moved still warm, and after cleaning up and chipping was shipped by rail from Carteret to Communipaw, N. J. Here the car containing it was run upon a railroad deck scow and was towed to the works of W. & A. Fletcher, Hoboken, N. J., the builders of the engine. The car in which it was shipped was especially cut out to receive it, but so large was the cylinder that it had but one inch clearance under some of the bridges.

Another cylinder, the mate of this one, has still to be cast. The cylinders are to go into a four-cylindered engine for a new Sound steamer for the Old Colony Steamboat Company. The engine is to be a double compound inclined engine, of 8,000 indicated horse power. Two cylinders such as the one described are for low pressure, and there are to be also two high pressure cylinders of 51 inches diameter, all of 11 foot stroke. The steamer is to have a length over all of 440 feet 6 inches and a width over the guards of 92 feet. She will displace at 12 feet draught 4,550 tons, and will be the largest steamer of her type in the world. The hull is being built at the yard of the Delaware River Iron Ship Building and Engine Company, Chester, Pa. It is to be launched about July 1, 1893. The boat is to be in service in 1894. The paddlewheels will be feathering, a type with which the Fletcher Company have become to some extent identified. As to some extent a prototype of this engine, the engine of the steamboat Plymouth may be referred to. (See SCIENTIFIC AMERICAN, October 4, 1890.)

Gelatine Dry Plate Photography.

The gelatine dry photo. plate process now so commonly used was first given to the world in practical form by John Burgess, of England. Various experiments by different photographers had been made previously with gelatine, but no one had succeeded in producing a definite and successful process until Mr. Burgess showed the way. The first announcement of the Burgess process, in this country, was given in the SCIENTIFIC AMERICAN of August 23, 1873, and reads as follows:

"New Photo Process.—A recent improvement, announced by Mr. Burgess, a photographic artist of Peckham, England, consists in sensitizing gelatine by means of bromide of silver. The mixture is applied warm to the glass plate, and the picture may be taken with the plate either wet or dry. The time of exposure is the same as for the ordinary wet collodion plates. The alkaline pyro. developer is used, the picture making its appearance rapidly, with any required degree of intensity. The new process promises to compete sharply with the ordinary collodion process."

Further details of the process were given in the SCIENTIFIC AMERICAN of December 13, 1873, quoted from the *British Journal of Photography*, as follows:

"*Dry Plate Photography with Gelatine.*—Place seven grains of Nelson's gelatine and seven grains of isinglass in cold water for several hours until soft and swollen, then drain off the water, and put them into a two ounce bottle, which place in hot water until the gelatine and isinglass are dissolved. Add thirteen grains of bromide of potassium, dissolved in a drachm of distilled water, and in another drachm of distilled water dissolve fourteen grains of nitrate of silver, and add it by degrees, in the dark, shaking well between each addition. Now add half a drachm of saturated solution of nitrate of baryta and two drops of muriatic acid. There will be a froth on the top of this emulsion from the shaking, and in order to get rid of this it may be strained through muslin, or if left in the hot water, it will gradually subside.

"This will form sufficient emulsion, at a cost of about two pence, to coat over one dozen quarter plates, which, as coated, should be laid on a flat surface until the film sets, which will take about five or ten minutes, when they can be put away in a box to dry. The drying will take about forty-eight hours (unless they are placed in a current of dry air), or they may be exposed at once. An exposure of thirty seconds, with alkaline developer, should give a negative of sufficient printing density without any intensifying. The plates should be placed in cold water for about a minute previous to developing.

"Emulsions prepared with the silver in excess caused the plates almost surely to fog, and the image to be very thin and faint."

An Omnibus with Pneumatic Tires.

The latest adaptation of pneumatic tires is to the wheels of an omnibus which is being tried by the Glasgow Tramway Company at Glasgow, Scotland. The tires are about 3½ inches diameter, and can withstand a pressure of 187 pounds to the square inch. To guard against any risk of the India rubber being punctured by sharp stones or otherwise, the tires are thoroughly protected by several plies of canvas, with a covering of wire-wove netting. The omnibus is said to be a very comfortable vehicle to ride in. The inside seats are mounted on springs, which adds to the comfort. There is an electric lamp fixed in the roof, supplied by a box underneath one of the seats containing a sufficient storage of electricity for 24 hours. Twelve passengers can be carried inside and 14 outside.

