ing hosts. It required from three to four days for a dead tunicate to sink to the depth of 1,000 fathoms.

The closing paper was by Prof. O. C. Marsh, "On the Brain and Spinal Cord of Some Extinct Reptiles." Referring to his previous paper on the same subject, and to the brain development previously enounced by him, Prof. Marsh called attention to the singular brain or brains of a gigantic reptilian of the jurassic formation which he had recently examined. This immense animal, though 30 feet in length, possessed a brain scarcely as large as that of an ordinary dog, as judged from the capacity of the brain cavity. But the most remarkable feature of its nervous system was an immense enlargement of the spinal cord in the sacral region, where the bone was so excavated as to form an immense vaulted receptacle, several times larger than the brain cavity. The sacrum consisted of four vertebræ, which were well ossified and of great solidity, and within this was contained, during the life of the animal, a posterior brain—if he might use the term—which was eight times as large as the encephalon. The point was of very curious interest, not only as a fact of fossil anatomy, but in respect to the physiological inferences that might be drawn from it, into which he did not propose to enter. It was so remarkable, indeed, that he took occasion to examine other examples of the same species before accepting it as a general fact of extensive application. Upon recurring to some younger specimens of the same gigantic saurian, he was enabled to verify the existence of the cavity in every instance, and to prove that sacral enlargement of the cord in extinct reptilians was an extraordinary fact. If it had appeared in a single instance, it must, of course, have been regarded as a phenomenon due to injury or disease; but in all cases since his attention was attracted to the point by this enormous creature he had found the posterior cavity in extinct reptiles.

There was nothing analogous to this sacral enlargement, Prof. Marsh continued, in existing vertebrates. The aurphiax had absolutely no brain—that is, no cerebral enlargement of the cord at the anterior extremity, but there was no enlargement of the spinal cavity at the sacrum which answered to what he had observed in extinct species. He would not take the time of his colleagues by drawing any conclusions from the facts he had stated. Prof. Rood inquired if the sacral enlargement was in such a position as to furnish a point of origin for the nerves of the leg. Prof. Marsh replied that such was the case, and that the creature had very powerful hind legs. But the fore legs were equally strong, and there was no corresponding enlargement.

AMERICAN INDUSTRIES.—No. 62.

THE MANUFACTURE OF STEAM, GAS, AND WATER FITTINGS, TOOLS, ETC.

The vast quantities and almost infinite variety of goods now required in this department, apart from the plain piping and other staple articles, render it especially appropriate that the making of these more difficult parts should constitute a branch of business by itself. The manufacture of cocks, valves, couplings, stops, etc., covers an almost endless assortment of varying patterns, and these, with the fittings and collateral articles, require an extensive variety of especially contrived tools and appliances, as well as the most skillful workmanship. Our illustrations on the first page of this paper represent the more important details of this branch of industry, as carried on at the extensive establishment of the Eaton, Cole & Burnham Company, at Bridgeport, Conn., where are made almost every description of steam, gas, and water goods, in cast, wrought, and malleable iron, as well as in brass, copper, and the related alloys.

The die making department is shown in one of the views at the top of the page. Here are made every description of screw threading taps and dies, with stocks adjustable or otherwise; also gas pipe reamers, drills, cutters, etc. A considerable proportion of the work done here is in the preparation of the working apparatus necessary in the other branches of the manufacture; but this is also the starting point for the making of a full line of tools for the use of gas, water, and steam fitters. The stocks and dies made are adapted to cutting threads on pipe of from ⅛ inch to 3 inches diameter, the dies being made either right or left, and fitted to work with a variety of different kinds of stocks.

The pipe cutter shown in one of the views, with engine attachment, is also furnished without such attachment, and of different sizes, to be used with either steam or hand power. The hand machine will cut and thread pipes of ⅛ inch to 2 inches inclusive, while the largest size machine will cut and thread pipes of 2½ to 6 inches diameter.

