were in position and the boat was ready for the experiment. A canal boat, rechristened the Frank W. Hawley, was fitted with Westinghouse motors. A double line of trolley wires was used and the boat carried two trolley poles, thus working without grounding. The switchboard was located near the helm. The Rochester Railway Company supplied the electric power. The Niagara Power Company was interested jointly with the Westinghouse Company in the trial, and the name of the boat was that of the representative of the Niagara Company, which may have much to do in the near future with canal transit. On Friday, November 17, a private trial was made with success. On Saturday the official trial took place.

Governor Flower and a large party of guests and representatives of the interests concerned were on the boat. To the executive was assigned the turning of the motor switch. On his doing so the motor started and the propeller began to churn up the water. The boat started off and in a few minutes was moving along at about four miles an hour. Curves and a bridge were passed without trouble and a lock was entered. The boat was loaded with sand ballast and her deck was crowded with people. A strong head wind and a head current were encountered.

Other causes also did much to interfere with a successful issue. The Rochester Railway Company failed in maintaining enough voltage. The pressure given was from 200 to 250 volts instead of 500 volts, as it should have been. Under this pressure, 60 amperes of current were taken, so that about 15,000 watts at the most were absorbed, indicating about 20 horse power. The boat was an everyday canal boat, with an old type propeller. Its preparation for the trial consisted in the removal of its boiler and engine, and the introduction of two Westinghouse street car motors. Each was of 25 horse power, and the two motors were connected directly to the propeller shaft. Under the circumstances the experiment was a very great success.

The trolley line was of No. 0 wire. The lines were about five feet apart, and were strung about two-thirds of the width of the canal from the berm bank or tow-path. The trolleys were regular street-car trolleys. It is proposed to use a trolley running on the wire and connected by a flexible conductor with the boat, so as to permit the craft to be steered in any direction. Under the present arrangement the trolley lines have to be followed within the limits of a small lateral deviation.

Much expense it is hoped can be saved by this use of electricity. The maintenance of the Erie Canal costs the State of New York almost $1,000,000 per annum, of which the greater part is devoted to the tow-path. The abolition of the tow-path would save in this item a good deal of money. By increased average speed it is believed that the capacity of the canal can be doubled or trebled, while material reduction can surely be made in the help required to run a boat.

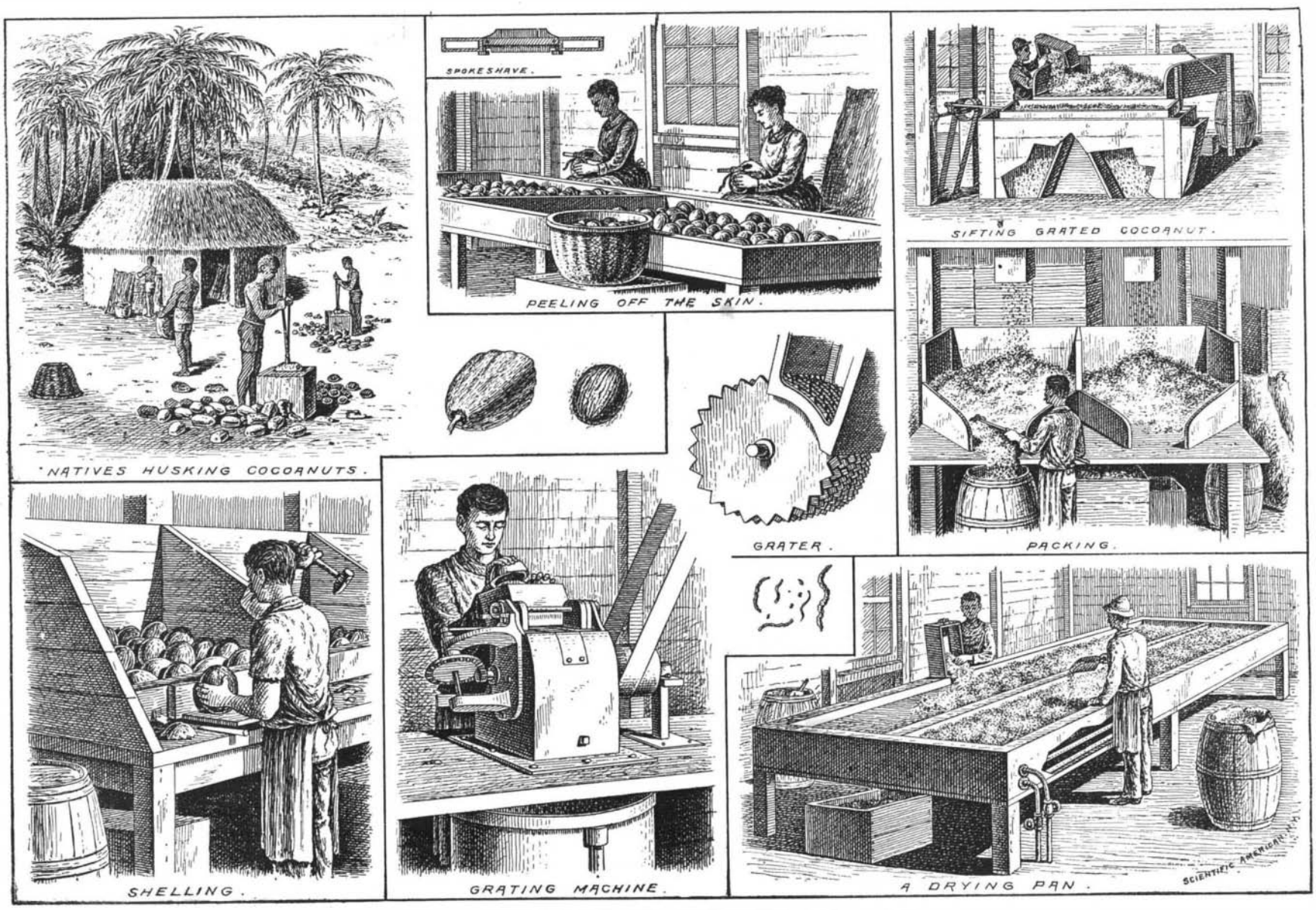
The trial is due to Governor Flower. He secured an appropriation of $10,000 from the State legislature for the purpose. The experiment cost about $5,000, and its cost was divided between the State and the Westinghouse Company.