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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361 Broadway, New York

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NEW YORK, SATURDAY, MARCH 11, 1893.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 897.

For the Week Ending March 11, 1893.

Price 10 cents. For sale by all newsdealers.

DELICACY OF A CERTAIN CHEMICAL TEST.

One of the most delicate tests known to chemical science is that in which potassium sulpho-cyanide is employed to discover the presence or absence of the element iron in a given solution. Potassium ferrocyanide is, perhaps, used more frequently, but gives much less satisfactory results. In cases where this salt failed to indicate the slightest trace, the sulpho-cyanide yielded a very evident proof of the presence of the element in question. The observance of this fact led to an attempt to ascertain as nearly as possible the actual value of the sulpho-cyanide as an iron test. The method adopted was very simple. A small quantity of polished iron wire was weighed out very accurately. In the actual process, 0·0347 gramme was taken. By considering the density of iron, it was found that this weight occupied a volume equal to 0·004458 cubic centimeter. This quantity of iron was now dissolved in hydrochloric acid and water and oxidized, forming ferric chloride, which was then diluted with a sufficient volume of water to yield a solution of one hundred cubic centimeters volume.

This was placed in a burette graduated to one-tenth centimeter, and three-tenths of a centimeter were drawn off, to which the potassium sulpho-cyanide test was applied, which imparted a reddish brown color to the liquid, indicating the presence of iron. The solution was then made more dilute and a second portion was tested. This process was continued until only a very faint tinge of red could be detected. A small quantity of water was again added and the test applied, which, however, did not indicate the presence of iron. The quantity of iron which was detected by the sulpho-cyanide on its last successful application was found to be no greater than forty-three one-hundred-millionths of a cubic centimeter, or thirty-three ten-millionths of a gramme. This seems, indeed, to be a wonderfully delicate test, but it is only necessary to call to mind the approximately determined weight of the molecule of iron to be struck with the crudeness and inaccuracy of our most delicate methods of qualitative analysis.

The weight of a molecule of hydrogen, as given by an eminent authority, is approximately 0·000,000,000,000,000,000,000,04 of a gramme; by multiplying this inconceivably small number by fifty-five, the atomic weight of iron, we ascertain the weight of a molecule of iron—0·000,000,000,000,000,000,002,2 gramme. In the sulpho-cyanide test we were able to detect the presence of thirty-three ten-millionths of a gramme of iron; dividing this number by the weight of one molecule of iron, we find that this apparently delicate test is unable to indicate to our senses a less number of molecules than 1,500,000,000,000,000. When we consider that most of our so-called tests are much less accurate than this, it is evident that in our determinations it is impossible to reach the absolute truth.

THE NICARAGUA CANAL.

In view of the demands of the present trade carried on between the Atlantic and the Pacific slopes of North and South America, and of the flattering promises of a greatly increased traffic by the construction of a canal across Central America, the promoters of the Nicaragua Canal scheme ask the United States government to guarantee their securities, and thus father the enterprise and hasten the work of construction by giving the securities financial standing. Both the great political parties of the country have committed themselves in favor of encouraging the building of the canal. Yet, as much as the demands of commerce need the completion of an isthmian passage, it is a question whether the government should commit itself in favor of or against the guarantee asked for until more definite knowledge of the perfect feasibility of the engineering features of the scheme is to be had. The Panama experience is a lesson from which much can be learned, and no patriot American would want it duplicated in any American scheme in such hairbrained engineering plans.

There is little doubt but what the Nicaragua Canal can be constructed on the plans already conceived. But there are greater demands on engineering skill to so construct the canal that it can be maintained. The plans call for many dams of remarkable length and unusual height. There are to be several deep cuts. Then a considerable watershed is crossed at an angle. The climate of Nicaragua is tropical and the precipitation at times is enormous, in fact, far greater than the engineers of the Panama Canal seem to have dreamed of. Another feature of much consequence is the geological formation of the country, which needs most thorough study in such engineering work as deep, narrow cuts and the construction of long, high dams. Several appropriations have been made by Congress and been spent in making surveys of the several proposed routes across the Isthmus, but some of these questions—vital to the successful construction and maintenance of the canal—have not been answered fully to the satisfaction of some eminent engineers who are favorable to the canal scheme.