In the core making, which is shown in one of the sketches, only the most skillful hands can be employed in many of the specialties here produced. Cores are of sand or loam, sometimes also having a little straw or horse dung, and they are so moulded that they may be used as a part of the pattern, and in many cases to enable the pattern to be cast in a two part flask, where a three or four part one would otherwise be required. The core boxes used are of wood and metal, and for many of the goods, have to be made particularly for the work; the long cores are generally strengthened by wires or rods, but they will never bear much handling, and are carefully removed from the boxes and thoroughly dried in an oven for this purpose before using. When but little sand or loam is used in the core the latter is well burned, which consumes the small particles of straw, making them more porous, in consequence of which the castings are sounder, because the cores thus made allow of the free escape of air. In making cores for long pipes a twisted straw rope is first wound around an iron bar; this is then covered with a mixture of loam and horse dung, which is swept into cylindrical form by being revolved against the edge of a board, on which are cut the patterns of any interior rings or changes in size which are to be made in the pipe for each length of a core. This gives a straw core, through which the gases generated by the liquid metal may freely escape. In some cases, also, when the designs are complicated, the cores themselves are made in halves and placed together after being dried.

The core making is, of course, directly dependent on the pattern department, but the latter, as well as the iron foundry and forge shop, which are necessarily leading departments of the business, are not shown in detail in our illustrations.

The brass foundry, which forms the center view on the first page, is a capacious, well lighted, and well ventilated building. The variety of valves, cocks, and fittings cast here includes almost everything known to the trade in this department, and yet a great proportion of the work, though only in small pieces, is such as requires the greatest care and skill.

It is of prime importance in this work that the quality of the brass should be especially adapted to the uses for which the goods are designed, and in this particular the long experience and great variety of goods made by this company have been of great value. It is evident, for instance, that for engine work, and in many of the uses for which brass is required in steam fittings, a much tougher article is called for than in cases where the pressure would be greatly lighter or the wear far less severe. The ordinary commercial brass consists of two parts by weight of copper and one of zinc, though the proportions vary according to the experience of founders and the work in hand. A small percentage of lead is sometimes used, and this diminishes the ductility and increases the hardness, so that it can with greater facility be worked on the lathe. A tough brass for engine work is composed of twenty parts of copper to three of zinc and three of tin; while for heavy bearings a brass is made of thirty-two parts of copper to one of zinc and five of tin. Zinc, which is a good deal cheaper than the other elements, melts more quickly, and, if care be not taken, will burn off more or less before the metal is ready to pour.

The different components of the alloy which it is proposed to make are put together by weight in the crucibles, the furnaces in which the latter are placed are shown in the center. At the sides are the workmen preparing the moulds, and between them and the furnaces are the flasks containing the moulds into which the melted metal is to be poured. The most of the copper used comes from the Lake Superior region, which furnishes the best quality, and many of the alloys made here have stood the test of the severest use in proof of their adaptation to the purposes designed.

The brass finishing room, shown in one of the views, is fitted up with a great variety of improved machinery. There is a great deal of lathe work here, and there are many machines especially adapted for rapid finishing on goods of which the company make large quantities. Here the gauges and gauge cocks are fitted up, and the different styles of lubricators, valves, bibbs, nozzles, and couplings put together. The cutting of V-shaped and square screw threads and threads of varying pitch is also done here, and the assortment of tools with which the shop is provided for this purpose is so large that any demand for an article in common use can immediately be filled, if, indeed, it be not already made up in stock.

The iron valve and fitting room shown in the view at the bottom of the page illustrates the department in which the finishing work on all iron goods is performed. Here the double and single section radiators are set up, and the machine work generally is completed on all goods in either malleable, cast, or wrought iron.

In hydraulic and double extra strong pipe, in wrought iron pipes of many sizes, and in boiler flues, etc., the work done in this establishment covers every variety of goods in which thoroughly good workmanship, a high degree of skill, and the best of materials are indispensable requisites. A bare enumeration of the different articles produced makes an extended catalogue. It includes everything required by the gas-fitter—pipe tongs, vises, and proving pumps, fixtures and fittings; in the goods for steam work are patterns of feed-water heaters, gauges, steam traps, oil cups, and lubricators; in plumbers' tools and materials are the modern heating appliances, traps, water fixtures, etc., plain and plated; besides hose couplings, caps, pipes, and nozzles for fire department, mill, and factory use. It would, of course, be impossible that so extensive a line of goods could be produced except in an establishment which had grown into the business by the natural enlargement of its trade, but the company have kept pace with the growing demands by successive enlargements of the works at Bridgeport through many years, until now they have one of the largest and most completely fitted up factories in this line of industry in the world.