THE MANUFACTURE OF DESICCATED COCOANUT.

The cocoanuts which are used in this country for the manufacture of confectionery, oil, etc., come principally from the West Indies. They thrive best on or near the coast. The cocoanut palm is a beautiful and lofty tree, growing sometimes to a height of 60 to 100 feet, with a cylindrical stem, which attains a thickness of about two feet. The tree terminates in a crown of graceful waving pinnate leaves. The leaf, which is about 20 feet in length, consists of a strong midrib, from which a number of long acute leaflets spring, giving the whole the appearance of a gigantic feather. The fruits mature in bunches of from 10 to 20. The fruits, when mature, are oblong and triangular in cross section, measuring from 12 to 18 inches in length and 6 to 8 inches in diameter. The fruit consists of a thick external husk or skin of a fibrous structure, within which is the ordinary cocoanut of commerce. The nut has a very hard wooden shell inclosing the kernel, within which is a milky fluid called cocoanut milk. The natives in Ceylon raise these palms in vast numbers, the ground being peculiarly suited for that purpose. It is estimated that as many as 20,000,000 of these trees flourish there. In planting the ripe nuts are placed in squares containing about 400 each. About an inch of sand or seaweed is covered over them and watered daily till they germinate. The nuts put down in April are sufficiently grown to be planted before the rains of September begin. They are then set out in holes 3 feet in depth and 20 to 30 feet apart. The roots of the young plants are first covered up with soft mud or seaweed, and for two years watered and protected from the glare of the sun. The palm begins to bear fruit from the fifth to the seventh year of its age, each stock carrying from 5 to 30 nuts, the tree bearing on an average 60 nuts yearly. The husk yields the coir fiber, which is used in the manufacture of rope, cordage, brushes, etc. The nuts are husked by the natives. They are first placed on blocks of wood and an instrument similar to a pair of shears is jabbed into the husk, the handles or arms are then opened, which tears the husk apart so that the nut can be taken out.

The cocoanuts come to this country packed in burlap bags, containing about one hundred nuts, weighing about 160 lb., and are sold from the dock or vessel at $30 to $60 per thousand.

The first operation in the manufacture of desiccated cocoanut is shelling. This is done by standing the nut on one end and striking the other with a hammer, which cracks the shell and kernel at the same time and lets out the milk. The attendant then takes an oyster knife and separates the outer shell from the kernel, which is then passed along to the peelers. An expert can shell as many as 3,000 per day. The peeling operation is done mostly by girls. The kernel is held in an upright position on the knee of the operator; starting at the top with a knife or spokeshave, it is drawn downward, taking off the dark skin from top to bottom in one stroke. This operation is repeated, the kernel being turned with the hand at every stroke until every particle of skin has disappeared. A first-class hand can peel as many as 1,800 per day. The kernels are then cut into halves and put through the grating machine. The kernels are first placed into a movable hopper at the top of the machine, which, when in motion, moves back and forth, drawing the material across a number of circular revolving knives, similar to those of a saw, which cut or grate the kernels into fine particles. The knives are about 9 inches in diameter, ⅛ inch thick, with twenty-two teeth about ¾ inch in length. The knives are set about ¼ inch part. The graters, when working steady, can grate as many as 7,000 cocoanuts per day. After grating, the material is taken to the drying room, where it is placed in heated galvanized iron pans. The tables containing the pans are 20 feet in length and about 7 feet in width.



