways.—Datare- garding the success of mechanical traction in New York City	17031

TYPOGRAPHY.-Machines for Composing Letterpress Printing Surfaces.-By JOHN SOUTHWARD.- A continuation of the Society of Arts lecture, describing the linotype and other typesetting machines.

company given every opportunity to carry out the ex- | form of nature's savagery. tension.

further move looking to extension of their system, the city should use the strong arm of the Legislature in swept over the whole city at the rate of eighty miles its behalf. The case is too serious to admit of delay. an hour. This was succeeded by a heavy deluge of The volume of travel is steadily increasing and already rain, in the midst of which the cylone developed in in some quarters it fairly swamps the accommodation the southwestern suburbs and cut a wide swath of provided for it. Many of the terminal stations are destruction through the city. Crossing the Missisnightly filled with a struggling mob, in which the sippi in the neighborhood of the Eads Bridge, the commonest laws of chivalry seem for the nonce to be upper works of which were badly wrecked, it laid low forgotten, and strong men elbow frail women in the a large part of East St. Louis, and demolished a vast wild rush to secure the much coveted seat-and this in amount of shipping and also a long stretch of warethe representative city of what should be, and in most house property that was standing on the river front. regards is, the most progressive country and people in the world!

<sup>2</sup> 17032 bird of flight thus far known."

The full cyclonic force of the storm of Wednesday If, however, the elevated roads should make no evening was not felt at the outset, but appears to have been preceded by a violent wind storm, which

The destruction was wrought with that speed and completeness which marks the passage of a tornado, and in a few minutes some 400 to 500 are estimated to A FOSSIL bird, represented by a piece of a bone from have been killed outright and over 1,500 wounded, a bed of clay on Vancouver Island, is described by while the damage to property will amount to many Cope, who thinks that it may have been "the largest millions of dollars. The details of this sad calamity arc too well known to call for any repetition. Beyond