The New York office and warehouse of the company is at No. 58 John street.

The Atmosphere of Celestial Bodies.

M. José J. Landeur communicates an interesting paper to *Les Mondes* on the atmosphere of celestial bodies. Whereas previous investigations have given about 250 miles as the furthest result for the height of the earth's atmosphere, M. Landeur places it at not less than 22,000 miles. He corroborates his calculation by showing that the height at which meteoric matter becomes incandescent on approaching the earth is far beyond the distance heretofore assigned to it, and therefore there must be an atmosphere at that greater distance to produce the incandescence. He also accounts for the spectrum of the aurora borealis, showing a marked coincidence with that of the zodiacal light by the theory that since the earth travels in the zodiacal nebulosity from September to May, the rarefied atmosphere beyond the earth's heavy envelope of air must absorb some of the constituent elements of the zodiacal nebulosity, and thus these elements make their presence apparent in the spectrum of the aurora, which phenomenon occurs in this rarefied outer envelope.

M. Landeur believes also that the difference between the *observed* acceleration of the moon's mean movement and that obtained by *calculation* on any of the previously advanced hypotheses, which is very marked, may be wholly explained by the resistance of this nebulosity in the moon's movement.

The Sense of Colors.

At the recent meeting of the French Association for the Advancement of Science, M. Charpentier, of Nancy, read a paper in which he propounded the somewhat novel theory that the sense of light and that of colors are independent. Since white light is the sum total of the various colors, it has been commonly thought that the sensation of white light was simply the sum total of the sensations of its constituent colors. On the ground that the sensitiveness of the eye for white light may be increased—as, for instance, by the previous absence of all light—without the sensitiveness for color being increased, he urges that there is a color-sense as distinct from that of light as is the sense of touch from the sense of heat.

Correspondence.

Shower of Angular Hailstones.

To the Editor of the Scientific American:

On the 1st of December, 1878, at 0:30 P.M., a remarkable hailstorm passed over Thymbra Farm, on the Plains of Troy, Asia Minor. A gale was blowing at the time from the southward, when a sudden massing of dark clouds flying in various concentric directions was observed. As the clouds passed over the farm there was a heavy discharge of hailstones, for the space of about five minutes, which whitened the ground with an icy covering. The hailstones were above the average size. The remarkable feature, however, was the extraordinary shapes these stones presented, some of which were round or irregular with angular projections, others flattened with but two of these points. Shapeless masses of ice also fell. The stones were whiter at the core than on the external portion. To account for this phenomenon, it may be suggested that the upper portion of the cloud was suddenly converted to snow, which, falling and gyrating in the lower, formed the nucleus around which the vapor was condensed and frozen; while a rotatory motion gave the round form to the body, or added to the spherical nucleus of the snow, the angular portions of the crystals increased in size. The delicate arrangement of the original hexagonal crystals of the snow was destroyed, which explains the various shapes and irregular number of angles in the hailstones. The drawing is made from a sketch taken at the time, which represents the natural size of the hailstones. Violent guests of wind, but no electrical discharge, accompanied the fall.

FRANK CALVERT,
U. S. C. A., Dardanelles.

MECHANICAL INVENTIONS.

An improved coffee pulper and separator has been patented by Mr. Edwin L. Henington, of Santaren, Para, Brazil. The object of this invention is to furnish simple and convenient machines for expeditiously removing and separating the pulp from the berries or kernels of the coffee fruit.

An improved car coupling has been patented by Mr. James Coart, of Harrisburg, Pa. This invention consists in improved means for supporting the coupling devices of a car, and in combining the parts that do the coupling with and uncoupling from the link.

Mr. Franklin H. Lummus, of Brooklyn, N. Y., has patented a cotton condenser, which may discharge the dirt accumulated in the pocket provided for it by being raised out at the bottom.

Mr. William Tucker, of East Toledo, Ohio, has patented

an improvement in that form of coupling in which the bumper is formed with a hooked head and provided with a hinged jaw that engages with the hooked head of the adjoining car.