THE MANUFACTURE OF DESICCATED COCOANUT.

Each table contains two pans 3 feet in width and about 5 inches in depth. Inclosed underneath these pans are nine double rows of steam pipes, which run back and forth the length of table. About seventy pounds of the grated material is placed in each pan, and from eight to thirty pounds of granulated sugar is added. The steam is then turned on, which heats the pans, melting the sugar, which, in turn, adheres to the grated cocoanut, the attendant occasionally mixing and turning over the material, so that the melted sugar can freely mix with it. After drying twelve hours, it is passed through a sieve, which separates the coarse from the fine material, and then packed into boxes and barrels. Thirteen hands can turn out from twenty to twenty-five barrels per day. Twenty-five horse power engine with eighty pounds of steam is used in running several graters and furnishing steam for heating twenty-four drying pans. The sketches were taken from the plant of Bussing & Graef, Jersey City.

THE Simplon road, from Switzerland to Italy, was built by Napoleon's engineers, in 1807; over forty thousand workmen were employed at one time.

The Howell Torpedo.*

Captain Sampson, Chief of the Naval Bureau of Ordnance, has received the report of the board appointed to conduct the trials of the Howell torpedo, at the Newport Torpedo Station. The report is elaborate, and gives the result of the trials in detail. The torpedoes were subjected, of course, to test under the full requirements of the contract. After a careful inspection, they were tried from a stationary platform and then from a vessel under way.

The torpedoes were required to run four hundred yards and maintain a speed of twenty-two and a half knots during that distance. The results of the tests were very satisfactory. Twenty-five knots was the maximum speed developed, while the minimum speed was twenty-two knots. Of the eighty-eight runs made there were but three which could be classed as mishaps, one being a misfire and the other two dives to the bottom. The report states that the regulating mechanism worked well, and the contract requirements as regards accuracy were fulfilled.

The torpedo boat Stiletto did not exceed a speed of fifteen knots during the trial. This, the board reports, was due to two reasons: First, the extent of the basin was too limited to permit attaining full speed without a turn shortly before launching, during which the rudder effect slowed the boat materially; second, the demands of the motor on the steam supply operated to slow the engine. This last reason was not so apparent exhausting into the atmosphere as in exhausting into the condenser. The added efficiency of the draught when exhausting into the smoke pipe probably made up for the increased demand on the steam supply. The report states that in order to maintain the speed of the boat while the torpedoes are being spun up it will be necessary to increase the capacity of both boiler and condenser above that of normal requirements. Atmospheric exhaust obviously cannot be used, on account of noise and the formation of vapor clouds which would show plainly in the beams of a search light.

The board reports that the present motor used by the contractors gives the required speed to the wheel in from 2 to 2·5 minutes, with 130 pounds effective steam pressure. It has not, however, sufficient power to fulfill the contract requirement as to time of spinning up with any available steam pressure. The motor cannot be heard under conditions favorable to the transmission of sound until within a distance of 400 yards.—*Army and Navy Journal.*

The Uses of Carborundum.

From the experiences of the Carborundum Company this crystallized carbide of silicon can be produced at the rate of 150 pounds on the average in a day of 24 hours. The cost of the production is found to be not more than half as much as that of mining and preparing corundum. In order to purify the crude product as it comes from the furnace, after preliminary crushing to remove extraneous matters, the partially separated crystals are put into stone tanks and treated with dilute sulphuric acid to remove all traces of iron, which is deterimental in the subsequent firing to which the product is subjected during its manufacture into grinding wheels.

The chief use to which carborundum can be put is to abrasion purposes. The extent to which emery wheels are employed in factories, mills, and shops has grown most astonishingly, and it is intended that carborundum should in a large measure supplant the use of emery wheels, on account of its higher efficiency. It has been found that twice as much work can be accomplished by a brass valve grinder with ⅛ oz. of carborundum in one day than could be accomplished with any amount of emery. Against this there must be set the great difference in price between the two articles, and also the economy of the workman, as a careless man would waste too much to make the use of carborundum possible.

