

reached a point with us where it is no longer "just rolled zinc," but, like brass and steel, is to be had with physical and chemical properties varied to suit the uses of the buyer. I do not mean to convey the idea that zinc can be substituted indiscriminately for other metals, nor that we have exhausted the possible variations which can be given it. It has its limits, as do all metals. Our study of the requirements of a number of trades has already resulted in the economical substitution of zinc, designed specifically for the purpose, for aluminum, brass, copper, and steel. Rolled zinc rod and drawn wire have also been made and have found some commercial application.

Another interesting chemical development has been the production of metallic zinc 99.995 per cent pure in considerable quantity, and the manufacture on a large scale of zinc oxide

meeting the *United States Pharmacopoeia* specifications. Both of these products were imported before the war and were sometimes inferior in quality. Our products are suitable for all kinds of chemical, analytical, dental, and pharmaceutical work.

We believe, therefore, that the application of chemistry and physics will play a most important rôle in the zinc industry during the present period of readjustment. We would like, in conclusion, to say that we believe our problems, not only in the zinc, but other industries as well, should be faced with an optimistic spirit. The best equipment, the most highly trained mind, will not avail unless the driving power of enthusiasm is behind our work. Let us all approach our problem with this spirit so necessary to-day.

THE NEW JERSEY ZINC COMPANY
NEW YORK CITY

PERKIN MEDAL AWARD

The Perkin Medal for 1919 was conferred on Frederick G. Cottrell, in recognition of his notable work in the field of electrical precipitation, at the meeting of the New York Section of the Society of Chemical Industry, held at the Chemists' Club, January 17, 1919. Remarks by Mr. Charles E. Sholes, chairman of the Section, and by Mr. Charles McDowell, chairman of the Chemicals Division of the War Industries Board, were followed by the presentation of the medal to Dr. Cottrell by Dr. C. F. Chandler. The address of acceptance by Dr. Cottrell followed and remarks in appreciation of Dr. Cottrell by Mr. Buckner Speed.

The usual informal dinner was held before the meeting in the dining hall of the Chemists' Club, giving the members the opportunity of meeting Dr. Cottrell.—[EDITOR.]

PRESENTATION ADDRESS

By C. F. CHANDLER

It is my privilege and very pleasant duty, as senior past president of the Society of Chemical Industry, residing in this country, to present to Frederick G. Cottrell, B.S., A.M., Ph.D., the thirteenth impression of the Perkin Medal, in recognition of his most original and valuable work in applied chemistry.

Dr. Cottrell was born in Oakland, Cal. in 1877, where he received his early education. The degree of bachelor of science was conferred upon him by the University of California in 1896. He continued his scientific studies at the University of Leipzig, graduating in 1902.

Returning at once to America, he became instructor in physical chemistry at the University of California, later assistant professor.

This position he held till 1911, when he joined the staff of the Bureau of Mines in Washington. Here he was at first the consulting chemist; then successively chief of physical chemistry, chief chemist, and finally chief metallurgist, which position he still holds.

After graduating at the University of California, he continued his work there, devoting his attention to studies of hydriodic acid, liquid and gaseous, which enabled him to greatly increase our knowledge of the physical and chemical properties of this substance. His papers on this subject were published in the *Journal of the American Chemical Society*, 1896 and 1899, and in the *Journal of Physical Chemistry* in 1898.

In 1900 he published a very elaborate investigation on manganous sulfate in the *Journal of Physical Chemistry*. This investigation was made with a view to throwing light upon the very interesting case of equilibrium in systems of manganous sulfate and water. His first publications, while in Germany, related to the genesis of some of the double and triple salts of magnesium, occurring in the Stassfurt saline deposits.

Dr. Cottrell's inaugural dissertation was entitled "The Residual Current of Galvanic Polarization Considered as a Problem of Diffusion." It was published in 1903.

From this date on he continued to publish reviews and investigations too numerous for me to refer to here. Specially interesting are papers on liquid air plants, 1905 and 1906.

Dr. Cottrell's most elaborate and valuable investigations relate to electrical precipitation of particles of liquids and solids begun in 1906 with his work on sulfur trioxide fumes which are not easily absorbed by water. It had long been known that electric brush discharges cause fog to clear. Sir Oliver Lodge had worked along this line. Dr. Cottrell describes his first fundamental experiment in his paper on "The Electrical Precipitation of Suspended Particles," published in the *Journal of Industrial and Engineering Chemistry*, August 1911.

