Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
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MUNN & CO., 361 Broadway, corner of Franklin Street, 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, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

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361 Broadway, New York

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NEW YORK, SATURDAY, JANUARY 21, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 890.

For the Week Ending January 21, 1893.

Price 10 cents. For sale by all newsdealers.

PROGRESS OF WORLD'S FAIR WORK AT CHICAGO.

Although the weather was cold enough in Chicago early in January to freeze ice fourteen inches thick on the lagoon in the fair grounds, the work of getting ready for the great Columbian Exposition, to be opened there next May, has not lagged in any department. The ice was properly cut and carried off to the cold storage warehouse, while the officials proceeded to complete the rules and regulations touching the cost of light, heat, and power, and make plans for the grand military review at the time of the opening. All the buildings will be lighted, but if exhibitors desire a special illumination, they can have it by paying $8 for each 16 candle power light for the period from May 1 to October 31. The rate for steam power is $40 per horse power. Those requiring only occasional power will be charged 4 cents per horse power per hour. The charges for electric power, exclusive of a fee of $10 or $15 for making connection with the main cable, are:

For one-quarter horse power and less	$20
For more than one-quarter horse power and not exceeding one-half	40
For more than one-half horse power and not exceeding one..	75
For more than one horse power and not exceeding two.....	70
For more than two horse power and not exceeding three...	60
For more than three horse power.....	50

The electric lighting at the fair is designed to surpass all prior attempts at illumination. About the avenues and walks 1,650 arc lights will be disposed, and there will be 4,500 of them in the buildings. The incandescent system will be employed wherever practicable. Fully 100,000 of the glass bulbs are to be used. They will be threaded along the cornices and about the domes and spires. Even the lawns and flower beds in certain parts of the grounds are to be made resplendent by the tiny electric lobes.

The work of laying railroad tracks through the several buildings has now progressed so far that the receipts of exhibits upon the grounds is becoming large, and the directors say that there must be constant pressure from now on to hurry them forward. On January 9 twenty carloads of exhibits were actually unloaded within the exposition buildings, and this may be said to have formed the practical commencement of the work of installation.

The big greenhouses and the horticultural building have been scenes of great activity during the January cold weather, for there has been a competitive pre-exposition primrose exhibit, in which were shown five thousand pots of primroses, arranged artistically and according to hybridization, color, habit and class. The show was a most rare and beautiful one, the flowers being produced from seeds furnished by the leading flower and seed firms of the United States, to whom awards are to be made according to a plan covering color and habit. Under the big dome and beneath the floor of the horticultural building there is also an immense mushroom cellar, kept at a temperature of 95° Fahrenheit, from which the restaurant cooks obtain every morning a great supply of this delicate fungus. Inside the doors of this great structure, however cold may be the weather outside, the temperature is that of the tropics. Warm draughts of air are wafted through its extensive reaches, and warm sprays of water sprinkle the palms and ferns and other tropical trees and plants, and the appearance everywhere is that of a land of perpetual summer and sunshine.

In the electrical building several exhibits are already arranged, and dynamos are set up and ready to furnish power. The Bell Telephone Company is here erecting a stand 100 feet square for its exhibit, the display to cost $22,000. The Edison General Electric Company has also begun preparing the space for its exhibit.

The Cable Roads of New York City.

The present state of cable road construction in New York City is as follows:

The track construction of the Broadway & Seventh Avenue road is completed from the Battery to Central Park and but little yet remains to be built between the Battery and South Ferry. The uptown power station, at 51st Street and Sixth Avenue, is practically completed and the machinery in place. The boilers were fired last Tuesday, and the cable, which is of steel wire wound on a hemp core and is 1½ inches in diameter, will be run in before the end of the week. At the downtown station, at Houston Street and Broadway, the work is about one month behind that at 51st Street, but it is expected that 125 cars will be in operation before March.

