level, is a sandstone almost as hard as granite. The first nine feet of the cut were plowed and scraped out with the aid of horses; the remainder was removed by careful blasting. We can easily understand the extreme delicacy with which the latter operation must be performed, when we take into consideration the brittle nature of the fossils, the hardness of the surrounding concretion, and the frequently involved positions of some of the bones. In fact, it was impossible to remove many of the fossils individually, so the surrounding matrix was cut out in a block, leaving the segregation of the bones to the laboratory force. The largest block weighed 4,100 pounds, and it required fourteen days' labor to transport the same to the railway.

The discovery included so many representative portions of the skeleton of this great flesh-eating dinosaur, that its general appearance can be described with reasonable accuracy. Tyrannosaurus, when in the erect position which in all probability he habitually assumed, measured about 39 feet in length, and carried his head at a height of some 19 feet above the ground. Some doubt still exists about the possible size of the forearm. In the first collection made in 1902 there were a small humerus and a small femur associated with the Tyrannosaurus bones. The humerus was supposed to belong to Tyrannosaurus and the latter was restored with a short forearm like the Jurassic carnivores, but in the collection of this year there is a large bone thought to be a humerus, and in this case the entire character of the animal would be changed. The whole matter can be cleared up only by freeing these new bones from the inclosing rock. He was practically a biped, with an agile bird-like manner of locomotion. The huge feet, about four feet long and three feet wide, also show bird-like characteristics, with three enormous toes projecting forward, and one extending backward. The toes of all four limbs were provided with great tearing claws. Enough skull bones were found to determine all of the characteristics of the head, which was far larger and contained a greater brain than that of the sluggish Brontosaurus, and was provided with great, sharp-edged serrated teeth, some of which were six inches long. Supplied by nature with such weapons, we can easily imagine that Tyrannosaurus made life miserable for some of his more inoffensive neighbors.

It is almost impossible to estimate the value of this find to the science of paleontology. It has already caused the reclassification of a number of the great denizens of the earth toward the end of the age of reptiles, among them the type Dynamosaurus, another carnivorous dinosaur, and the somewhat more primitive genus Albertosaurus, hitherto included in the type Dryptosaurus. The extreme rarity of fossils of this kind adds greatly to the value, a rarity undoubtedly due to the fact that the creatures were essentially land animals, that they were born, lived, and died in the open where their remains were speedily disintegrated and destroyed. In the case of amphibious Dinosaurs, on the other hand, the bodies usually settled to the bottom of the waters which they frequented, and were gradually covered over in the formation of the sedimentary rocks in which we find these fossils to-day. And so the preservation of individuals of the land species only occurred when the body accidentally became submerged in one of the waters of the region in which they lived. In three years' work carried on by the American Museum in the Cretaceous formations, parts of only three skeletons of this kind have come to light, one of these, an allied species of the same geological age, being found in Wyoming. From the traces of palms, rushes, and ferns, which are often found together with the bones of the Cretaceous period, the conclusion has been drawn that this region then possessed a sub-tropical climate, not unlike that of the West Indies of to-day. The region also included the great seas and lakes of salt or brackish water, the sedimentary remains of which are the bad lands of our age, the greatest fossil graveyards of the world.

REFRIGERATION WITH ELECTRIC MOTIVE POWER.

BY DR. ALFRED GRADENWITZ.

The most primitive and most extensively used processes of producing low temperatures are through the agency of melting ice. This is dependent on the following principle. The melting of ice requires a well-defined amount of heat, viz., 80 heat units or calories for each kilogramme at 0 deg. C. (32 deg. Fahr.), each calorie being capable of heating 1 kilogramme water (1.06 quarts) at 15 deg. C. (59 deg. Fahr.) through 1 deg. (1.8 deg. Fahr.). Now, as this amount of heat is derived by the ice from its surroundings, i.e., the air and other objects it comes in contact with, a *refrigerating* action will obviously be produced on the latter. This process of refrigeration is, however, affected by many disadvantages, the supply of ice primarily involving considerable expense, especially in the case of an extensive demand. There is also the nuisance connected with the moisture and dirt of the ice, and finally the space requirements of the outfit. Furthermore, this melting process does not allow the refrigeration to be carried below the temperature of melting ice, nor does it insure the dryness of the air, which is quite indispensable for a satisfactory preservation of food, etc., the melting ice producing a certain quantity of moisture in the cooling compartment.