The experience of the government in building the Sault Ste. Marie Canal has shown that thought should

be had not alone for present needs, but for the future, by recognizing the tendencies in ship building, and that a ship canal should have ample width as well as ample depth. Experience proved that the Suez Canal did not possess enough width as originally constructed, and it had to be widened. Yet, in spite of these costly precedents, the Nicaragua Canal, as at present planned, is surprisingly narrow in places.

However much the Nicaragua Canal may be needed by commerce, it is only ordinary business requirement that such a guarantee as that of $100,000,000 in securities should not be made until there is absolute surety of the successful consummation of the project. New York and San Francisco are now 15,600 miles apart by the water route around Cape Horn. By the Nicaragua route this mileage is reduced about 10,000 miles. From an economic standpoint the construction of the canal would be beneficial, as it would more nearly equalize prices of commodities. The Pacific coast needs the cheap coal of the South and the cheap manufactured products of the North, while the South and the North can take in exchange wheat, fruit, lumber, and other products. But rather than make a hasty effort to secure these benefits, the government can afford to wait a year or two if necessary until a competent commission has looked thoroughly into the weak spots of the canal scheme. It is safe to be thorough in all preliminaries, so that when the work is undertaken and completed it shall be an engineering, a commercial, and a financial success.

THE COMING NAVAL REVIEW.

As the time approaches for the assembling of the great fleet which, at Hampton Roads and in New York harbor, will take part in a magnificent pageant to mark the opening of the World's Columbian Exposition at Chicago, a strong public interest is being manifested in the affair. This will be the first occasion on which the ships of our new navy will come into comparison with those of the leading foreign powers.

The letter of invitation to foreign powers, inviting participation in the naval review, set forth that our government would "assemble a fleet at the prescribed rendezvous at Hampton Roads in the month of April next, with instructions to proceed thence to New York harbor, there to take part in a naval review in connection with the International Exposition at Chicago, commemorative of the 400th anniversary of the discovery of America by Columbus. It is the sincere and earnest wish of the President that this proposed celebration shall be commensurate with the importance of the historical event which it commemorates, and shall illustrate the extraordinary advance in the progress of naval architecture at the present time. To this end the fleet of vessels of the United States will be composed of vessels of the most modern types which shall have been completed at the date named, and the demonstration will further include reproductions of the caravels which composed the fleet of Columbus upon his voyage of discovery."

Twenty-one vessels have been selected by the Navy Department to take part in the review as follows: The New York (flagship), Baltimore, San Francisco, Charleston, Newark, Philadelphia, Chicago, Miantonomoh, Kearsarge, Detroit, Montgomery, Atlanta, Yorktown, Concord, Bennington, Castine, Essex, Dolphin, Bancroft, Vesuvius, and Cushing. Of the foreign powers invited, Austria, Turkey, and Greece have declined, having no vessels available. Germany will send two armored cruisers, the Kaiserin Augusta and the Seeadler. Russia will send a large fleet, and will probably have the largest representation of any nation in the ceremonies. The Russian fleet will include the first-class armored cruisers Dimitri Donskoi and General Admiral, and the corvette Rynda, with Vice Admiral Koznakoff commanding. Great Britain has accepted the invitation, but the fleet has not been definitely selected. The flagship Blake and several vessels of the North Atlantic squadron will be present, and it is probable that one or two belted cruisers will also be sent over. Italy will send the cruisers Etna, Bausan, and Dogali, and perhaps the transport Fridano, under Rear Admiral Magnaghi. Spain will be represented by the cruisers Reina Regente and Infanta Isabel and the gun boat España. The Duke of Veragua and his suite will sail for America on the American line steamer New York on April 8. France has virtually accepted the invitation to participate, but no vessels have yet been designated. Brazil will send the ironclad Aquidaban and the cruisers Republica and Tiradentes. From the Netherlands will come one frigate of the first class, the Van Speyk, and there will be still other participants not yet announced, but enough to constitute the largest naval demonstration ever seen on this side of the Atlantic.