The Third Avenue cable road is completed with the exception of short stretches in front of the two power stations and at 125th and 129th Streets and a short piece extending from the terminus of the East River bridge to the end of Park Row. The east track over this length is now being built, and when completed the west track will be put in. The uptown power station, at 65th Street, is rapidly nearing completion, the building being now up to the second story. The downtown station, at Bayard Street and Bowery, is much behind the other, being barely up to the street level. This is due to the extensive and difficult excavation that was necessary in order to make room for the enormous machinery.

On the 29th ult., franchises for the construction of surface roads in Lexington Avenue and Ninth Avenue were to be sold. A company known as the Lexington Avenue & Pavonia Ferry Railroad Company has been formed for the purpose of building and operating a cable road on Lexington Avenue if they are successful in obtaining the franchise. The Broadway cable road will bid for the Ninth Avenue franchise, and will introduce the cable if they get it. At all events it is probable that, owing to the municipal limitations to mechanical traction in the streets of the city, the cable will be used on both these important lines.—*Railroad Gazette.*

The Colorado Desert.

The fact that considerable areas of the Colorado Desert, so called, were susceptible of reclamation by use of the water from the Colorado River and from other sources has more than once been pointed out in these columns. That fact has been known to a few for many years, and a noted pioneer of the State, Dr. O. M. Wozencraft, spent many years in a fruitless effort to persuade Congress to undertake that reclamation on a large scale. Unhappily, however, he encountered the ignorance and obstinacy of men in nowise acquainted with the desirability of such an enterprise, and consequently he went to his grave without securing the fruition of his hopes.

A proof of the feasibility of this scheme of reclamation was afforded during the past season, when the exceptionally heavy rains caused the water of the Colorado to attain a higher point than it had been known for years. The banks of the river to the west were in consequence overflowed and the water spread to a depth of two or three feet for no less than forty miles or more on the desert. This water has since subsided, and in consequence of the thorough saturation of the soil there has sprung up a heavy growth of grasses, which affords pasturage to cattle and sheep driven across the desert from Arizona, and which are an unfailing index to the fertility of the soil. It is demonstrated in an indisputable manner that with the water of the Colorado suitably diverted and properly handled, many thousand acres of desert may be made productive in the highest degree.

All that is necessary is the enterprise which shall embark in a comprehensive system of reclamation. That an abundant reward awaits the genius who shall undertake and carry such a scheme to perfection no one doubts who is at all conversant with the situation.—*Irrigation Age.*

A Golden City in Africa.

We find in the London *Times* a letter giving a striking description of the remarkable town of Johannesburg in the Transvaal, which is well called "The Golden City." Its name even does not appear on the maps of Africa issued ten years ago. It will be a surprise to multitudes to know that there is any such spot on the African continent. The city stands upon a gold reef, upon which reef fifty companies are now working, employing 3,370 white men and over 32,000 natives. Of the city of Johannesburg itself, the writer says:

"It is neither beautiful nor impressive from the æsthetic point of view, but it might be set down as it stands in any part of the civilized world. It has a population of about 40,000. The buildings are good, the streets are broad, there are shops with plate glass windows full of ball dresses and silver plate, the residential quarters are rapidly spreading themselves out into squares and boulevards, a tram line connects them with the business center, for twenty miles east and west you may see the funnels of mining works smoking against the sky, the sound of an engine whistle is in your ears, and you find that a tram has been constructed, which runs from one end of the Rand to the other. The town is lit with gas, water is supplied to all its houses, every ordinary appliance of civilization is here, and when you remember that it has all been done in five years, and that every scrap of material has been carried up, and the six pianos waiting at the frontier will presently be carried, by ox wagons, you begin to realize something of the extraordinary conditions which can have called so sudden a development into existence."

MR. C. A. HAMMOND, Superintendent of the Boston, Revere Beach and Lynn Railroad, suggests the feasibility of using the telephone instead of the telegraph for the transmission of railroad messages and train orders. He states that for ten or twelve years past the telephone has been in use on his short railroad for the purposes mentioned, with much success. He is of opinion there are no greater dangers of error by the use of the telephone than with the telegraph, while there are many advantages in favor of the telephone. In the case of wrecks or other stoppages, the whole situation may be more quickly ascertained at headquarters, and measures taken to get the line in proper order for operation than could be done by telegraphing in the ordinary way.

