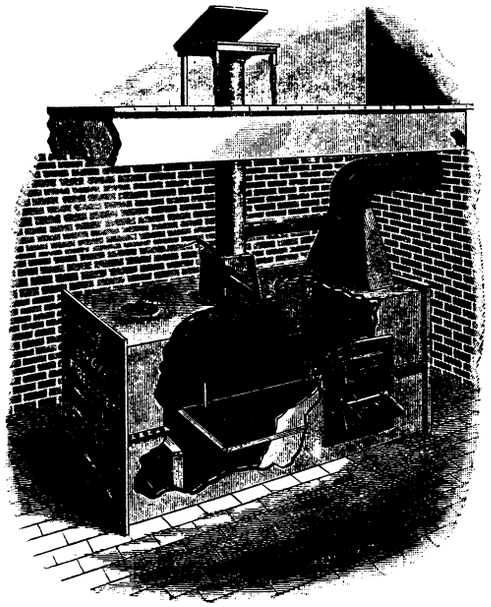
Both the compressors shown here are duplex or double-acting, but they differ in other features. One is actuated by steam direct, and the other is intended to be driven by a belt. The valves and much of the other mechanism of the compressors are constructed on the same principles as those of the steam-pumps made by the same company, which are too well known to require any description here. As the length of stroke of the pistons, in both the pumps and the compressors, is about the same under all ordinary variations of steam-pressure or load, much less clearance is needed for the steam-valves than would otherwise be necessary, — an important point in the construction of compressors. Any desired air-pressure may be maintained by means of an automatic regulator, which opens or closes a valve in the steam-pipe. It may be added that these machines are as compact and simple in construction as is compatible with the uses for which they are intended; and they are not liable to get out of order, even when run at high speeds.

GARBAGE CREMATION.

We had occasion a year ago to describe the Engle furnace for the cremation on a large scale of a city's garbage. To-day we are able to show an illustration of a small furnace for the same use in private houses.

It is doubtless true that nature has its own way of transforming offensive unsanitary matter into new forms in which it is no longer dangerous; but the application of fire can bring about in a few moments that which, if left to natural processes, would take weeks or months to accomplish.



THE ENGLE FIRE-CLOSET.

The practice of cremation in place of burial is doubtless growing, and is each day gaining new adherents. A recent canvass of the opinions of the leading physicians of Philadelphia brought out the fact that the majority of them favored the fire method of disposal of human bodies, several of them taking occasion to point out that it all comes to the same thing in the end, the difference being only in the time consumed.

The Engle fire-closet is the application, on a somewhat smaller scale, of exactly the same principles contained in the garbage cremator described last year. By the use of two fires, one at either end of a small furnace, the smoke and gas evolved in consumption are destroyed, There is no escape of any offensive smell, and the furnace perfectly supplies the use intended, for the sanitary and economical destruction of all matters placed therein.

The advantages of such an apparatus as this are obvious. It is placed in a dwelling, where it is used for the reception and destruction of all garbage, as well as night-soil. It is especially useful in places of public resort, hotels, and restaurants, where a large number of people congregate, and supplies the place in such institutions of an expensive and elaborate system and sewerage. It is in daily use in large collegiate institutions and public-school buildings of cities where no adequate system of drainage is in force, and is serviceable for the destruction of the waste and worthless matters produced by all manufacturing establishments.

The Engle fire-closet is in use in hospitals, for the burning of infected clothing, bedding, furniture, and other matter requiring to be destroyed, from patients suffering with contagious or infectious diseases. As an adjunct to the disinfecting and quarantine stations of cities and the general government, it is an auxiliary of importance.

The illustration shows the construction of an Engle fire-closet adapted for the use of a single family. The matter to be destroyed, both solid and liquid, is received directly through soil-pipes from closets above into the evaporating pans and on the garbage bars of the furnace. The flues into the chimney are kept open, and there is no escape of any smell or odor into the surrounding room; and at the proper time fire is applied, and the contents are destroyed. These fire-closets are constructed of steel, lined with fire tiles, with receiving pans adapted for the purpose required, and occupying a comparatively limited space. They are placed in convenient locations, usually in the lower part of the building, or in the cellar, where access can be had to a flue or chimney of moderate size. Being portable and easy to handle, they may be removed at any time to any other desirable site as the exigencies of the weather may require.