It is the present intention to have the fleet assemble at Hampton Roads on April 26, and proceed thence to the review in New York harbor, but the full details have not yet been settled. Admiral Gherardi, who has been assigned to the chief command, expects that the battle ships in line will stretch from the Narrows up along the North River shore, and has suggested that "instead of having the vessels pass in review, it may seem best that the vessel upon which will be the President, members of the Cabinet, and such other dignitaries as may be with him, should steam down along the whole line and receive the honors that will be due to him."

On the day of the review New York harbor will be under Federal jurisdiction, and there can be no room for doubt but that the great pageant here will be in every way worthy of the great exposition whose inauguration it will mark.

The American Silk Industry.

According to Census Bulletin No. 348, the advance in the state of this art for the past decade has been wonderful, not only in the quantity and character of production, but in the invention and development of improved machinery, through the operation of which silk fabrics of all descriptions have been brought within the reach of the masses and, to considerable extent, translated from the category of luxuries to that of necessities. The success attending the industry of silk manufacture in the United States has naturally given birth to healthy home competition, with the result that production has been stimulated and American-made silk goods now find abundant demand within our own markets.

The classification of silk goods of American manufacture is now practically without limit, embracing every article made in the older silk-manufacturing countries, and fully equal to the foreign product in quality of weave, beauty of design, and excellence of finish.

The value of the net or finished production of silk goods manufactured during the census year 1890 was $69,154,599, against $34,519,723 for the census year 1880, an increase of $34,634,876, or 100·33 per cent.

The following is a comparative statement:

	1890.	1880.
Number of establishments	472	382
Capital invested	$51,007,537	$19,125,300
Number of hands employed	50,913	31,337
Amount of wages paid	$19,680,318	$9,146,705
Miscellaneous expenses	$4,345,032	....
Cost of materials used	$50,919,016	$22,467,701
Value of product	$87,298,454	$41,033,045
Number of spindles	1,254,798	508,137
Number of looms	22,569	8,474

These figures do not include the operations of fifty-two establishments engaged in dyeing and finishing silk goods, with an invested capital of $2,368,157, employing 1,745 hands and paying $1,013,325 in wages.

This report was prepared under the general directions of the division of manufactures of the Census Office by Mr. Byron Rose, special agent, assisted by Mr. Peter T. Wood.

LOCATION OF SILK MILLS.

The following list, substantially complete, indicates the location of silk mills, with the year of their establishment, at points where none existed prior to 1880. At a number of the locations named additional mills have also been erected within the last census decade, but only the first one established is referred to in this list.

1880. Poughkeepsie, N. Y.
Boonton, N. J.
Hawley, Pa.

1881. Dover, N. J.
Linden, N. J.
Allentown, Pa.
Darby, Pa.

1882. Bridgeport, Conn.
Preston, Conn.
Tariffville, Conn.
Oswego, N. Y.

1883. Athol, Mass.
Auburn, N. Y.
Easton, Pa.

1884. Woonsocket, R. I.
Marlboro, Conn.

1885. Stirling, N. J.
South Bethlehem, Pa.

1886. Becket, Mass.
Newton Upper Falls, Mass.
Guilford, Conn.
Fultonville, N. Y.
Phillipsburg, N. J.
Bethlehem, Pa.
Catasauqua, Pa.
East Mauch Chunk, Pa.
Harrisburg, Pa.
Stroudsburg, Pa.
Wilkesbarre, Pa.

1887. Hopedale, Mass.
Mapleville, R. I.
Glenn, N. Y.
Middletown, N. Y.
Norwich, N. Y.
Whitehall, N. Y.
Hackettstown, N. J.
Honesdale, Pa.
Hagerstown, Md.
Pittston, Pa.
Reading, Pa.
Belding, Mich.

1888. Jamestown, N. Y.
Bayonne, N. J.
Midland Park, N. J.
Port Oram, N. J.
Altoona, Pa.
Bloomsburg, Pa.
Pottsville, Pa.
Tobyhanna, Pa.
Weatherly, Pa.
Petersburg, Va.
Wadesboro, N. C.

1889. Argusville, N. Y.
Hillburn, N. Y.
Hornellsville, N. Y.
Kinderhook, N. Y.
Matteawan, N. Y.
Spring Valley, N. Y.
Steinway, Long Island, N. Y.
Oakland, N. J.
Pompton, N. J.

1890. Sandwich, Mass.
Monroe, N. Y.

Preserve for Binding.