Needed Enlargement of Machinery Hall.

According to Mr. James Dredge, member of the Royal British Commission, there is likely to be a great lack of space for American mechanical exhibits at the Columbian Exposition. In a recent lecture before the Society of Arts, London, he says :

The Machinery Hall, which is one of the great buildings in the central court, is 850 feet long and 500 feet wide, with an annex of 500 feet by 550 feet; the east front faces on the central court and the north adjoins the Administration Building. Three main galleries occupy the length and width of the area; they are about 130 feet wide, and are crossed in the center by a transept of the same width. The roofs of these galleries and transept are in each case semicircular, the height of springing of the arch being about 22 feet from the floor level. Each rib is free to turn on three points —the two bed plates and a central point at the summit of the roofs. The ribs thus consist of two half arches connected by a central pin, and constructed of light iron lattice girders of the type already referred to, excepting at the base and the summit of the arch, where solid panels are introduced for the whole width of the rib, which is about 6 feet. At the intersection of the transept, the ribs of which cross those of the galleries at right angles, the former are so spaced as to serve as the base for the rectangular iron framework that rises above the top of the ribs, and forms the foundation for three flat domes of 130 feet in diameter, rising to the height of more than 50 feet above the ribs. By this arrangement the arched framework of the transept is removed, and its place is taken by the series of three domes rising to a height of about 130 feet above the floor. The domes are circular in plan, and the space between the lower boundaries and the corners of the rectangular frame above spoken of, as resting on the arched ribs, is filled in with a flat roof. At each corner of the building is an entrance pavilion, surmounted by a domed roof, and in the center of the north and east sides there are large entrance porticoes flanked by towers 200 feet high. Outside the arched galleries just described, and surrounding the building, are flat-roofed courts framed in timber and sheathed with fibrous plaster. These courts are in two stories, affording an extensive promenade on the ground floor and a large gallery space above. The longitudinal framework of the iron portion of this structure is very elaborate, and cannot be described in so brief a notice as the present. The roof is to a large extent covered with glass, and, so far as can be judged, the arrangements provided for lighting and ventilation cannot fail to be satisfactory. The building was designed with a view to erecting it hereafter as a great railway station, to which purpose it can be admirably adapted. The construction of the annex calls for no particular comment, nor does that of the power station adjoining. This power station will form probably one of the most interesting parts of the machinery section, as it will contain the boilers, engines, and dynamos for generating all the power required throughout the Exposition, about 24,000 horse power. The various units of this station will constitute exhibits. The adoption of electricity on a very large scale for driving the machinery in motion will be one of the new departures at the Columbian Exposition, it will be exclusively used in the annex, which is framed wholly in timber, but in the main hall steam will be employed. As in the Paris Machinery Hall, overhead rails will run from one end of the buiiding to the other, and on these traveling platforms will be placed for the convenience of visitors. These platforms will be electrically driven.

The area of the Machinery Hall is 17½ acres, which is divided as follows:

	Square feet.
Main hall	425.000
Annex	269.990
Total	694,990

This area is not quite so large as that of the Machinery Hall and its annexes at the Paris (1889) Exhibition. As, however, it is hardly to be expected that foreign nations will require so much space for this class of exhibit in Chicago as they did in Paris, it might have been supposed that the space allotted to American exhibitors would have been sufficient for the purpose. This does not appear to be so, however, and, according to the report of Mr. L. W. Robinson, the demands for space are altogether out of proportion with what can be supplied. The statement that there are 17½ acres of floor space is in itself somewhat misleading, because from this total many important deductions have to be made. These deductions are approximately as follows:

	Square feet.
Stairways, restaurants, entrances, etc.	56,990
Foreign sections	175,000
Power plant for engines and dynamos	112.974
Engines for driving American exhibits	3,000
Deduction for aisles, avenues, and passageways	116.675
Total net space for American exhibits	220,351

