[For the Scientific American.]

CHEMICALS AT THE CENTENNIAL.

It is generally admitted that the German section at the Centennial Exposition is far inferior to what it ought to be, and does not adequately represent the present state of manufacture and industry in that empire. Be this true or not, it certainly does not apply to the chemicals, for in this department Germany is *facile princeps*. She supasses France, is far beyond England, and finds a worthy competitor only on this side of the ocean. In quantity, Philadelphia chemists far excel; but in rare chemicals, new compounds, and interesting preparations, Germany leads. Entering by the main entrance on Elm Avenue, and passing up the center cross nave, we have on our right the magnificent display of Powers & Weightman, Rosengarten, and Pease; on our left the smaller black show cases of the German exhibitors, Brohme, Trommsdroff, and others.

THE GERMAN EXHIBIT.

This department has an advantage over all others inhaving a complete and instructive catalogue, which enables the visitor to examine with greater ease and understand more readily what is to be seen here. An intelligent attendant is also ready at all times to explain more fully whatever is of interest The chemicals in this department may, for our convenience, be arranged under three heads, namely, chemicals largely employed in the arts, rare and curious chemicals chiefly of theoretical interest at present, and coal tar products, including the aniline colors. This division is, of course, very imperfect, because new substances are so rapidly passing from the second to the first class, while the third class belongs to both the others.

The most interesting of the commercial exhibits, because the newest, are the samples of carbonate and bicarbonate of soda made by Moritz Honigmann at Aix la Chapelle, by the ammonia soda process of Solvay (see SCIENTIFIC AMERICAN, June 24, 1876). This establishment employs 35 men and 3 steam engines of 25 horse power in the aggregate, producing 6,600 lbs. of soda ash per diem. The operations are performed in large wrought iron vessels at a pressure of ¼ to ¾ atmosphere. Chloride of sodium obtained from the saltpeter works (SCIENTIFIC AMERICAN, January 22, 1876) is decomposed, at a temperature of 95° Fah., by carbonic acid and ammonia, into bicarbonate of soda and chloride of ammonium. The ammonia is recovered from the latter by means of unslaked lime, at a temperature of 212° Fah.; the lime is obtained by burning mountain limestone with coke, and the carbonic acid utilized for converting the salt into a bicarbonate of soda in the presence of ammonia, as above stated. No use has yet been found for the waste chloride of calcium. The calcined soda ash contains 98 to 99 per cent of the carbonate; and,being free from iron, sulphur, and sulphuric acid, is largely employed in dye works and glass houses. This process will attract our notice again in the chemical sections of France and Belgium.

Vorster and Grueneberg, of Kalk, exhibit potash and saltpeter made from the Stassfurt salts.

There are several exhibitors of glue, gelatin, and phosphates from animal refuse.

Xanthate and sulpho-carbonate of potassium, the new insect destroyer, is exhibited by J. F. Hayl & Co., the well known manufacturers of oisulphide of carbon. This establishment, which covers over 7 acres and employs 12 men, is chiefly occupied in the extraction of fatty oils by means of bisulphide of carbon. They exhibit oil cake and oils. They claim for the oil cake that it contains 6 to 15 per cent less oil than those which have been pressed, but are better as fodder because the nitrogenous principles remain in the residues.

Paraffin and paraffin candles made from peat are exhibited by two stock companies, one at Rehmsdroff, the other at Halle.

The Nuremberg Ultramarine Works have a pyramid over ten feet high, around and on which their products are arranged. Green, blue,and violet ultramarines are exhibited. Several smaller exhibits of ultramarine,both blue and green, were also noticed.

The exhibition of mineral colors, although varied and pleasing to look at, requires but little to be said about them Zinc and cadmium yellows, umbers, ochers, siennas, lampblacks, etc., filled the list.

Brohme & Co., Bergen, exhibit soda and potash water glass in solid and liquid form, composition for artificial stone, water glass whetstones, etc.

Oxalic acid and oxalate of potash are exhibited by R Koepp & Co. and Kunkeim & Co. The latter also exhibit the rarer substances, tungstate of soda, naphthaline yellow, and phthalic acid.

The largest exhibit of alkaloids is by Fried. Jobst, Stuttgart, and includes also opium grown in Würtemberg and Silesia. Here we notice a dozen different salts of quinine, including the anetholate, and several salts of other cinchona alkaloids. The new preparations made since the Vienna Exposition of 1873, and never before exhibited, are the muriate, sulphate, and salicylate of phenyl-quinine, sulphate of phenyl-cinchonidine, oxalates of cinchonicine and of quinicine, santoninic acid, cotoine, echicerine, chinamine, echitine, and echi eine.

