is easily decomposed; when heated in a small tube, in presence of air, an explosion takes place, due to the liberation of hydrogen, this being followed by the combustion of the metal. The second compound, the nitride of thorium, is formed by heating the metal to redness in an atmosphere of nitrogen; it corresponds to the formula Th_3N_4. Unlike the former body, it is not decomposed by heating in the air. Water decomposes it slowly when cold, but more rapidly warm, giving the reaction

$$Th_3N_4 + 6H_2O = 3TH_2 + 4NH_3.$$

These two compounds will burn in oxygen, but without giving the brilliant incandescence of the metal itself.

SOME FIGURES OF THE FIRST COST AND OPERATION OF SOUTHERN COTTON MILLS.

To make the assertion that cotton mills in the Southern States have increased from 10,000 to 5,000,000 spindles working in 485 mills in seventy years invites criticism from those who are unfamiliar with the development of the industry in this section of the United States. Yet, according to the most accurate calculations, mills containing the number referred to were either in operation or practically completed at the beginning of the new century. It should not be imagined that they are located in all parts of the South, for Florida has no mills whatever, but a half dozen are in the State of Texas, extensive as is its area, and Kentucky and Virginia have but a few, scattered here and there.

The principal activity in construction of cotton mills has been confined to the South Atlantic and Gulf States, beginning in the north in North Carolina and ending at the Mississippi River, although a beginning has been made in Arkansas, as well as Oklahoma and Indian Territories. An idea of the rapidity of construction can be gained when it is stated that the number of mills built in the South during 1900 was about 100, compared with 75 during the previous year. In 1895, according to best estimates, the number of mills was 325, representing 2,400,000 spindles. In 1897 the number had increased to 390, representing about 3,500,000 spindles. Here is shown a gain in five years alone of over 100 per cent. During the present year the number of plants projected is estimated to be somewhat less than in 1900, but the tendency in the South has been to increase the number of spindles and looms installed in a single mill, so that the total amount of machinery would practically be more than that erected during 1900.

The figures showing the cost of mill construction, etc., are significant. Those which follow are based upon actual estimates made of plants which have been constructed. The sum of $75,000 will build and equip a plant ready for operation containing from 3,000 to 4,500 spindles, according to the size of the yarn it is to produce. The sum of $100,000 is sufficient for a mill ranging from 4,000 to 6,000 spindles, while $175,000 will complete a 13,000-spindle plant. This price includes a brick and stone building, with heavy framework, containing fire protection, electric lights, steam heating, a water supply, also tenements for the necessary number of operatives, and warehouses for storing cotton. The $75,000 plant will consume between 50 and 60 bales of cotton a week, working on No. 8 yarn, or from 25 to 30, working on a finer product, No. 30, for example. In calculating these figures, an estimate of 15 per cent is allowed for waste of material by soiling, the amount taken out in going through the various processes, and the shrinkage. To operate such a mill with 6,000 spindles, 40 operatives are required for spinning alone. The labor is calculated to represent 15 per cent of the total cost of the product when coarse goods are made, the raw material 65 per cent, and the depreciation of the plant and other expenses the balance. The organization of a company operating a mill of 10,000 spindles and 320 looms generally consists of a president, who is also the treasurer, a secretary and a superintendent. These three form the executive heads of the various departments, the secretary acting as bookkeeper. No large salaries are paid, that of the president sometimes being as low as $2,500, while the superintendent receives from $1,500 to $2,000, and the secretary $1,200 to $1,600. The salaries, of course, increase in proportion to the size of the mill; the president of a plant of from 75,000 to 100,000 spindles may receive from $12,000 to $15,000 annually, the secretary $2,500, and the superintendent, who may have an assistant, $5,000. The cost for power, of course, varies, but upon averages secured from a number of mills in various portions of the South, operated under different conditions, steam costs per horse power per year from $12.50 to $17.50. Water power varies from $7.50 to $15 where the power is applied directly to the machinery and not used for electrical generation. It is calculated that between six and eight tons of coal per day are sufficient to operate a 400 horse power engine during eleven hours of continuous service. About one and one-half cords of pine wood are equal to one ton of coal.

