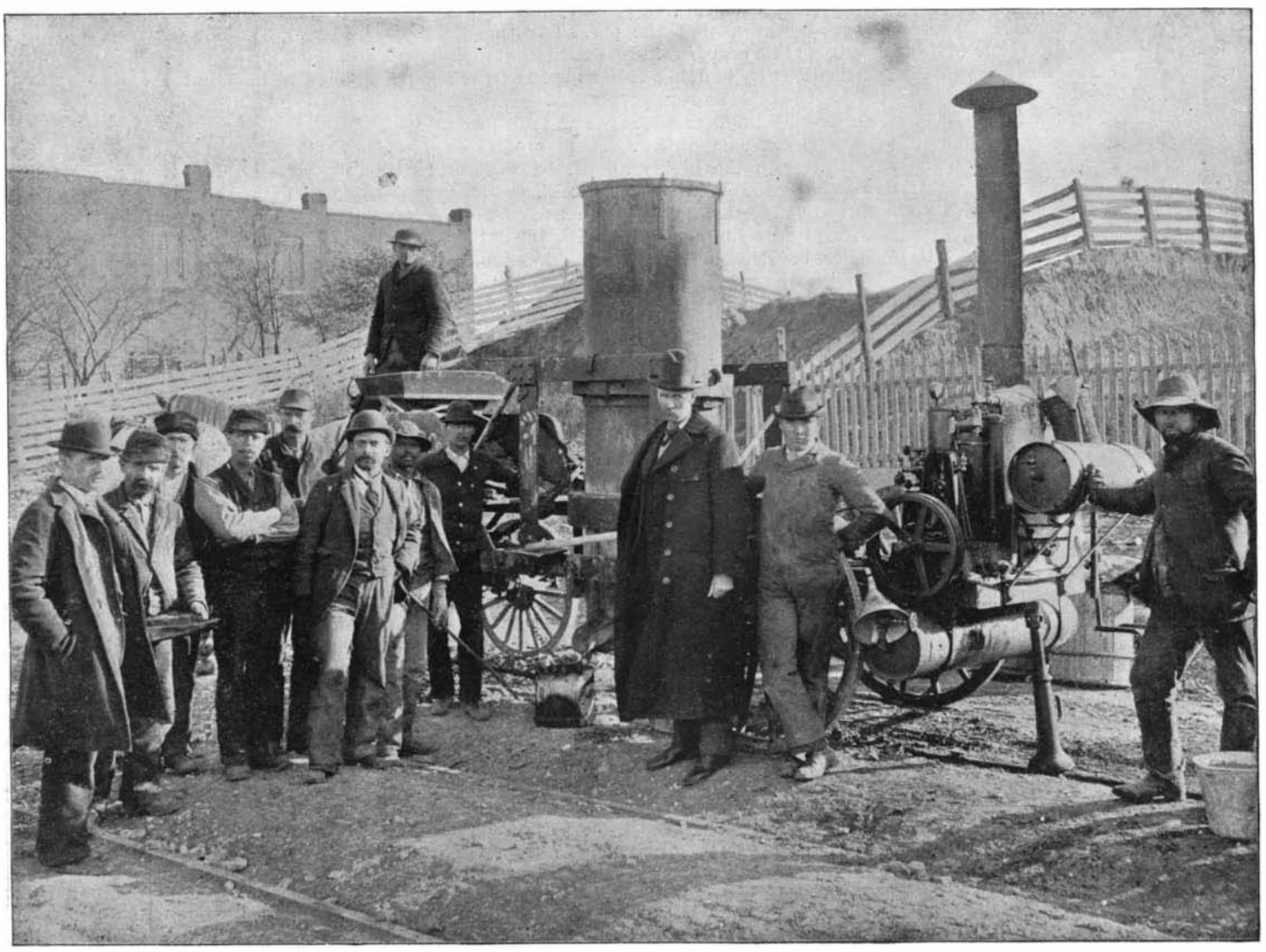
CAST WELDING RAIL JOINTS.

The electric welding of railway rail joints has, from its inception, attracted the especial attention of street railway managers, particularly those operating trolley lines. In the accompanying illustrations we present another method of welding rail joints, recently brought forward by the Falk Manufacturing Company, of Milwaukee. It consists in casting around the meeting ends of the rails, in heated metal moulds, a large body of melted iron, the principal portion of the metal being directed about the base and web of the rails, and thus effecting, it is claimed, a good weld between the iron and the steel of the rail. The iron is poured into the moulds from a ladle, as in an ordinary foundry, and it is stated that the union of the parts thus attained, as shown by broken sections through joints and pieces of casting, is equal to that commonly made by good welding.