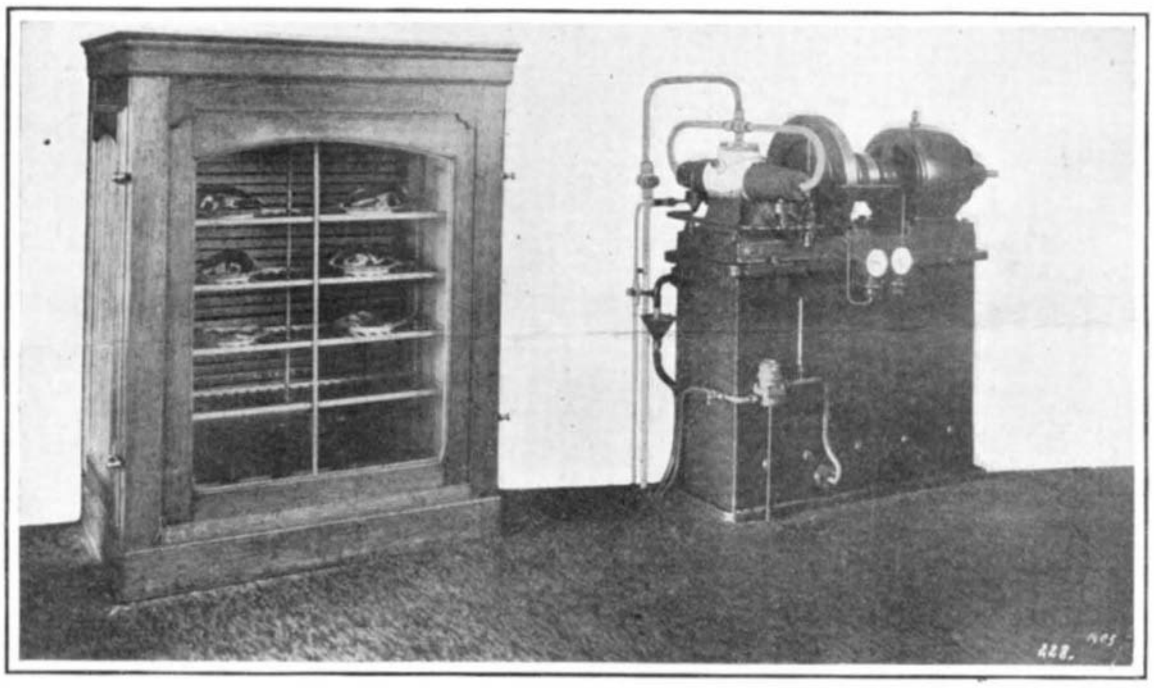
Mechanical processes of refrigeration have therefore been resorted to of late years, using a method quite analogous to melting, viz., evaporation. When passing from the liquid into the gaseous state, a substance consumes a certain amount of heat termed *heat of evaporation*. As much as 536 heat units (calories) are thus required to convert 1 kilogramme of water at 100 deg. C. (212 deg. Fahr.) into steam of the same temperature under normal pressure. Now, the heat required for evaporation is derived from the surroundings of the body in the same way as in the case of the melting process, and these are consequently cooled down. Carbonic acid, ammonia, and sulphurous acid have been generally used as refrigerating agents in connection with vaporization processes, these substances being vaporized at low temperatures, while capable of absorbing large amounts of heat. The arrangement and working of a refrigerating machine using any one of these substances is as follows: After freeing the liquid from any water, it is vaporized at low temperatures in a system of tubes (the so-called "vaporizer") and thus caused to absorb heat from the cooling medium (i.e., either the air or any other substance) surrounding the tubes. The evolved gas is drawn in and compressed by a suction and compression pump, which is connected with the vaporizer; then it is forced into another tubular apparatus called the "condenser," where it is liquefied again, while yielding the absorbed heat to the cooling water; it finally flows back as a liquid into the vaporizer. This process is thus a cyclic one, wherein the refrigerating liquid is used over and over again, so that only the amount of energy required to drive the pump and the necessary cooling water is used up.

