for several nights in succession for periods varying from four to five hours, and even longer without showing any appreciable rise in temperature. These generators in ordinary usage never get ten degrees above the temperature of the surrounding atmosphere. I am convinced from personal observation that there is no occasion whatever for the gas to be generated at a temperature more than five or ten degrees above the air surrounding the plant. Hence it appears beyond question that the limit set by the judges at the Pan-American was excessive, and is now entirely out of date as a criterion of judgment as to the merits of a generator. In conclusion, I may add that it is also established by modern practice in designing generators that storage chambers or gasometers of any kind are entirely unnecessary.

A SCIENTIFIC REVOLUTION.

The discovery of radium is apparently to have results far more important than merely adding a new element to the catalogue of the chemist and the physicist. That radium gives off heat, without combustion or deterioration, modifies all preconceived ideas as to the production of heat or other forms of energy. Heat without decomposition has been considered a chemical impossibility, just as perpetual motion is a mechanical impossibility. Radium, we are told, has this property, and it has led to a stupendous theory, for some time foreshadowed, but now apparently substantiated. At least three scientists, Crookes, in Berlin, and Lodge and Curie, in London, have confidently proclaimed the theory, which may be stated very briefly, but is far beyond the comprehension of the human mind.

The theory that the atoms of elements consist of indivisible units of matter is now definitely discarded. Instead, we are told that each atom is a whole stellar system of infinitely smaller but absolutely identical units, all in regular orbital motion. An atom consists of 700 such units or ions. The nature or identity of each substance depends upon the number of such ions contained in each atom. Thus 11,200 ions in each atom produce what we know as oxygen, 37,200 of the same ions, if combined in a single atom, would yield gold. The nature of these ions is, for want of a better word, electrical. In other words, electricity and matter are one and the same thing.

This theory has been familiar to scientific men for two or three years, but it was undemonstrable, though suggested by the Rontgen rays, till radium was discovered. Everybody knows of the disintegration of matter into atoms, but it was never imagined that the atoms were capable of disintegration. It is now shown that this is a process of nature, but it is proceeding at a rate so slow that it baffles the powers of conception of the human mind to estimate the length of time required. In radium alone it proceeds so rapidly that the phenomenon is easily observed, hence the discovery.

HEATING OF THE PENNSYLVANIA STEEL CO.'S SHOPS AND OFFICES.

The Pennsylvania Steel Co. has recently erected at Steelton, Pa., a large shop and an office building for its Bridge and Construction Department. The system of heating and ventilating has been designed with much care and exemplifies the latest practice, particularly in regard to the heating of machine shops and other similar one-story structures. Buildings of this nature offer many difficulties, not only on account of their mere size, but also because of the great height considered as one story and the rapid rate at which heat is transmitted through single walls and skylights. At first thought, the most obvious way of heating such structures would appear to be by the distribution of steam or hot water through pipe coils or radiators placed at suitable intervals over the area to be heated. This was, in fact, one of the first methods adopted, but actual experience with it has developed a number of disadvantages, some of which are serious. In the first place, a long and extended system of piping involves many fixtures and many joints to keep tight, gives rise to danger from fire where unprotected pipes pass near wood or other inflammable material and is subject to damage by freezing in severe cold weather. Morover, it does not deliver the heat where it is most needed, for while the neighborhood of the steam coils may be excessively hot, due to direct radiation, other places at a distance are not sufficiently warmed. Most of the heat transmitted directly to the air by conduction and convection is lost, since the hot air-currents rise vertically and impart their heat to the roof and sky-lights. Ventilation in connection with this method of heating is an uncertain and unsatisfactory affair and is usually not considered.

The above objections are obviated in the fan and heater or "hot-blast" system, which has been adopted in the buildings under consideration. In this system the steam piping is concentrated in a compact heater, which is enclosed by a steel housing. Due to the greater velocity of the air over the pipes of the heater, mush less length of pipe is required than if the piping were scattered throughout the shop and all dangers from freezing and bursting of pipes, setting fire to woodwork, etc., are of course eliminated. Air taken either from the shop or from out-of-doors is forced through the heater by a fan and is then carried to various points about the shop by a system of galvanized iron piping. The exhaust from the fan engine is condensed in a section of the heater arranged for that purpose, and there is, therefore, no loss of steam due to the engine. The distribution of the heated air in the shop is a very important question. The hot air should be so delivered that there is no perceptible draft upon the workmen, but at the same time the outlets should be placed at short intervals apart and directed towards the floor, since that is where the heat is wanted. By this means it has been found possible, as in the works of the New York Shipbuilding Co., at Camden, N.J., to keep a zone of nine or ten feet in height comfortably warm, while the space overhead is in comparatively free communication with the outside air. This would be impossible with direct heating, or if the hot air were delivered through a few large outlets in the upper part of the building, as is sometimes practised. The ventilation of shop buildings is of importance especially during sultry weather, and the fan makes it possible to obtain most satisfactory results. On account, however, of the comparatively few number of occupants in buildings of this class as compared with the total cubic contents, sufficient ventilation will be brought about under the usual weather conditions by the leakage of air through doors and about windows and in other ways, and a considerable economy of steam can be effected by drawing the air directly from the building rather than from out-of-doors. This is always possible when heating up in the morning before the arrival of the workmen and renders that process much more expeditious.

In the Bridge and Construction shops of the Pennsylvania Steel Co., there are eight fan and heater equipments, consisting each of a steam-coil heater in connection with a steam-engine-driven exhaust wheel. The heaters, with the remainder of the equipment, were furnished by the B. F. Sturtevant Co., and are built on that Company's patent, corrugated, cast-iron sectional bases, with 1-in. steam pipes set staggered and at the proper distance on centres to obtain the highest efficiency from the heating surfaces without restricting the passage of the air. The sections rest on heavy wrought-iron bases with ample provision for contraction and expansion. The fans are enclosed in three-quarter, steel-plate housings, the lower part of the fan scroll being under ground and forming a part of the foundation. They are driven by direct-connected, horizontal, side-crank engines. A system of galvanized-iron pipe distributes the air throughout the buildings, the air being discharged through branch drop-connections having outlets near the floor. The ducts are of large size with bends of long radius to reduce the frictional losses to a minimum. Each drop pipe is fitted with a butterfly damper with a counterweight for holding the same open or closed as may be desired. The entire apparatus is of sufficient capacity to heat the buildings to 65 degrees F. in zero weather. In the case of the receiving shed this applies only to a section 50 ft. in width in the middle of the building, but extending its whole length. Under the conditions of the