This method of welding has recently been put upon practical trial on about three miles of railway in St. Louis, and has also been employed in the repair of thirty-seven joints in six miles of track which had been electrically welded. In operation the first thing, of course, is to dig up the paving and expose the joints. Meanwhile the moulds, which are of common cast iron, are thrown in a heap somewhere near by and a fire built around them, so that by the time they are to be put around the joints they are a dull red. The moulds are lined with a composition of graphite and another substance applied with an ordinary paint brush. The moulds are relined in this way for about every twenty joints cast in them. They can be lined while hot and it takes about half a minute to reline a pair. Before the moulds are applied the rails near the ends are cleaned, and if the ends do not butt together closely, a thin section of rail is driven in to fill the crack. The moulds are then put around the joints and the metal is poured. The outfit is practically a small foundry cupola on wheels, the one used in St.

RUNNING THE METAL.



CASTING OUTFIT READY FOR WORK.

CAST WELDING FOR RAILWAY RAIL JOINTS.

Louis, and shown herewith, weighing 7,000 pounds. It made seventy joints a day, but outfits having a larger capacity are now being manufactured. The cupola is hung on gimbals, keeping it always level, and behind it is a small steam engine which drives a blower furnishing an air blast. The engine takes care of itself to a large extent, as the feed is automatic, being regulated by the height of water in the boiler, and the oil fuel flow is regulated by the pressure of the steam. The air pipe between the blower and cupola has a flexible joint, to allow for the movement of the cupola on its pivots, and under the engine can be seen the tank for water supply.

The moulds have eyebolts, so that they can be handled with iron hooks. They are held in place with ordinary clamps and are of such shape as to fit up snugly against the rails and hold them firmly in line until the joint has cooled. As shown in the engravings the cracks on top between moulds and rails are filled with clay and sand. A plate of iron is laid over the crack between the ends of the rails, so that when the iron attempts to rise there it is suddenly chilled and prevented from flowing out on top of the rail. Underneath the moulds the crack between the halves is closed by holding a pan of sand up against it. The moulds can be put on a joint in about two minutes. The moulds are hot when put on, and they are allowed to stay on long enough to heat the rail ends. After the iron has been poured in, about ten minutes is allowed to elapse before the moulds are taken off and put on another joint. About a dozen sets of moulds are kept in use at once. Every other joint of a section of track is cast in the morning and in the afternoon the remaining joints are cast, to prevent, as far as possible, the severe strain of contraction and expansion, as the operation heats the rail for some distance on each side.

The joints made at St. Louis weighed 120 pounds each. They may, of course, be made of any desired weight, and this would seem to be a very large mass of metal to deposit at each rail joint. The joints first made by the company weighed only 54 pounds each, and it is claimed that such a joint, when placed on blocks two feet apart, withstood a downward test pressure of 100,000 pounds. The 120 pound joint covers four bolt holes, and the cost of each joint is stated to be about $3.

It is said that the welding action between the rail and casting takes place around the base and about two-thirds of the way up the web of the rail only, so that if the joint is defective and breaks, the head of the rail remains intact. Another advantage claimed for this improvement is that a solid mechanical joint may be made thereby by slightly varying the method and preventing the welding action, such a joint allowing for the contraction and expansion of the rails.

Although this process has not yet been sufficiently employed to determine its ultimate value, it is being looked upon with considerable interest, especially by the managers of small street railway systems, as the initial cost of apparatus for electric welding is very much higher than that of this system, and the electric apparatus is more expensive to maintain. One of the views represents one of the lugs knocked off a broken electrically welded joint, showing that welding took place on but a comparatively small portion of the area. It is said that a cupola plant for making and mending joints on a small system can be furnished at a cost of less than $1,000, so that, with its use, there need be no angle bar joints on the entire road. For illustrations and details we are indebted to the Street Railway Review.

CUPOLA AND CREW.

FILLING MOULDS.

LUG FROM DEFECTIVE ELECTRIC WELD.