A NEW PROCESS OF PROTECTING IRON EFFECTUALLY AGAINST CORROSION.

The following report on this process was made by Professor H. Haupt to the Franklin Institute of Philadelphia some time since: —

"For a period of more than ten years experiments have been made under the auspices of the Hydrogen Company of the United States to discover a simple, economical, and practical method of protecting iron and steel from all ordinary corrosive influences. A large number of patents were secured, and about $100,000 expended in the erection of plants at Washington, D.C., Newburg on the Hudson, and New York; and some of the results were of the most satisfactory character. Iron that had been treated by the processes referred to effectually resisted the action of nitro-muriatic acid and other severe tests to which it was subjected, while untreated iron was immediately attacked by the acids and quickly destroyed.

"But, although many of the specimens thus treated gave very satisfactory results, others proved defective; and it became apparent to the contributors to the funds that the exact conditions as regards temperature, quality, and quantity of material employed, and duration of treatment, had not been so accurately determined that results could be duplicated with unerring certainty, — an essential condition, without which no process could ever be made a commercial success.

"This explanation has been considered necessary to account for the fact that an industry which promised results of such extraordinary value to the public and to the parties financially interested should have been allowed to linger until the greater portion of the life of the original patents had expired.

"But persistency has at last been rewarded with success. The company succeeded in securing the services of a thoroughly practical and scientific engineer, chemist, and metallurgist, Dr. George W. Gesner, who was enabled to discern the defects of former treatments, and to remedy them successfully by new apparatus and processes, which have recently been patented; so that, while the old patents are still held by the company, they have to a great extent been superseded by more recent issues, under which operations now are and will hereafter be conducted.

"The former treatment consisted in placing the articles to be operated upon in a close chamber, similar to a gas-retort; and when heated to a temperature of about 1200° F., steam superheated in a separate furnace was introduced, followed by naphtha or other hydrocarbon vapor.

"The results, as previously stated, were not always uniform, and,

when satisfactory, could not be duplicated under former management with certainty as to the result.

"All this is now changed; and the results are so uniform and certain, that, with a few hours of instruction in the manipulation of the apparatus, an ordinary laborer, with no technical education and with average intelligence, can secure results with entire uniformity.

"Dr. Gesner soon discerned that one of the chief defects in the former treatment arose from the fact that the steam superheated in a separate furnace, and conducted by pipes into the retort, was invariably cooled to the extent of several hundred degrees before admission, and came in contact with the heated iron at a much lower temperature.

"To remedy this defect and insure absolute uniformity of temperature between the iron and the superheated steam at the instant of contact, a peculiar but very simple form of superheater was devised, and inserted in the retort itself. The result was entirely satisfactory; and, after a number of experiments by him to determine the conditions necessary to insure the best treatment, the works were turned over to an employee, who has since operated them with uniform results.

"The plant now in operation is located at East Port Chester, near the extensive foundery of Abendroth Brothers, and consists of twelve vertical retorts with a capacity for the treatment of about twenty tons per day of the Gesner sanitary soil-pipe. The time required for each charge is about two hours.

"After the pipes have been lowered into the retorts by means of a traveller, the retorts are closed for about fifteen minutes, until the contents are heated to the proper temperature. Steam from a boiler at sixty pounds pressure is then introduced into the superheater, which it traverses, and from which it escapes at the temperature of the iron, upon which it acts for about one hour. A measured quantity of some hydrocarbon is then admitted with a jet of steam, followed again by a fixing-bath of superheated steam, which completes the process.

"The most extraordinary feature of the operation is that, as Professor Gesner positively asserts, there is no pressure in the retort, and no free explosive gases. The water-seals attached to the retorts show only slight oscillations, but not an inch of pressure; and when the covers are removed, and air admitted, there is no explosion, as there always is when free hydrogen or carbonic oxide are present, and as there always was before Professor Gesner took charge.

"The absence of pressure and of explosive gases is a proof that all the operations have been so nicely regulated as regards material used, quantity, and time of application, that a perfect absorption and union of the carbon, oxygen, and hydrogen with the iron has been effected.

"The protection thus afforded to the iron is not a mere coating, like paint, but an actual conversion, to a greater or less depth, into a new material, just as, in the process of case-hardening, iron is converted into steel. When properly treated, this material does not seem to be detachable by pounding, bending, hammering, rolling, or heating. The pipes treated at Port Chester have been immersed in baths of dilute sulphuric acid, and exposed to the salt air for weeks without change, while untreated pipes were quickly covered with red oxide or with sulphate of iron.