The exhibit of alcoholic preparations, by C. A. F. Kahlbaum, Berlin, is deserving of special notice, showing as it does how soon chemical compounds pass from the class of rare and curious chemicals to commercial articles. These works, which are under the direction of Drs. G. Krämer and Bannow, were the first to manufacture artificial mustard oil (from allyle alcohol) on a large scale, and now it is capable, by excellence and cheapness, of competing with the natural oil. The other staple productions are methyl, ethyl, and amyl alcohols, iodoform, acetone, aldehyde, ether, acetic acid, and acetates The most interesting portion of this exhibit is, however, a series of scientific preparations, made in the laboratory connected with these works, and in many cases from waste products. A list of these curious and new compounds would exceed our present limits, and we may only mention a few, such as metaldehyd, a white solid crystaline substance having the same percentage composition as common aldehyde, and convertible into it by heat at 112° to 115° in a closed tube. Paraldehyd, a liquid isomer of aldehyd, which boils at 124° and crystalizes below 10°, is also exhibited. Resorcin, phenylacetic acid, phloron, phthalic acid, azobenzol, methyl and ethyl iodides, zinc methyl and ethyl, sulpho-butylates, methylates, propylates, and vinates are among the things seldom, if ever, seen before in America.

In the case adjoining Kahlbaum's exhibit is the far smaller but equally interesting one of Dr. Wilhelm Haarmann, Holzminden on the Weser. Here is exhibited the new artificial vanillin, discovered by Drs. Haarmann and Tiemann; also a glass of coniferine, a glucoside contained in the cambium of coniferous woods, and from this the vanillin is made. The latter is identical in composition, melting point, flavor, and all other properties with vanillic acid from the vanilla bean. Vanillinic acid (a by-product), vanillinic sugar, vanillinic alcohol, and vanillinic glycerin are also exhibited. These works were established in 1875, and employ in the summer months about 46 workmen.

Next to this is the exhibit of the Berlin Stock Company, formerly E. Schering. The exhibit is large and handsome, including salycilic acid in large quantities, salicylates of ammonium, quinine, sodium, and zinc, also chloral hydrate, both in cake and crystals. Just around the corner is the curious little exhibit of Dr. F. Wilhelm, Reudnitz-Leipsic. He exhibits the artificial bitter almond oil (not, he says, nitrobenzol), of which he claims to be the inventor and only manufacturer. He also exhibits benzoic acid, Niobe essence (?), benzyl chloride, and some manganese salts.

The well known house of H. Trommsdorff, Erfürt, makes a very large and interesting show. It includes 50 different alkaloids, glucocides, and bitter principles, 30 organic acids, various physiological preparations, such as glycocoll, allantoine, cholestrine, taurine, etc. Among the rare metals and metallic salts, we noticed selenous, tellurous, and vanadic acids, sulphate of beryllium, cæsium, and rubidium alums, sulphates of cerium, lanthanum, and didymium, biehromate of rubidium, bivanadate of ammonium, and metallic tellurium, thallium, titanium, tungsten, molybdenum, etc.

Another fine display, in close competition with Trommsdorff and Kahlbaum, is that of Dr. Theodor Schuchart, Görlitz. There are 110 preparations of purely scientific interest, and 20 for technical purposes. Among the former are included nearly all the rare metals and their salts. One of the most beautiful things here is the double cyanide of yttrium and platinum, which consists of dichroitic (red and green) crystals. We also noticed some handsome crystals of boron, also specimens of nitrate of roseo-cobalt, chloride of purpureo-cobalt, sulphate of xantho-cobalt, crystals of nitrate of uranium, metallic chromium, nickel salts, sesquichloride of titanium, chloride of niobium (columbium), and blue oxide of tungsten. A few organic preparations, thymol, anthracene, alizarin, etc., completed the list.

Salicylic acid and its derivatives are exhibited in large quantities by Dr. F. von Heyden, Dresden, who manufactures, under Professor Kolbe's patent, from the best English carbolic acid. The collection contains wintergreen oil, pure and crude salicylic acid, crude and pure salicylicate of soda, and sodium phenylate.

Dr. L. C. Marquart, Bonn, has a very good display, including salicylic acid, cæsium, and rubidium alums, ethyl sulphate of lithium, ethyl benzol, bibrom-benzol, and dichlorhydrine, the curious chlorine derivative of glycerin.

Chloral hydrate is the specialty of Saame & Co., Ludwigshafen. The works cover 17 acres, and originally were devoted to the production of chloral hydrate only; but since the fall in price of that article, they have begun the manufacture of the mineralacids,of which they produce 13,200,000 lbs. annually. They also manufacture and exhibit chloroform, made from chloral and absolutely free from other chlorine compounds, chloral alcoholate, chloride of sulphur, bisulphite of soda, used in making the new reducing agent hydrosulphurous acid, chlorate of potash, etc.