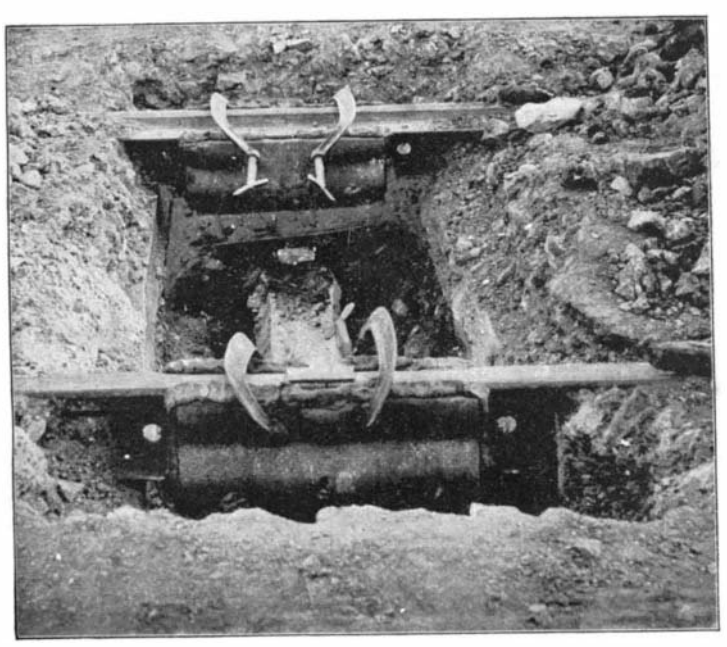
Parcel Service on Street Railway Cars.

It is not generally known that a number of the street railways are being brought into general use for carrying various forms of light merchandise. Statistics recently gathered on the subject show that one hundred and twenty-five street railway companies of the country are regularly employed to carry the mails, sixty-nine roads are used to carry parcels under regular contracts, and some ninety-two roads have made provision for carrying other light forms of merchandise. It is probable that the practice will be greatly extended in the next few years, for the advantages of such a system are much too important to be neglected. The street cars reach a great many important points and they run with almost absolute regularity, since every precaution is taken to guard against their stoppage or delay.

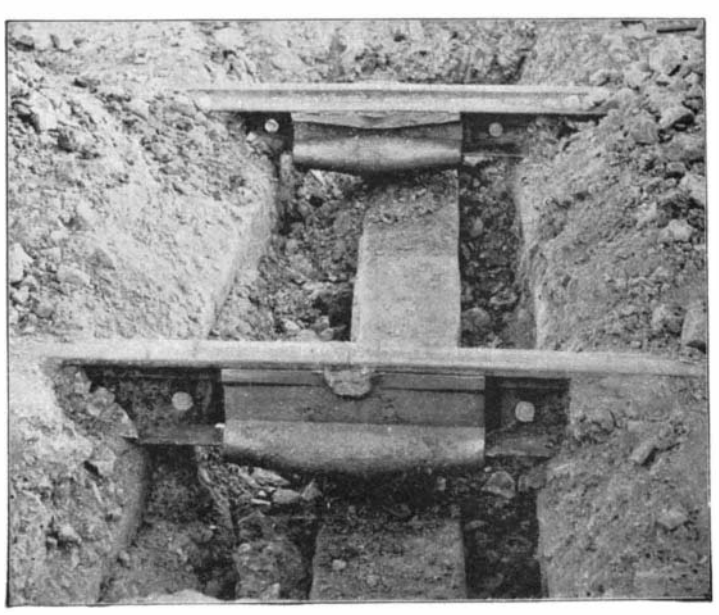
Some of the plans in operation in different parts of the country for utilizing the street cars are interesting. On one of the trolley lines of St. Louis, for instance, a regular delivery service is in operation, involving the collection and house to house delivery of ordinary express packages. This particular line starts in the heart of the city and runs for seven miles through a thickly settled district. A delivery car used for the work makes three trips per day, running on schedule time. The car is especially equipped for the purpose and is mounted on motors of its own, since the ordinary form of motor would not be sufficiently powerful. The car starts from a down town receiving station, where a clerk receives all parcels and keeps the books pertaining to the service. The important feature of the system is the work of collection and delivery along the route. The company use five wagons in the work, two of which are kept at the down town end of the road and the others meet the cars at fixed points along the road. These wagons call for packages in the usual manner, and deliver them to the express car, and the car carries it to the proper wagon for its delivery. The plan has proved so efficient that many of the large retail stores along the route which make a practice of delivering packages have ceased to run their delivery wagons to the part of the city along the trolley line, and now consign all their bundles to this express company. Formerly the express wagons made but one delivery per day, and at present the street railway makes three regular deliveries. Several large factories along this route consign all their goods to the "Electric Express." The company assumes all the responsibilities of a common carrier and is held responsible for all loss or damage. The service is not found to interfere with the regular running of the cars, and in the two years it has been in operation has never failed to pay.