It will be seen from the foregoing figures that the space available for American exhibits and machinery sinks into really insignificant proportions. That this is so will be a cause of deep regret and disappointment to those American manufacturers who will be unable to display their specialties with advantage, and also to the numerous foreign visitors, to whom the show of American machinery will be one of the principal attractions. It would seem, indeed, that unless some very extensive annexes be made to this building, the Machinery Hall will be a general source of disappointment, because it will be incapable of doing full justice to that branch of American industry which has made such prodigious progress during the last few years. Six months ago the applications for space represented more than four times the total amount available, and the unsatisfactory problem which Mr. Robinson is called upon to solve is to satisfy exhibitors who require 900,000 feet of space with one fourth of that amount. Those who call to mind the American section in the Machinery Hall of the Centennial Exhibition in 1876 will remember that it was densely crowded, and yet it covered an area of more than 100,000 feet greater. It is true that on that occasion exhibits relating to electricity, to transportation, and to mines and mining were all grouped within the Machinery Hall, but in 1876 none of these classes occupied a great deal of space. At Chicago a vast building has been allotted to each of these groups, and the prospects are that they will be densely packed with exhibits.

When the progress that has been made during the last 18 years in mechanical arts is borne in mind, there is no reason for surprise that the demand for space is far greater than the supply, and it would almost appear as if the organizers of the Exposition had lost sight of the fact that the pressure in this department will be unprecedented. Mr. Robinson, the chief of the department, writes at a recent date in a somewhat desponding tone as follows: "Either three-quarters of the applicants must be left out, or cut down to one-fourth of the space applied for, or finally the chief of the department must take upon himself the responsibility of placing on the space available the representative firms who have applied, and eliminate the less consequential applicants. Thus the manufacturers of the country will suffer greatly by not being able to make as full a display of their products as they would otherwise be entitled to do, and there will be many strong and enterprising concerns who will not be represented. Unless additional buildings are provided, the whole brick and tile industry will not find a place, nor will fire engines and fire extinguishing apparatus secure a location. Besides these, heavy machinery, like drop hammers, steam hammers, and machinery requiring fire for its operation, like forges, special boilers, gas and oil machinery, must be omitted."

Worsteds.

A further reply to Mr. Brennan's question: Worsteds are generally classed under the head of wool goods without any distinction as to their special construction. The manipulation of the wool to make a piece of worsted differs very much from that necessary for the production of woolens. Although both are composed of wool, they are two different materials. A worsted is made entirely of wool direct from the sheep's back, and must be of sufficient length to permit of being combed. This is a very important distinction, for other wool yarns may be made from wool that has before seen service in a garment, and being reconstructed into a wool substance called shoddy, and being mixed with a greater or less amount of pure wool, according to the yarn desired to be produced, is again converted into yarn. Worsted yarn is made not only of wool in its first stage from the sheep's back, but from wools sufficiently long in staple to permit of being combed.

After the wool is taken from the sheep's back it is passed on to men trained in ascertaining the various qualities of wool, and by them sorted into the several grades that the fleece contains. The number of qualities or grades of fineness of the fibers in a fleece varies according to the breed of the sheep. Some classes of wool contain as many as fifteen distinct varieties. By the quality of wool is meant its adaptability to produce so many number of yards of thread to a given weight. After beng sorted, the desired quality of wool to produce a certain yarn is taken into the wash house and thoroughly washed by a machine in warm water and soft soap. All the grease and dirt are removed by this process. It is then passed on to the carding room; the carding machine opens out the fibers of the fleece and places them perfectly straight, so that a continuous rope of wool is run off the machine. The fibers of wool vary in length, some being long enough for worsted yarn, while others are not.

In the process of washing and the natural growth of the wool, some of the fibers become worked into little balls like pinhead specks, which, if permitted to pass into the yarn, would make a specked effect in the cloth. These must be removed by the comb, and in order to do this the wool is passed from the card to the back-wash, from back-wash to punch, from punch to comb. Wool combing machines are of various constructions, such as Noble's, Holden's, and Lister's, but the principle of all is the same, in that the wool is drawn through fine steel pins, which permit the straight sliver of wool to pass through rollers, while the short, knotty bits are carried to the noil tin. The long combed wool is known to the trade as *tops*, while short, knotty portion is called *noils*. The top alone is used to produce worsted yarn, and the noil is used for making a woolen yarn chiefly to be employed in making blankets, although it is equally serviceable for making woolen cloth or woolen dress goods.