The refrigerating apparatus proper or vaporizer is located either directly in the compartment to be cooled (this being called direct vaporization) or in a reservoir containing a liquid congealing at a low temperature, e.g., a salt solution, which on being cooled down to the required temperature is in turn conveyed by a special pump through the refrigerating compartment and back into the reservoir (this being the process of indirect vaporization). The latter alternative possesses the advantage that it allows of a local concentration of the process and of storing cold in the cooled brine, so that the refrigerating effect is maintained for some time even after the plant has been out of service. Accordingly this process is especially used in the case of permanent refrigeration of extensive rooms for cooling at longer distances or else for the production of ice on a large scale.

The advantage of artificial refrigeration over the cooling by ice may be excellently demonstrated in the case of two identical cultures, one of which had been exposed to an ice refrigeration compartment and the other in a mechanical cooling plant. Whereas a whole colony of micro-organisms had been evolved in the former, the culture being partly consumed by putrefaction fungi, the latter at most shows only small traces of inoffensive mold, thus illustrating the efficient results of mechanical refrigeration.

While this process of refrigeration, which in many cases is utilized in the manufacture of ice, has been generally introduced in large plants, ships, etc., it has been impossible up to the present to use it economically on a small scale or to introduce it into general practice. The type of apparatus illustrated herewith has been constructed for this purpose jointly by the Berlin Electricity Works and the Gesellschaft für Linde's Eismaschinen. This electrically-driven refrigerating machine, which is being exhibited at present at the permanent electrical exposition of the Electricity Works, will be particularly welcome to architects and builders, for the installation of cooling plants in villas, dwelling houses, etc.

The ammonia refrigerating machine includes a horizontal compressor, consisting of two single-action cylinders with a plunger piston driven from a common crankpin and running in an oil bath. This machine is directly operated by a 1.3-horse-power A. E. G. motor mounted with it on the same foundation plate. The condenser, where the vaporized liquid is reconverted into the liquid condition, is located in the iron supporting casing, wrought-iron serpentines being provided for the admission and discharge of the cooled water. The vaporizer is located in a cooling compartment shown in the photograph; but as the apparatus is intended for demonstration purposes only, its dimensions do not correspond to the full output of the machine. There is furthermore an isolated vaporizer beneath the motor for the case of the indirect process referred to above. In this event a small circulation pump would have to be added to the mechanism. The output of the machine is about 1,000 calories per hour with a gas temperature of —10 deg. C. in the vaporizer and a speed of 400 R.P.M., the corresponding consumption of energy being about 900 watts. In order to illustrate the significance of these figures, it may be said that this amount of heat would be sufficient to cool about 150 cubic meters of air per hour from 20 deg. down to 0 deg. C., irrespective of its moisture.



A SMALL ELECTRIC REFRIGERATING PLANT.

After the apparatus has been prepared for operation, its manipulation will be found extremely simple. It is only necessary to turn on the cold water and start the motor, while any friction parts, such as bearings, stuffing boxes, etc., should of course be properly lubricated from time to time. About 3 kilogrammes of ammonia, sufficient for a considerable period, are used as charge.

The small type of refrigerating machine described in the above is only intended to acquaint the general public with the arrangement and operation of such an apparatus, and to demonstrate that artificial refrigeration is readily available wherever electric current can be obtained, and that it can be secured at a relatively small expense.

Poisonous Effects of Eggs.

L'Illustration recently published the following curious facts:

"Should we think that eggs possess a poison? That nevertheless is what M. G. Loisel declares. But we must understand each other. Eggs are poisonous in certain conditions merely, when we absorb them in a certain way. They are poisonous when injected beneath the skin, and no one thinks of applying them in that way. It is the yolk chiefly that is poisonous. The poison varies according to the species that provided the egg. The duck's egg kills the rabbit in a dose of 8 cubic centimeters; that of the hen kills only in a larger dose. By way of compensation, the turtle's egg is more noxious than that of the duck: it kills in a dose of 5 or 6 cubic centimeters. Therefore the turtle is more poisonous than the duck, and this last is more so than the hen. Rabbits poisoned by the yolk of an egg injected under the skin or into a cavity of the body die with the symptoms of an acute intoxication of the central nervous system. The white also of the turtle's egg is very poisonous. But none of these eggs is hurtful when absorbed by the digestive organs."