Street Car Transfers in Baltimore.

The transfer system among the street railroads of Baltimore has grown since its introduction in 1882, and free transfers are now issued at some 40 different points; in some cases it is possible to ride 20 miles for a single fare. As a rule, in any city transfers are confined to different lines of one company; but at a crossing of the Lake Roland Elevated and Central roads free transfers are given from one to the other. A station is located at the junction and an agent provides the transferring passengers with a ticket. At the end of each quarter officials of the two companies meet, exchange coupons and divide equally the residue of fares collected by one company over the other. It is a very simple arrangement, and has resulted in greatly increasing the traffic of both roads.



MOULDS ON JOINTS.



JOINTS FINISHED.

CAST WELDING FOR RAILWAY RAIL JOINTS.

Physical Decay.

"If the repair were always identical with the waste, life would then only be terminated by accident, never by old age." This is a fact well known to all who have investigated the subject, though Mr. G. H. Lewes, in his "Physiology of Common Life," makes the statement quoted. In early years this balance of the human system is admirably preserved. As man advances in life, however, and gets up to 50 or 60, he begins to get stiff in the joints, and experiences what he calls "feeling his age." Renovation of various organs of the body depends on the blood, and if this supply is not at all times furnished in sufficient quantity and quality, a gradual deterioration takes place. Heart and arteries become clogged, and the whole delicate machinery suffers from the lack of nourishment. Deposits of phosphate and carbonate of lime accumulate, and the change is really a chemical one, by which the blood is hindered from going to the extremities of the system and fulfilling its work of repair and renovation. Old age, then, is the result of a change in the blood, which becomes overloaded with earthy salts, leaves its refuse matter in the system, and the valves of the heart become cartilaginous. Becoming thus, the heart is not able to propel the blood to its destination. Arteries also having become ossified, a still further obstruction takes place, and the whole body languishes. Blood is life. If it is kept continually in good order, our years are prolonged. New bodies, as in youth and early manhood, do not accumulate these fibrinous and gelatinous deposits, which, as the years go by, help the gradual process of ossification and cause the decrepitude of age. Now if some means were discovered by which the blood could be kept in a condition like that of youth, it would throw off these earthy salts which obstruct the action of the heart and arteries. Our food and drink make our blood. It seems, then, that it is to them we should look primarily for the quality of it.

Without eating and drinking there is no life, but we may select certain kinds of foods containing a minimum amount of the elements which cause the ossific blockages in the system. An English physician, Dr. C. F. De Lacy Evans, who made many researches in regard to our food, comes to the conclusion that more fruit should be eaten, especially apples, grapes, and bananas, they being rich in nutritious elements. Being deficient in nitrogen, they are best for elderly people, as they keep the blood in a better condition than flesh. After the age of 60 people should eat less beef and mutton, and use more apples and nuts of all kinds, the latter being rich in many of the nutritious elements of meat. Fish and poultry have not the objectionable earth salts of beef. In order to retard physical decay and to keep the blood in a wholesome condition distilled water is recommended. It has solvent qualities which act upon the earth salts in the blood and expel them from the body. A goblet of this water taken three times a day, with ten or fifteen drops of diluted phosphoric acid in each glass, has a tendency to assist the blood in eliminating the obstructing salts. A man is as old as his arteries. If they are soft and compressible, the deteriorating effects of old age have not appeared.