After the wool sliver leaves the comb, it is passed through a series of machines called gill boxes, and made into balls ready for the drawing room. In the drawing, each operation will reduce the weight of wool in a given length entering the machine according to the counts the wool has to be spun to. The next and last operation for making a single yarn is the spinning room. In the spinning a perfectly even and fine thread is produced and wound on to a bobbin. The process of spinning is now completed, and the next thing to be considered is the design and color of cloth.—*Geo. Simpson, Wade's Fiber and Fabric.*

Tommasi's New Multitubular Electric Accumulator.

Dr. Donato Tommasi's accumulator is characterized by electrodes inclosed in a tubular envelope or sheath of metal or insulating material, either rigid or elastic (celluloid, ebonite, caoutchouc, etc.), perforated by a multitude of little holes.

In the center of this sheath is arranged a core of lead or other suitable metal or alloy serving as a current conductor, and in contact, on each of its faces, with a layer of oxide of lead which is preserved from falling or disintegration by the perforated envelope which imprisons it.

The immediate consequence of this arrangement is to double, for a given weight, the proportion of the active matter and, consequently, the capacity of the accumulator

Thus, the advantages of the multitubular accumulator are explained from three points of view, the capacity, the weight and the volume.

The charge is made by such a system that it can attain, without inconvenience, 5 to 6 amperes per kilogramme.

The discharge can vary from 1 to 4 amperes per kilogramme of the electrodes. It should be stopped when the tension is lowered to 1·7 volt. In the case of variable strains, when sudden power is needed, the Tommasi accumulators can stand, without inconvenience, intensities of from 6 to 8 amperes per kilogramme of electrodes.

The electrical constants of this accumulator are the following:

Initial electromotive force	2·4 volts.
Capacity per kilogramme of electrode	20 amperes.
Result in quantity	95 p. c.
Result in work	80 p. c.

In announcing a capacity of 20 ampere hours that can be utilized per kilogramme, Mr. Tommasi has adopted a system of discharge which can vary from 1 to 3 amperes per kilogramme of electrodes. It is evident that, if less were employed, the capacity would be increased.

Comparison.—To give an idea of the great electric capacity possessed by the Tommasi accumulator, it is only necessary to compare this capacity with that of the best types of accumulators known, which are most used in electric lighting and traction, and thus we find that the capacity of the multitubular accumulator is 3·3 to 5 6 times that of the best types known.

The arrangements employed in the accumulator of Dr. D. Tommasi show, as will be seen, considerable progress beyond those that have been produced heretofore. The simplicity and strength of its construction make of it an absolutely industrial apparatus, which will have to render immense services, and consequently destined for a great future.

Coal Consumption of War Vessels.

Tests of the coal consumption of some of the United States war vessels have shown the following results: The Newark, which has triple expansion horizontal engines, indicating 9,131 horse power, burned 2·434 pounds of coal per horse power per hour. The Concord, with the same style of engines, indicating 3,513 horse power, burned 2·76, and the Bennington, indicating 3,533 horse power, burned 2·6 pounds per horse power per hour. The rate of consumption was about 40 pounds of coal per square foot of grate surface per hour with a forced draught. The coal used by the Newark was semi-bituminous, of excellent quality, and that used by the other ships was a good quality of anthracite.

Dimensions of the New Cunard Steamers.

In an article in the SCIENTIFIC AMERICAN of December 31 relative to English-American steamers the dimensions of the new Cunard steamer Campania were given as 700 feet length, 20,000 tons. This was an error. The above are the proposed dimensions for the new White Star steamers. The new Cunard boats Campania and Lucania are 620 feet length, 65 feet 3 inches beam, 43 feet depth, 12,500 tonnage.