"The exact chemical composition of the material produced by this treatment has not been reported upon by Professor Gesner, but it is probably a carbide, hydride, and superoxide of iron. This would seem to be a necessary result, if, as is stated, the retorts when opened contained no free gases, neither hydrogen, oxygen, nor carbonic oxide. As these gases are necessarily formed, their disappearance can only be explained on the theory that they have combined with the iron, forming the three compounds of superoxide, plumbago, and the alloy of hydrogen and iron, for which Professor Gesner has proposed the name of 'hydron.'

"The plant now in operation at Port Chester has been designed simply for cast-iron soil-pipe, but Professor Gesner is preparing plans for a more extensive plant for the treatment of wrought iron and steel, to be erected at South Brooklyn.

"In the application of this process, each specialty will require a plant adapted to it, and a series of experiments to determine the exact conditions as to temperature, quantity, kind, duration, etc., to secure the best results, after which they can be duplicated indefinitely with any ordinary intelligence.

"The question is often asked, 'What is the effect of this treatment upon the tensile strength of the material?' This can only be answered by direct tests; but if the new material should not possess the tensile strength of the untreated iron, as in wires or rods, compensation can be secured by a slight increase in diameter. It is certain that in some specimens the treatment has increased the toughness and strength by the annealing process to which the material is subjected. Sheet iron of poor quality, that would break by bending, has been rendered tough and pliable.

"The cost of the process is said to be about one-fourth of that of galvanizing, while the durability under similar conditions promises to be greatly extended."

SUPPOSED SHOWERS OF METEORITES IN THE DESERT OF ATACAMA.

IT is now universally acknowledged, says a correspondent of *Nature*, that meteorites come from outer space, and that shooting-stars, whatever they are, have an extra-terrestrial origin. It is further asserted that a meteoritic fireball and a shooting-star are only varieties of one phenomenon. Indeed, after it is once granted that a meteoritic fireball is produced by the passage through the terrestrial atmosphere of a dense body entering it with planetary velocity from without, and that shooting-stars have an extra-terrestrial origin, it is a very fair assumption that a shooting-star is likewise a dense body rendered luminous during its atmospheric flight.

One great objection to this assertion is, that again and again showers of hundreds of thousands of shooting-stars have taken place, during which no heavy body has been observed to reach the earth's surface. The only known case of the arrival of a meteorite during a shooting-star shower was that of Mazapil, on Nov. 27, 1885, and that single coincidence may possibly be the result of accident. A sufficient explanation of this difficulty, however, is to be found in the small size of the individuals which produce the appearance of a shooting-star shower. That the individuals are really minute is proved by the fact, that, while the total mass of a large swarm, like that producing the November meteors, is so small that there is no perceptible influence on the motion of the planets, the number of separate individuals is almost infinite. It is established that the Leonid swarm must be hundreds of millions of miles in length, and some hundreds of thousands of miles in thickness; and in the densest part of the Bielid swarm, passed through in 1885, the average distance of the individuals from each other was about twenty miles.

Further, it is now acknowledged that comets are themselves meteoritic swarms, and Mr. Lockyer has lately brought forward spectroscopic evidence that the fixed stars and the nebulæ are similar to comets in their constitution.

The question therefore immediately presents itself, is the size of a meteoritic shower, on reaching the earth's surface, ever comparable with that of a meteoritic swarm, as manifested by a shower of shooting-stars?

During the present century nearly three hundred meteoritic falls on the earth's surface have been observed, and on only a single date, namely, Aug. 25, 1865, has there been observed a fall on two distant parts of the earth on the same day. On that date stones fell at Aumale in Algeria, and at Sherghotty in India; but as the times of fall differed by about eight hours, and the stones arrived from different directions, it is more than probable that the coincidence of date was accidental.

The most convincing proof of the actuality of such showers is furnished by the masses which have been found in the valley of Toluca, in Mexico. Their existence had been chronicled as early as the year 1784, yet in 1856 it was still possible to collect as many as sixty-nine. Belonging, as they do, to a single type, they lead to the conviction that they are the result of a single shower. But the region over which the fall took place is not large: the length of it is said to have been only about fourteen miles.