The use of electricity generated by water or steam power is becoming more and more popular with Southern mill owners. Calculations have been made showing that the installation of motors in various departments, so that one section of the machinery can be operated independently of another, is much more economical than when power is communicated by shafting and belting, which requires possibly half or all of the mill equipment to be run in order to operate a certain portion. The Columbia Manufacturing Company, at Columbia, S. C., recently constructed an extensive plant for the manufacture of heavy duck. A set of turbines located on the Columbia Power Canal supply the sources of power from a series of large dynamos, and the current is conveyed to motors in each department. In turn, the machinery in the departments is divided into sections, each connected with its individual motor. Thus a section of looms can be placed in operation, while the rest of the plant is idle, if desired. The Pelzer mill, at Pelzer, S. C., containing the largest number of spindles under one roof of any plant in the world, is also operated by electricity, distributed upon the same plan. It has been argued that even where steam is depended upon solely, electric transmission is from 20 to 30 per cent cheaper in the long run.

Houses for the operatives are usually constructed of wood, and in the larger mill villages have from six to ten rooms each. If the company installs gas or electric lights and water works, they are furnished with these conveniences, also baths. A six-room house costs, on an average, $600, or $100 a room. The same is true of the larger houses. A six-room house will rent at from $10 to $12 a month, or 25 per cent of its total cost. Estimating interest on investment, "wear and tear" and taxes at 10 per cent of the rental, a profit to the company is left of 15 per cent yearly. The scale of wages naturally varies according to the character of the goods produced. An estimate taken from the daily pay roll of a North Carolina mill gives $13.50 for fifty-four hands. They include one spinner at $1.50, six boys in various capacities from 75 cents to 40 cents, and twelve girls at 26 cents each. This group includes every department of the mill, from picking the cotton to the spinning. Yet at this scale of wages, little difficulty has thus far been encountered to obtain enough labor, as the operatives, on the average, live much better and suffer less hardships than when earning a livelihood in the mountains.

The above are some of the reasons why cotton manufacturing in the South has so rapidly revived on account of the profits which have accrued to the manufacturers. The combination of advantages which they have enjoyed has enabled not a few of the companies to earn enough to declare, if they desired, an average dividend of from 10 to 15 per cent annually, after allowing from 8 to 10 per cent for depreciation of machinery and buildings. Few such dividends are announced, however, as it has been the general policy of late years to add to the surplus, making it a fund for enlargements and betterments. This is why quite a number of the Carolina mills have doubled their capacity within the last ten years, paying entirely for the enlargements out of the profits of the original plant. A number of illustrations might be cited of this kind. One mill located at Gaffney, S. C., earned 22 per cent yearly for the first three years it was in operation, and its machinery was operated 22 hours out of the 24 during the first two years. It manufactured a certain grade of sheeting, and during the period mentioned actually controlled the price of the American market. Instances are also known of mills which have cleared as high as 30 per cent in a year upon their capital stock, or enough to give stockholders a dividend of 20 per cent, after allowing for wear and tear and new machinery. These figures include income from all sources, including the rental of property owned by the company.

The inducements to construct mills have resulted in possibly a score of small plants being built on the installment plan. In the vicinity of Gastonia, N. C., are several of this character, in which the operatives are also stockholders. For instance, a $100,000 company would be organized, divided into 1,000 shares of $100 each, each shareholder being allowed to pay at the rate of fifty cents to $2 per week per share, the idea being to have the stock fully paid up at the end of two or three years. As soon as $25,000, or enough had been accumulated to start work, contracts would be let for a certain portion of the mill building. Possibly it would be finished off and a small amount of machinery installed and started, the balance of the machinery being added as subscriptions were made to the capital stock. Thus employes were actually helping to pay for the plant out of the proceeds of the wages received from the company. The plan followed is quite similar to that pursued by building and loan associations.