Flourens, in his well known work on "Human Longevity," cites the case of the Italian centenarian Cornaro, whose recipe for health and long life was extreme moderation in all things. Flourens himself insists that a century is the normal life, but that 50 years beyond, and even 200 years, are human possibilities under advantageous conditions. Hufeland also believed in 200 years as an extreme limit. Sir James Crichton Browne, M.D., concedes, in a late address, that Flourens was right. Duration of growth gives the length of life. Hufeland held that the human body grows till the age of 25, and that eight times the growth period was the utmost limit of man. But if 20 years be taken as the time of growth, even five times that will give us a century. According to Flourens and Cuvier, man is of the frugivorous or fruit and nut eating class of animals, like the gorillas and other apes and monkeys. Man has not teeth like the lions and carnivorous beasts, neither has he teeth like the cows and herbivorous oncs. Intestines in the man are seven or eight times the length of the body; the lion's are but three times the length of his body. Herbivorous animals, like the cow, have intestines forty-eight times the length of the body.

So judging man by his teeth, his stomach, and his intestines, he is naturally and primitively frugivorous, and was not intended to eat flesh. Fruit is aperient, and apples act on the liver, and are good brain food also, as they contain much phosphoric acid. As to the effect of certain climates, perhaps too much stress has been laid upon that. We find that Thomas Parr, who lived in England, died in his 153d year, and was dissected by the celebrated discoverer of the circulation of the blood, Dr. William Harvey (who expressed no doubt of his age), was never out of his native country. Accounts of men who have lived to extreme age in Ecuador and Mexico indicate possibilities. A climate that allows much outdoor living is the best for health. More depends on food than on any climate. Exercise, fresh air to live in and to sleep in, daily bathing, and freedom from medicine are the important things. In July, 1893, the Courier Journal, of Louisville, published a long account of James McMullin, who died in Carlisle County, Ky., at 117 years of age. When Buffon, Hufeland, Flourens, and men of that class, who had studied the subject, believed in the possibility of 150 or 200 years of life, the subject is not to be laughed at.—William Kinnear, in Harper's Weekly.

FOSSIL FROST CRACKS.

BY J. A. UDDEN, ROCK ISLAND, ILL.

Sun cracks have long been known to geologists as characteristic of littoral deposits. During the summer season they are quite often to be seen on the muddy shores of larger waters and still oftener, perhaps, on the bottom of desiccated inland ponds. Their recognition in the fossil state was easy. But there is another kind of mud cracks which are produced under quite different conditions of less common occurrence, and these have, perhaps, but seldom been preserved during past ages.

Their making may be described as follows: When mud freezes, the water which it contains has a tendency to crystallize. The crystals begin to grow on the surface, and a continuous coating of ice is apt to form, if water is present in sufficient quantity. Such a coating will be much thicker along certain lines where the freezing commenced, and the ice will often extend as a thin plate some distance down in the mass, which is thus fissured by clefts filled with ice crystals. These clefts are mostly straight, and they branch and cluster after the crystalline properties of water, uniting preferably at angles of 60 and 120 degrees. When dry winds cause the crystals to disappear, as sometimes will happen, the empty cracks remain open and exhibit perfectly the forms of the branching plates which made them.

As a result of the special conditions attending their

FROST CRACKS ON A BLOCK OF SANDSTONE IN THE BLACK HILLS, S. D.

formation, frost cracks are quite unlike sun cracks in their appearance. The most important points of difference may be tabulated thus:

SUN CRACKS	FROST CRACKS
are jagged and curved irregularly,	are straight,
are of somewhat uniform and rather large width,	are apt to taper to a point at one end and are narrow, and
tend to form a network with six-sided meshes and, as a consequence, often meet in tri-radiate clusters	form branching tree-like patterns, in which shorter members run out from one side of a longer main stem
at various angles approximating 120 degrees.	usually at angles of 60 and exceptionally at 120 degrees.

While out on a tramp in the Black Hills last summer, the writer found some fossil marks that appeared to be frost cracks produced in this way. They were seen on some blocks of sandstone resting on a talus about three miles south-southwest of Minnekahta station in the southern foothills. The blocks were evidently detached from a ledge which comes in a little below some strata that have lately yielded a number of petrified stems of cycad trees. On one side these blocks presented an unusually smooth and plane surface, which was almost glossy and covered with a coating of fine red material about $\frac{1}{16}$ of an inch in thickness. There was something of a resemblance to an ice surface. It bore impressions which corresponded to the description of frost cracks as given above. The lines were but slightly sunk below the plane of the surface and measured from one-half to four inches in length and from one-sixteenth to one-eighth of an inch in width. Some of the branched patterns they formed were over eight inches in length, and most of the angles observed measured just sixty degrees, while a few of them exceeded seventy and even eighty degrees. Quite a few lines also met at angles of one hundred and twenty degrees.