An improved tool for cutting plate iron has been patented by Mr. William T. Bennett, of Petersburg, Ill. This invention is more particularly intended for cutting pieces from steam boilers in order to insert patches, but it may be used for various other purposes. It consists in a cutting blade and a handle or lever and its fulcrum, and the combination and arrangement thereof with relation to each other, so that by operating the handle the blade will cut or saw the metal.

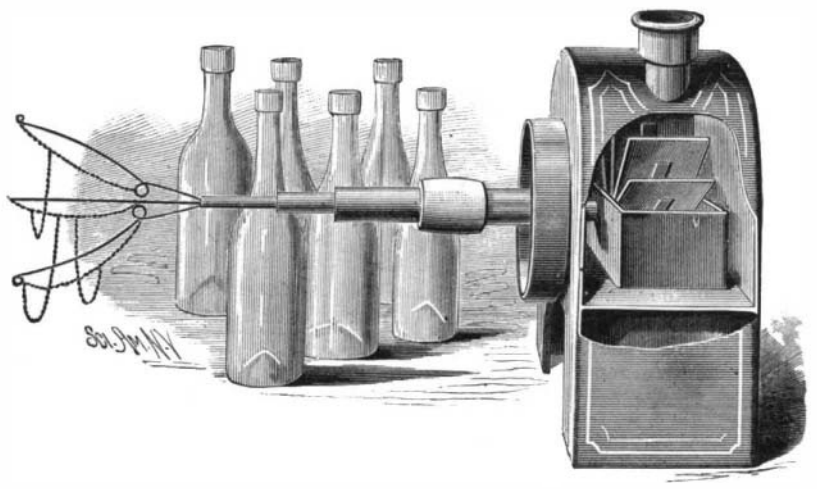
NEW MACHINE FOR WASHING BOTTLES.

The engraving shows a simple machine for washing bottles, lamp chimneys, tumblers, and other similar vessels. It consists of a shaft revolved by a small water wheel propelled by a jet of water from the faucet on the water pipe.

The brush, which is inserted in the bottle or other vessel to be cleaned, may be of any suitable size or form; the illustration shows three wire arms springing outwardly and carrying chains which are thrown against the inner surface of the vessel by centrifugal force.

These chains loosen any adhering matter and agitate the soap and water so that the bottle is rapidly and thoroughly cleansed.

This invention was recently patented by Mr. M. Cody, of Boston, Mass.



MACHINE FOR WASHING BOTTLES.

Bleaching Gutta Percha.

Dissolve the gutta percha in twenty times its weight of boiling benzole, add to the solution plaster of very good quality, and agitate the mixture from time to time. By reposing for two days the plaster is deposited and carries down with it all the impurities of the gutta percha insoluble in benzole. The clear liquid decanted is introduced by small portions at a time into twice its volume of alcohol of 90 per cent, agitating continually. During this operation the gutta percha is precipitated in the state of a pasty mass, perfectly white. The desiccation of the gutta percha thus purified requires several weeks' exposure to the air, but may be accelerated by trituration in a mortar, which liberate moistures which it tends to retain.—*Journal de Pharmacy.*

IMPROVEMENT IN FEEDING AND WATERING LIVE STOCK ON CARS.

The cruel and barbarous treatment to which animals in transit from the West to Eastern markets are frequently subjected is an old and long-standing abuse. It has been clearly stated and denounced for years as shameful, inhuman, and uneconomical, but up to the present time there has been no substantial improvement in the means and methods provided over those of twenty years ago, when the business was begun.

So important has this question become that the American Humane Association has offered a premium of $5,000 for the best device for, and most practicable improvement in, cattle cars.

From the best information at hand the estimated loss on cattle in transit equals 6 per cent, and about 9 per cent on sheep and swine, the greater portion of which loss is chargeable to improper treatment *en route*. The saving of one half of this percentage would amount to an enormous profit to the cattle interest, and would mean as well better and cheaper meat both in this country and in Europe. Of the cattle that live, many, by reason of starvation and cruelties inflicted while in transit, and after, lose nearly a hundred pounds weight from the sweetest and best part of the meat, and come out of the cars full of fever, or with bruises, sores, and ulcers, and these, together with smaller animals, to which the loss and suffering are proportionately great, are all sold in our market for food.