As this shows the beginning of one of the most important contributions to industrial chemistry, I feel that I can afford to consume two or three minutes of the time allotted to me to quote this experiment:

It may be of interest to note that the clue to the solution of this difficulty came from an almost accidental observation. Working one evening in the twilight when the efficiency of the different points could be roughly judged by the pale luminous discharge from them, it was noticed that under the particular conditions employed at the time, this glow only became appreciable when the points had approached the plates almost to within the distance for disruptive discharge, while at the same time a piece of cotton-covered magnet wire which carried the current from the transformer and commutator to the discharge electrodes, although widely separated from any conductor of opposite polarity, showed a beautiful uniform purple glow along its whole length. The explanation lay in the fact that every loose fiber of the cotton insulation, although a relatively poor conductor, compared to a metallic point, was still sufficiently conductive from its natural hygroscopic moisture to act as a discharge point for this high potential current and its fineness and sharpness, of course, far exceeded that of the sharpest needle or thinnest metallic wire. Acting on this suggestion it was found that a piece of this cotton-covered wire when used as a discharge electrode at ordinary temperature proved far more effective in precipitating the sulfuric acid mists, which were then the object of study, than any system of metallic points which it had been possible to construct. Perhaps the greatest advantage thus gained lay in the less accurate spacing demanded between the electrodes of opposite polarity in order to secure a reasonably uniform discharge.

The first installation of his system was made at the plant of the Hercules Powder Company, at Pinole, Cal., where there was a small contact sulfuric acid plant. There he used a 6,600 volt, alternating current, rectified into a direct current by a motor-driven contact apparatus, and sent this current, by means of pubescent (hairy) asbestos electrodes, through the wet sulfur trioxide fumes, and obtained precipitation.

This process, though successful, was not sufficiently profitable

to warrant extensive use. It would probably have died had it not been that the nearby Selby smelter was in trouble. This smelter had a large plant near one of the tunnels of the Southern Pacific Railroad, and with certain winds, the fumes of sulfur trioxide from the silver-dissolving house would fill this tunnel with choking fumes, and finally legal proceedings were started to close the smelter plant. At this juncture Dr. Cottrell erected a small electric plant which met the difficulty completely and is running to-day, yielding dilute sulfuric acid as a by-product.

But for the above-mentioned legal proceedings, the Cottrell process might never have materialized. The knowledge that fumes and smoke could be Cottrellized made the fume-pestered farmers all over the West sue the smelters, right and left, and satisfied the courts and juries that they were not asking the impossible of the smelters.

The story of the Cottrell process for several years has been told in the news columns of the papers. Not alone has he taken the sting out of sulfuric acid waste fumes of smelters, he has brought down poisonous arsenic, saved metal dust otherwise going to waste, saved the orange groves from cement kiln smoke, and recovered potash from that cement smoke to put on those very orange groves for fertilizer. The dust in the air, which was death to the trees through the clogging of the tender pores of their leaves, when duly Cottrellized and sacked and emptied on their roots, has given them new strength and life.

It would take a long time to give you a realizing idea of the marvelous extension of this Cottrellizing invention. I will content myself by giving you one example which I saw in the *Evening Post* of January 11 last:

Montana now has the tallest chimney stack in the world, by a dozen feet, and in other dimensions it is immensely greater than its rivals. This is the recently completed stack of the Washoe reduction works of the Anaconda Copper Mining Company, which is 585 ft. $1\frac{1}{2}$ in. in height. The outside diameter of the base, built in the form of a truncated octagonal pyramid, is 86 ft., and the walls are 5 ft. 4 in. thick at this point. The stack contains the equivalent of 6,672,214 common brick. Conducted through a vast flue system from the furnaces, the smoke will pass into chambers where will hang 111 miles of chains, electrified by a high-tension current. All the particles in the gases are electrified by contact as they pass through the links, and are violently repelled to be attracted by great plates between which the chains are suspended. These plates are grounded to form a negative pole. When they are thickly coated, the circulation will be diverted, the current shut off, and the accumulations will drop into hoppers.

Dr. Cottrell's more recent work of investigation has had to do with the securing of helium gas for war balloons, which being absolutely incombustible, is a wonderful substitute for inflammable hydrogen, while it is only slightly inferior in ascensional

power. The helium is obtained from certain gas wells, by liquefying out all the other constituents.