For glass cutting, tests have shown that the same amount of work can be accomplished in one-quarter the time that it could be accomplished with emery, and a saving of labor amounting to 25 per cent can be effected when working on hard steel or chilled iron. As a substitute for diamond dust in polishing diamonds, carborundum has been successfully tried. A new lap, and therefore absolutely free from diamond powder, was fed with carborundum powder, and in twenty minutes restored the facet of a damaged diamond, much to the surprise of the skeptical operator. It is at present used in three diamond polishing establishments in New York, though it is not as efficient as diamond powder for the first cutting and facing of rough diamonds. Although a compound bearing the formula SiC has been independently prepared by Schutzenberger, no mention is made of its being prepared in a crystalline form, which is one of the chief features of carborundum. In addition to this it transpires that the date of Schutzenberger's communication to the Academy des Sciences is three months later than the date on which Nicola Tesla exhibited a lamp fitted with a carborundum button; which constitutes another use to which this compound has been put. The application of its properties of infusibility and incombustibility have yet to be further developed.—*Chem. Tr. Jour.*

* The Howell torpedo was fully illustrated in the SCIENTIFIC AMERICAN for October 20, 1888.

The Cereal Crops of the World.

An attempt has been made by the United States Department of Agriculture to afford a trustworthy view of the production and distribution of the principal agricultural crops of the world. Ninety-two countries are represented in the work, and the period embraces ten consecutive years wherever annual statistics are available. It is claimed, and no doubt correctly, that never before has there been "so comprehensive and complete a collection as to extent of geographical area represented and continuity of annual statements." The subjoined details refer to the chief cereal crops, excluding rice:

ESTIMATED ANNUAL AVERAGE YIELD OF THE CEREAL CROPS OF THE WORLD.

	Bushels.
Oats	2,328,000,000
Corn	2,300,000,000
Wheat	2,281,000,000
Rye	1,317,803,000
Barley	802,000,000

Europe and North America grow most of the oats produced in the world, while Australasia raises a considerable quantity for her own consumption. In the bulk annually produced the United States takes the lead, being followed in order by Russia, Germany, and France. The world's trade is confined chiefly to exchanges among European countries, the foreign trade of other nations being comparatively small.

Of the world's corn crop, 80 per cent is produced in the United States alone, while the great crop of 1891 in that country was almost equal to the average annual crop of the world. The average annual net importation into Europe appears to be about 64,000,000 bushels. The average annual net exportation from the United States is about 57,000,000 bushels, of which Canada takes 2,000,000 bushels. This leaves a balance of 9,000,000 bushels to be made up for Europe, and it is supplied from the Argentine Republic. Only four European countries export corn—Russia, Roumania, Bulgaria, and Servia—and of these the two last named are unimportant. Russia and Roumania ship about one-half of their total product of corn. Notwithstanding the vast exportations from the United States, they yet represent less than 4 per cent of the total annual production of that country.

The wheat "market of the world" is practically all within Europe, and even here is limited to the necessities of a few countries. "Insular and factory-studded Great Britain," with its small area and its teeming population, and populous little Belgium furnish in effect the market for which the wheat growers of the world are striving in competition. Outside England and Belgium, Europe may be regarded as self-supporting, the excess in the eastern countries of Europe being sufficient to cover the deficiencies in the western. It should be mentioned that, according to a consular report published recently, the Argentine Republic is rapidly acquiring a prominent position as a wheat-exporting county. In the year ended June 30, 1892, the Argentine Republic exported 13,500,000 bushels, while in the year ended June 30, 1893, the corresponding quantity was 26,000,000 bushels, large quantities of wheat being at the same time held back for considerations connected with the currency. A dozen years ago the Argentine Republic was producing barely enough for its own consumption. The area which it is there possible to place under this crop is capable of enormous extension.

Excepting in European countries, rye is of minor importance. In many parts of the Continent it furnishes the bread of the people, and in such countries the production and consumption of rye exceed those of wheat.

Russia has the credit of the largest output, her annual production averaging upward of 700,000,000 bushels, a cereal crop which is exceeded only by the corn crop of the United States. Germany, with an average crop of 228,000,000 bushels, stands next to Russia, and is followed by Austria-Hungary with a crop of 122,000,000 bushels. Inasmuch as the areas of production and consumption are almost identical, rye does not figure in international trade to an extent proportionate to its importance as a crop. Germany is the largest importing country, but she purchases only 30,000,000 bushels per annum, while Russia, the greatest exporting country, does not ship more than 46,000,000 bushels of rye grain. The only extra-European countries in which rye may be regarded as an important crop are the United States and Japan. In the former country the annual product is about 25,000,000 bushels. Deducting from this the net exportation of 2,000,000 bushels, there are left some 23,000,000 bushels for home use, a quantity equivalent to a little over one-third of a bushel for each head of the population.