If there were no other side to this question than that which pertains to the "profit and loss account" of the business ledger, we might be content to leave the subject here, letting those whose economical interests are involved discover the remedy. Such, however, is not the case, for it has become well settled through our Boards of Health at the commercial centers, societies of social science, and veterinary experts, that a large portion of the meats offered for sale in our markets is diseased and unfit for consumption, which condition is very largely attributable to the improper and unnatural treatment of live stock during the time of shipment from the West to the East. We can, therefore, only hope for healthy meats for consumption, as a general rule, when live stock are cared for in transit as they should be.

From these facts it appears that cruelty to animals in transportation avenges itself upon the consumer, and that we shall never be secure against disease from eating poisonous meats until animals are properly fed and watered and thus brought in good health to the shambles. This can readily be done without materially adding to the expense of transportation, and with increased profit to all concerned, by adopting the cheap, effectual, and practical method shown in the engraving, which are devices recently perfected by Mr. A. D. Tingley, of this city, and are now owned by the Union Live Stock Feeding Company, of 27 Union Square, and are indorsed by the "Farmers' Club" and Mr. Henry Bergh, of this city. The Feeding Company are negotiating with the trunk railroad lines of this country for the early erection and operation of these feeding stations.

There is, therefore, an urgent need for the introduction of some plan by which the needless suffering of these dumb creatures in transit may be lessened. It has been fully demonstrated by actual tests that, by feeding and watering live stock regularly every twelve hours between St. Louis or Chicago and New York, 50 pounds and upward in shrinkage was saved to each head of cattle, and the condition of the meat materially improved. The following is a moderate estimate of saving to the shipper with eight feeding and watering stations between St. Louis and New York:

Allowing 16 cattle to each car, and a saving in shrinkage of 50 lb. per head, or 800 lb. per car, worth 8 cents per lb., we have a total saving to the shipper on each car load	$64·00
Deduct cost of feeding and watering at 20 cents per head at each station	$25.60
Net saving to the shipper on each car load	$38.40