I think I must cut my story short at this point and leave to Dr. Cottrell himself and Mr. Speed the pleasure of telling you of the doctor's varied work at the Bureau of Mines and among the Field Experiment Stations, as well as about the "Research Corporation, an Experiment in Public Administration of Patent Rights," in which he takes such an active interest. I must say one more word: Dr. Cottrell has been granted many patents for his inventions and has generously donated them to the use of the public.

CONFERRING THE MEDAL

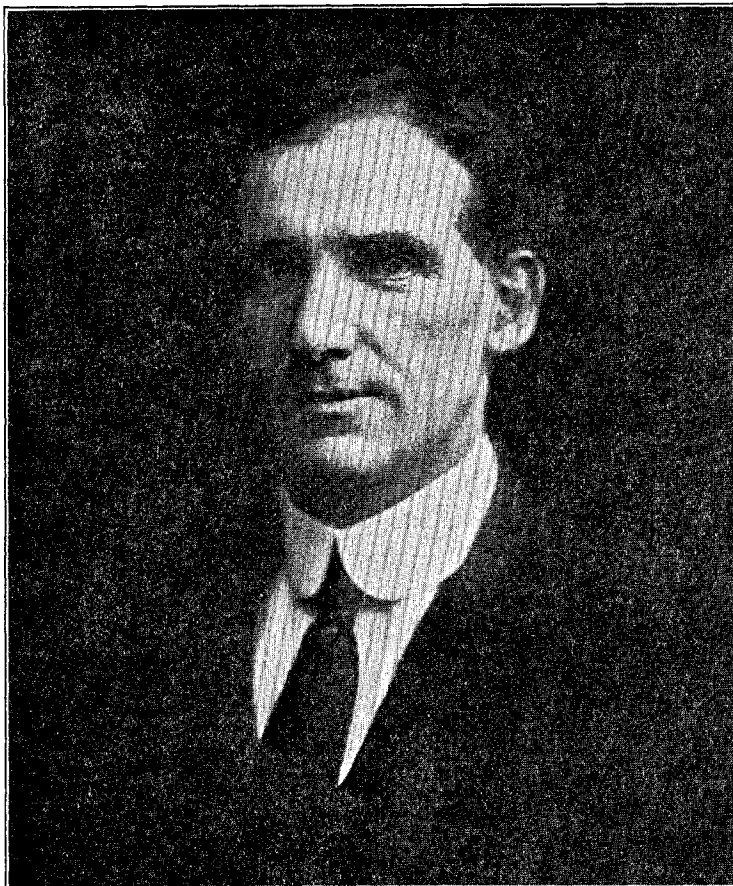
Dr. Cottrell, it gives me the greatest pleasure, as the representative of the affiliated chemical and electrochemical societies of America, to place in your hands this beautiful Perkin Medal, as a token of the appreciation and affection of your fellow chemists.

NEW YORK CITY

ADDRESS OF ACCEPTANCE

By FREDERICK G. COTTRELL

MR. CHAIRMAN, DR. CHANDLER, LADIES AND GENTLEMEN: It is with a profound sense of appreciation on the one hand and of added responsibilities on the other that I accept this symbol of your approbation, friendship and confidence. I value the two former more than words can express, and this beautiful emblem will ever serve to keep clearly before me the responsibility to justify your confidence by striving to maintain unbroken the long line of high traditions of public service with which the Perkin Medal is associated on both sides of the ocean. I wish to thank you, Dr. Chandler, for this medal and for your kind words, and through you, the mem-



FREDERICK G. COTTRELL, PERKIN MEDALIST, 1919

bers of the Awarding Committee and the societies which they represent.

I am aware that it has been customary for the recipient of this honor to review the history of the subject particularly cited in the award, but the present year has witnessed the breaking of so many precedents and I have already on former occasions so thoroughly told you all that I know about electrical precipitation, that to-night I shall take the liberty of dealing chiefly with quite another subject, though one which attracted my serious attention and study even earlier than electrical precipitation.

This is the industrial liquefaction and separation of the so-called permanent gases. My justification for this particular selection lies in the general interest at present in scientific problems whose solutions have been accelerated by the pressure of war needs, the case in point forming an interesting example