While barley is a prominent crop in Europe and Canada, and an important one in Japan, it only ranks as one of the minor cereal crops in the United States and Australasia. In Europe, Russia is the largest producer, followed in order by Germany, Austria-Hungary, and the United Kingdom. Though barley is regarded as a minor cereal in the United States, yet only four countries in the world produce an absolutely larger crop. The decennial average puts the United States crop at 55,000,000 bushels, but of late years it has been steadily increasing. It is the only cereal which is not produced to a sufficient extent in the United States to meet the requirements of home consumption, the average net imports for ten years having reached about 10,000,000 bushels annually.

The exports of wheat flour from the United States exceed the net exports of flour of all kinds from all other surplus countries. Austria-Hungary and Germany rank next in flour-exporting capacity. The great market for flour is found in the United Kingdom which has an annual average importation of 1,660,000,000 lb. of wheat flour, the product of about 38,000,000 bushels of wheat grain. The total net exports of the manufactured article from the United States represent about 42,000,000 bushels of wheat grain.

Impressions with Modeling Compound.

I have made the subject of taking impressions with modeling compound a special study for a number of years, until I have fully satisfied myself that there is no longer a place, or even an excuse, for the use of plaster for taking impressions under any circumstances. But within the last twelve months I have discovered a new use for the compound, which I think will be greatly appreciated by all who are doing crown and bridge work. I know most men imagine they get a very good adaptation of bands under the free margin of the gum, but it would surprise any one who will first adapt the band to the root in the mouth as is usually done, then take an impression of the root (as I do) and get a metal cast and try them, and see how far from an adaptation it is. The way I proceed is thus: Take No. 3 modeling compound, or No. 2 that has been used a few times, and with Mellott's No. 20 impression cup, with the bottom cut out so as to insert a finger, proceed to take an impression. Trim your root to the proper shape, and if there is a tooth on each side, place a small piece of celluloid (a piece of collar, for instance) between the root and the tooth or teeth; then fill the cup level full with the heated compound and press to place; with ice water cool the outer edges, and then, still holding the cup steady, press the compound in the center of cup with the finger or a round instrument; cool thoroughly with ice water; then withdraw, and you have a perfect impression of the root as far up as the free margin of the gum extends. Now dip the impression in ice water, have some Mellott's metal ready, wipe the impression perfectly dry and dust with soap stone, slip on rubber ring and pour metal as cold as it will flow. Have a syringe full of ice water ready, and as soon as the metal is poured throw on ice water with syringe till you can drop it into ice water, when you will find you have the most perfect metal cast that can be made. You can then adapt your crown or band to the cast so that when adjusted it will be the most complete adaptation, and so do away with annoyance and pain to the patient.—*Staples (G. S.), Western Dental Journal.*

The Discoveries of Scheele.

Professor T. E. Thorpe contributes a paper to the *Fortnightly Review* on Carl Wilhelm Scheele, whose life's work is summed up as follows:

"We owe to Scheele our first knowledge of chlorine and of the individuality of manganese and baryta. He was an independent discoverer of oxygen, ammonia, and hydrochloric acid gas. He discovered also hydrofluoric, nitrosulphonic, molybdic, tungstic, and arsenic acids among the inorganic acids; and lactic, gallic, pyrogallic, oxalic, citric, tartaric, malic, mucic, and uric among the organic acids. He isolated glycerin and milk sugar; determined the nature of microcosmic salt, borax, and Prussian blue, and prepared hydrocyanic acid. He demonstrated that plumbago is nothing but carbon associated with more or less iron, and that the black powder left on solution of cast iron in mineral acids is essentially the same substance. He ascertained the chemical nature of sulphureted hydrogen, discovered arseneted hydrogen and the green arsenical pigment which is associated with his name. He invented new processes for preparing ether, powder of algaroth, phosphorus, calomel, and *magnesia alba*. His services to quantitative chemistry included the discovery of ferrous ammonium sulphate and of the methods still in use for the analytical separation of iron and manganese and for the decomposition of mineral silicates by fusion with alkaline carbonates."

To this long list of successful labors must be added the memoir on "Air and Fire," which appeared in 1777, and the experimental material for which was partly collected in Malmo and Stockholm before 1770, and partly during Scheele's stay at Upsala, that is, prior to 1776. These dates, Professor Thorpe reminds us, are important in view of Scheele's relations as a discoverer to Priestley and Lavoisier.