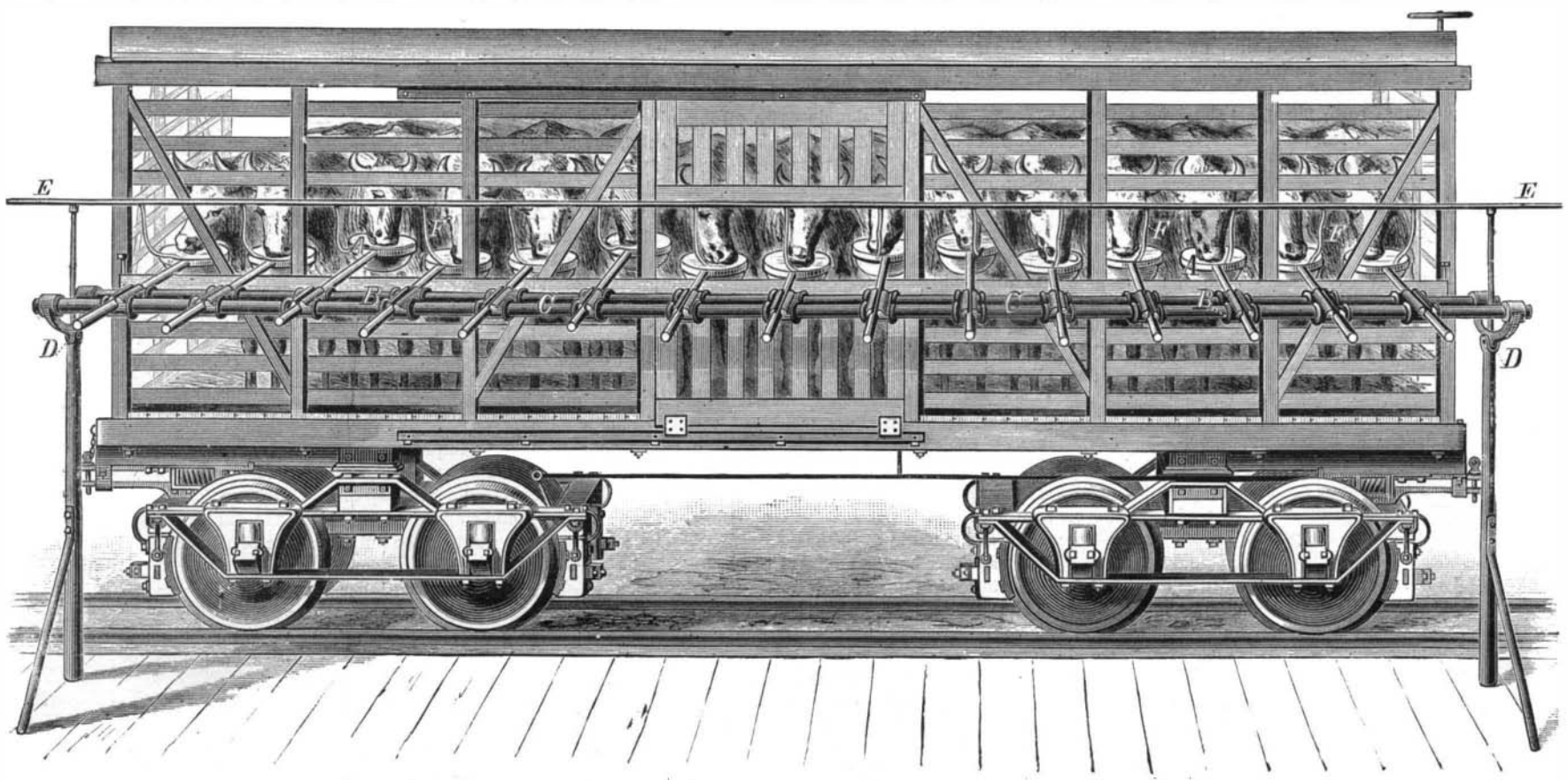
By official reports there were received and shipped at the two cities of St. Louis and Chicago alone, during the year 1879, 14,024,172 head of live stock, and the adoption and use of these devices would save millions of dollars annually to this industry, and at the small charge of five cents per head for the devices which effect this large saving, would bring the Union Live Stock Company an annual net income of over $700,000, besides the great beneficial results to beef consumers. It is a simple device for feeding and watering, entirely separate from the cars, and is erected about twelve hours' run apart, at suitable stopping places along the track on both sides of the car. Its construction and use will appear from the following description, reference being had to letters in the engraving.

A represents a series of feed boxes, with handles which slide back and forth in socket, B, and allow the feed boxes to be pushed in and out of the car as desired. The sockets or supports, B, of the feed boxes (through which the handles slide) slide sideways on the rods, C, giving a lateral movement to the feed boxes to avoid posts and braces when the boxes are pushed into the car. D is a joint or hinge in the upright posts, which gives a slight rocking motion to the horizontal part of the framework, allowing the feed boxes to be slightly raised or lowered. E is the main water pipe, and F represents small leaders from the main water pipe, to each separate feed box. It is designed to build a row of these on both sides of the track, and thus get at the heads of the stock, wherever they are. The only alteration required to be made in the stock cars now in use is to loosen one board on each side of the car, head high, and support it on hinges and hooks, so that it may, by lowering, provide an opening for the feed boxes.

This arrangement not only provides in a simple and inexpensive manner for the comfort of the stock, but permits of their transportation with greater dispatch, since it avoids the labor and delay of unloading.

Unfit for Human Food.

At the regular session of the Health Board yesterday, Dr. Ewing, executive officer of the Night Medical Service, reported that during the month of October thirty-eight persons had been treated by twenty-five physicians. Assistant Sanitary Superintendent Dr. Janes informs the Commissioners that on the 11th inst. he visited two slaughter houses on First avenue and seized several quarters of beef which was unfit to eat. In closing his communication Dr. Janes stated that he understood that the cattle were weak and sickly before being killed, and that the butchers were in the habit of selling the meat to Bologna sausage makers for two or three cents a pound. A committee of the leading cattle slaughterers in this city asked the Board to appoint a veterinary surgeon as an inspector of cattle and slaughter houses. —*New York Daily Herald, Nov.* 17.



LIVE STOCK FEEDING AND WATERING APPARATUS FOR RAILWAY CARS.