The series of sandstones and shales to which the rocks of this locality belong furnishes sufficient evidence of shallow water conditions attending its making. This consists in ripple marks, cross bedding and the remains of ancient land plants. Sun cracks are also known to occur. The rocks were made during a period of transition between the Jurassic and the Cretaceous ages. This is known to have been a time of increasing cold, when the tropical plants of the earlier age were giving place to the temperate vegetation of the later. During an age of such changes it would, indeed, be quite probable that a frozen mud flat should occasionally become buried under the sediments of an advancing tide, and to such a contingency the singular markings on these sandstone blocks are probably to be ascribed.

Muzzle Velocity of Shot.

In the course of his first Cantor lecture, delivered before the Society of Arts on "Explosives and their Modern Development," Prof. Vivian B. Lewes referred to the method of determining the muzzle velocity of shot which is effected by means of the chronograph. He said:

"Two screens are arranged, one about 120 feet from the muzzle of the gun, and the second 120 feet beyond the first. These screens consist of wooden frames strung with fine copper wire, the disruption of a single strand of which is sufficient to break the flow of the galvanic current. In the Boulenge chronograph, a current from a battery of eight Bunsen cells flows through these wires and back to the instrument house, where the wire from each frame is coiled round a separate soft iron core and converts it into an electro-magnet, each of which attracts and holds a rod of steel. The electro-magnet in connection with the second frame is fixed at a lower level than the electro-magnet connected with the first, and carries a short rod with a weight at the bottom, while the first magnet is at a much higher level, and carries a longer rod. The current being allowed to pass through both electro-magnets, the rods are suspended in position. By pressing a key both circuits can be simultaneously broken, with the result that both the rods are liberated and drop down guide tubes; the short rod strikes a catch and causes a knife edge to be brought against the longer falling iron, and to make a nick in it. When both rods are liberated simultaneously, this nick occurs at a definite place. The current is then allowed to pass, the rods hung on the electro-magnets, and the gun containing the charge, the power of which is to be tested, is fired, the projectile passing through the screens and breaking the current by cutting the wires. Under these conditions the long rod is liberated a fraction of a second sooner than the shorter rod, the result being that the nick of the knife blade is no longer in the original place. By measuring the distance between the two nicks, and knowing the length of time to which this is equivalent, allowance being made for the time taken in liberating the knife blade, etc., the interval of time which elapses while the projectile is passing between the screens can be calculated, and, being corrected for the distance of the first screen from the muzzle, gives the muzzle velocity of the projectile."

Cooling Devices for Dwellings.

It must be something like fifteen years since the air of the Madison Square Theater was artificially cooled in summer by passing it over ice; and refrigerating apparatus is in use in every large city in the civilized world, for cooling rooms for the storage of provisions. Many attempts have been made to introduce refrigerating apparatus of the same sort as that used in the cold storage buildings into dwelling houses, but they have failed, and with reason, to please the public. The apparatus now attracting the attention of the newspaper reporters is simply an ammonia machine, depending for it frigorific properties on the alternate condensation and expansion of ammonia gas. To judge from the accounts, the apparatus is, as a piece of machinery, well designed, but the descriptions of the methods by which it is intended to convey the chilling influence to the rooms of a dwelling are rather amusing. We are told, by way of introduction, that the use of ice for cooling rooms causes "dampness," while the ammonia apparatus produces "a pure, dry cold." It is hardly necessary to say that the facts are just the other way. When warm air, which, in inhabited buildings, is always moist air, is passed over ice, after the Madison Square plan, the moisture of the air is condensed by the reduction of temperature, and deposited on the ice, to be carried away with the drainage water from the ice; and the air which passes beyond the ice is not only cool, but comparatively dry, as its moisture has been, so to speak, wrung out of it by the ice.

With pipes filled with ammonia-chilled liquid running through the room to be cooled, the case is reversed. All the moisture originally contained in the air remains in the room. Such air as comes in contact with the cold pipes will deposit its moisture in the form of drops of water, which will either fall on the floor or must be collected in some way and drained off; while the remaining air will be held at the point of saturation. A more unwholesome atmospheric condition it would be difficult to conceive than the reeking, dripping, chilly dampness of a room to which such a cooling system had been applied.—American Architect.