The third class of chemicals, coal tar products, form the most beautiful and interesting part of the chemical section. (See SCIENTIFIC AMERICAN SUPPLEMENT, page 496, volume I.) There are several exhibitors of these goods, the largest and best being those of Fried, Bayer & Co., at Barmen and Elberfeld, and the *Actien Gesellschaft für Anilin-Fabrikation* at Berlin. The former is especially interesting, as showing all the steps of the process, and all the intermediate products from the coal to the finished dye, all numbered and labeled, the formulas being given, too, in most cases. Among the rarer substances, we noticed the new and beautiful cosine and silks dyed with it, also fluorescin, resorcin, phthalic acid, benzyl chloride, cumol, xylol, rosolic acid, iodide of ethyl and methyl, coralline, and a full series of anthracene derivatives, bibrom-anthracene, anthraquinone, sulphanthroquinonic acid and its barium and sodium and sodium salts, alizarates of sodium, potassium, barium, and aluminum, alizarine itself, and samples of dyeing. The Actien-Gesellschaft present even a better show of the aniline dyes and dyed specimens, many of the dyes being in much larger quantity, and the whole well mounted and catalogued. The Frankfurt Anilin Color Works exhibit 25 specimens, including cosine, phosphine, indigotine, phenyl-yellow, indigo carmine, aniline blue, green, and violet. Taken as a whole, the exhibit of German chemicals does credit to the manufacturers and to the committee who organized and executed this difficult work. E. J. H.

[For the Scientific American.]

BOILER NOTES.

We have just received the last annual report of the Hartford Steam Boiler and Insurance Company, and, in accordance with our usual custom, proceed to present a synopsis of it to our readers.

The present report is one of unusual interest, as the President, in honor of the completion of the first decade of the company's existence, gives a review of the work done since the organization. The task undertaken by the company, as most of our readers doubtless know, is to institute such a system of inspection of the boilers under their charge as to render them reasonably secure against explosion, agreeing to pay the owners the amounts of insurance stated in the policies, in case explosions do occur. The company's record for two years shows a list of 848 boiler explosions in the United States, by which 1,768 persons were killed, and 1,904 injured. Of these boilers that exploded, 18 were insured by the company, and a careful examination of the causes shows them to have generally been such as no inspection could have prevented. Thus, in one instance, a boiler being under repairs, the workman drove a plug into the steam pipe, and neglected to remove it when the work was completed. As might naturally be expected, in getting up steam in the boiler, it exploded. Several other cases of explosion occurred with long boilers, supported only at three points of their length, and fired by the waste gases from iron furnaces. The President states that it cost the company $10,000 to learn that such boilers should have supports not more than 10 feet apart—though, if we mistake not, considerable attention has been paid to this subject in England in former years, resulting in the adoption of a method of supporting long boilers which seems to give good results. During the period covered by this last report, from August 31, 1874, to December 31, 1875, the company have made 44,763 inspections, discovering 24,040 defects, of which 5,149 were classed as dangerous, requiring immediate attention. Some of these defects may be briefly recounted and discussed. Their nature is clearly illustrated in the report, by a series of well executed engravings.

Furnaces become distorted, and plates are fractured, chiefly by bad management, such as suddenly introducing cold water into an overheated boiler. These distortions and fractures are frequently hastened by the method of construction, the plates being overstrained by using drift pins to bring the rivet holes in line. A sheet may be nearly fractured by this mal-construction, and yet appear to be uninjured, when viewed from the outside.

Plates become burned from forcing the fire too fiercely, or on account of the deposition of scale or sediment. Comparatively few manufacturers seem to realize the danger of using a boiler that is too small for the work, and forcing it to the utmost extent. When a blister forms on a plate, it is generally due to the uneven character of the iron, and the whole plate should be renewed, the application of a patch being only a temporary expedient. Sheets may be corroded on the outside by leaks at the seams, in places which are not readily accessible for examination. Such defects can only be discovered by careful inspection. The use of impure water frequently causes the rapid destruction of a boiler by internal corrosion; and unless this is discovered by internal inspection, a so-called mysterious explosion may be the result.

Careless engineers allow water gages to become clogged, blow valves to leak, and safety valves to stick fast. The following simple rules should be observed by every one in charge of a boiler.

Blow through the water gage at least once a day, and several times, if the water is dirty.

Before starting the fire in the morning, always try the water in the boiler, and do not raise steam until assured that it is at the proper level.

Raise the safety valve, at least once a day, and observe whether it works freely. Attach a stop to the lever, so that the ball cannot possibly be moved out beyond the proper position; and never hang any additional weight on the lever.

Among the steam gages examined by the company, 649 were found to be dangerously defective, having errors ranging from —45 to + 70 with inoperative safely valves. What splendid chances for "mysterious explosions" were presented!

A number of boilers were found without gages, and 19 of these were considered dangerous, because a high pressure was carried.

Several boilers were examined, in which there were no hand holes for removing the sediment, and in many boilers the bracing was very insufficient. When such boilers explode, there ought to be little difficulty in finding the cause. The experience of the company, with boilers in which some of the sheets were made of Bessemer steel, seems to show that this metal is quite as reliable as iron, all cases of distortion or fraction of steel plates being traced to overheating or sediment.

During the time covered by the last report, 139 boiler explosions were reported in the United States, by which 191 persons were killed, and 267 injured. An investigation of a number of these by the company has served to clear up all mystery in reference to their causes.

In the above brief synopsis of this interesting report, we have endeavored to give prominence to such matters as will be of especial interest to those in charge of steam machin-