The publishers of the SCIENTIFIC AMERICAN would advise all subscribers to preserve their numbers for binding. One year's issue (52 numbers) contains over 800 pages of illustrations and reading matter. The practical receipts and information contained in the Notes and Queries columns alone make the numbers worth preserving. Persons whose subscriptions have commenced since the beginning of this year can have the back numbers sent them on signifying such wish. Their subscriptions will then expire with the year.

Eight Young Naturalists.

The daily *Sun*, relating how eight New Jersey boys, with a taste for natural history and some training in that line, made a very profitable and enjoyable use of a part of their vacation last summer, adds:

These boys, who were high school students, took a walking and collecting trip. In twelve days they traveled 160 miles, and came home with a new stock of health and a big load of collections. It was a very cheap trip, too, the total expenses being $9 for each member of the party.

The expedition left Monclair one morning about the middle of June. One of the boys supplied a strong horse, which was attached to a grocer's delivery wagon. A vehicle was needed for their camp equipment and their collections. They had a complete camping outfit except a tent, which they had not been able to borrow: so they made up their minds that they would give the farmers a chance to offer them the hospitality of their barns. The idea worked well, and every night they slept on the hay in one or another of the capacious barns of New Jersey. Their wagon carried food supplies for two weeks.

Each boy had a valise and a roll of blankets. Then there were botany cans, a collecting press and driers, geological hammers, a camera, and all the other apparatus the boys needed for such a tour. Before they left home they agreed upon their daily routine. They were to have cooked meals morning and night and a cold snack at noon. Four boys each day attended to the culinary department, two serving as cooks and the other two serving the meals. The next day the other half of the party took their turn at the cooking pot. Usually the commissary detail rode in the wagon while the others were busy with beetles, bugs, plants, and minerals.

The boys studied every geological formation from Newark to the Delaware Water Gap. Some of the most interesting places visited were the slate quarries at Newton, the mines at Sterling Hill and Franklin, which are so rich in the beautiful crimson and green ores of zinc, and the Delaware Water Gap, where the young students were greatly interested in the finely exposed rock formations. Many specimens of everything that interested them were obtained, and when they came home they enriched the cabinet of the high school and had many things left to label and store away in their private collections as souvenirs of a very sensible and pleasant vacation jaunt.

The example of the eight Montclair boys may well be emulated by students in many places who have a fondness for nature and a taste for collecting specimens.

How Fires Affect People.

In a fire you get very close down to human nature, observes the New York *Sun*. The other night an apartment house took fire. There was no time to be lost by the inmates. A mother, scantily clad and crying, took out her two little children. A wife buttoned herself in her long newmarket and ran, leading her brown-eared setter. A devoted son and daughter on the top floor dressed warmly their helpless old mother of 80 and waited to carry her, if need be, across the fire escape. One woman put on a fur-lined cape over her night dress and came forth with a traveling bag filled with silver. A young widow ran for her new Sunday frock and took down the departed one's portrait. Another came forth fully equipped as for church, in jacket, tipped hat, and crimps. Another young woman left all her belongings and fled in her night dress, blistering her bare feet on the cinders, and ran down the street calling for a carriage. Another got her valuables in her sealskin coat, and finding the smoke not too threatening, fished out her long-tailed gown and the black silk silhouettes of her grandfather and grandmother, which she knew she couldn't replace. One man contented himself with a bath robe, another dressed himself in his four-in-hand tie and scarf pin.

Hygiene and Sanitation at the Exposition.

The Bureau of Hygiene and Sanitation at the World's Columbian Exposition has been organized for the purpose of giving as complete a view of the present state of the science as possible. More and more attention is being given to sanitary science, and the truth of the expression "the common health is the common wealth" is being abundantly proved by the decreasing death rate in many of our leading cities. The exhibit bids fair to be of interest not only to the specialist, but to the general public also. Athletic training both at home and at the gymnasium will be well represented. Food, its preparation and sophistication, will occupy a large amount of floor space. Another class (827) will include dwellings, their sanitary defects and the best means of remedying them. This will be followed by hotels, public baths, lavatories, models relating to the disposal of the dead, the supply of water, the disposal of sewage, etc. Such subjects as dust nuisances, the removal of noxious vapors, the danger from infectious diseases in certain trades, will be given great attention and will doubtless be productive of much good.