At present the mills in the South are manufacturing 17 per cent of the cotton produced in the United States, which represents nearly 70 per cent of the world's production. The home consumption of Southern cotton is rapidly increasing, as might be imagined from the activity in mill building, and calculations have been made that at the present rate of progress fully 5,000,000 bales will be converted into yarn and cloth in 1901 by the plants in the section referred to or three times the present amount.

SCIENCE NOTES.

Prince Luigi of the Abruzzi has been presented with the citizenship of Rome.

Capt. Bernier, whose scheme to organize an expedition for the discovery of the North Pole is now before the Canadian government, has received a letter from Lord Minto, the Governor-General, stating that he has much pleasure in publicly becoming a patron of the Arctic exploration scheme.

A strange phenomenon was recently witnessed in Southern Italy and Sicily. This was a heavy red cloud which extended over this territory, and the rain resembled drops of coagulated blood. This phenomenon, which is called "bloody rain," is attributed to dust from the African deserts transported by heavy south winds.

Germany proposes to forbid the employment of saccharine and other sweetening matter, except when it is recommended for therapeutic purposes. The sale of the substance will be permitted only by chemists and other specially authorized persons. Even in these instances it will be subjected to a consumption tax of $20 per kilogramme. This new law will go into effect in April, 1902.

The great dinosaur, the restoration of which has been the work of the Geological Department of Yale University for more than a year, has been placed in position in the Peabody Museum at Yale. It was discovered by Prof. J. B. Hatcher in the summer of 1891 while exploring for the late Prof. O. C. Marsh of Yale in Wyoming. The specimen was in excellent condition with all its parts intact, and it was also an entirely new variety. There is but one other specimen in the world, and this is in Brussels; its length is 29 feet 3 inches. The height of the head above the base is 13 feet 2 inches.

The indigo industry of Bengal is suffering severely from the competition of the manufactured German dye, huge quantities of which are being exported to India and the other markets hitherto controlled by the Indian industry. The German synthetic indigo is considered to be superior and is much cheaper. It is also stated that if the native indigo manufacturers were to conduct their work upon a more scientific basis, and were to extract the maximum quantity of dye from each plant, they would be in a position to meet the German competition. With a view to encouraging the industry, the government of Bengal has voted $22,500 for research work, with a view to facilitating and improving the existent process of manufacture.

Samarium oxide, according to Mr. Henri Moissan, at the temperature of the electric furnace, and in presence of carbon, forms a crystallized carbide of formula $Sa C_2$. The composition of this carbide is comparable with that of the carbide of cerium, lanthanum, neodymium, and praseodymium. It decomposes cold water in the same way as the carbide of the alkaline earths, giving a complex mixture of hydrocarbons, very rich in acetylene. It has a density of 5.86, a yellow color, and when examined under the microscope has a crystalline appearance—the particles having a hexagonal shape. This substance burns brilliantly at 400 deg. in a current of oxygen. The decomposition of water by the carbide brings the metal samarium near to the yttrium group, and removes it farther from the rare earths belonging to the cerium group.

A Parisian professor suggests a certain treatment of silk for enhancing its hygienic value. The process consists in combining gun cotton with silk or wool by impregnating either of them with a solution of collodion or a solution of celluloid. The dissolvent used may be either (preferably Hoffmann's) amyl acetate, acetone, or methylic alcohol. A solution is made consisting of one part of gun cotton (octonitric cellulose) or of celluloid in 100 parts of Hoffmann's ether (a mixture of alcohol and sulphuric ether), or any other suitable solvent. Or one part of tetracetate of cellulose may be dissolved in 100 parts of nitrobenzene. (The proportions are by weight.) Either of the above solutions forms the required "dressing" to be applied to the material. The material to be treated is made into a roll either of a loose fibrous material or as a fabric, according to the purpose for which it is designed. This roll is immersed in a cylinder filled with the solution. The roll is turned round several times in this bath, and the cylinder is then emptied by means of a tap provided for that purpose. The material is taken out, unrolled and left to dry.