paramount importance, and that can be secured and controlled irrespective of climate or seasons. The process is used on a large scale by:

Armour & Co., Union Stock Yards, Chicago, Ill. (50 tons); New Orleans Refrigeration and Manufacturing Company; Rohe & Bro., New York; Roth, Meyer & Co., Cincinnati, O.; A. Merkle, Zanesville, O.; Charles Lang & Co., Covington, Ky.; Henderson Coal and Mining Company, Henderson, Ky.; J. O. Powlis, Louisville, Ky. (25 tons per diem); Brenham Ice Company, Brenham, Texas; Rio Grande Ice Company, Brownsville, Texas; C. H. Lawrence & Co., New Orleans, La.; Huse, Loomis & Co., St. Louis, Mo.; Z. Wainwright & Co., Pittsburg, Pa.; Reymann Brewing Company, Wheeling, W. Va.; Russell H. Nevins, Lake Maitland, Fla.; S. H. Macrae, Granada, Nicaragua, C. A.; Rubsam & Horrmann, Staten Island, N. Y.; Peter Harley, Puenta Arenas, Costa Rica; L. Bon, Santiago, Cuba; and many others.

Anhydrous ammonia is also used, and vaporized and condensed by mechanical action of a pump upon the same principle as in the Pictet machine. But the resistance which ammonia offers to condensation is much greater than that by anhydrous sulphurous oxide, in round numbers about 600 per cent greater. For if we take a pump of say 11 inches in diameter, having a superficial area of 95 square inches, and multiply this by the Pictet pressure of 35 pounds per square inch, we have a resistance to be overcome at each stroke of the piston of 3,325 pounds, whereas if ammonia were used in this same sized cylinder with its pressure of 200 pounds the resistance would be 19,000 pounds to be overcome at each stroke of the piston. One great advantage in the use of anhydrous sulphurous oxide is that the machines using it can be built of any metal, as this gas has no effect upon any.

The Pictet machines, with the exception of the pump and engine, are built entirely of copper and are practically indestructible. Ammonia corrodes all metals, though it has less effect upon wrought iron than other metals. In a short time it will, owing to its high pressures, actually "honeycomb" cast iron plates an inch in thickness.

Furthermore, iron being used throughout, the entire apparatus, with the exception of the pump and engine, is exposed to water, the condenser to fresh water and the refrigerator to salt water, and so the more or less rapid oxidation finally destroys the machine.

Another serious trouble arises in the machines using anhydrous ammonia from the necessity of oiling the gas pumps.

The oil combining with the ammonia forms a stiff soap, and this is carried into all parts of the apparatus, and soon chokes up the tubes of both refrigerator and condenser, necessitating the frequent stoppage of the machine for the purpose of taking it apart to cleanse the pipes.

This amounts almost to a rebuilding of the apparatus, takes a long time, and often becomes necessary during hot weather, causing a stoppage of the machine of several days' duration, when its work is most needed. Anhydrous sulphurous oxide being a lubricant in itself, the pump of the Pictet machine is never oiled, and consequently it never becomes necessary to cleanse the interior of the machine.

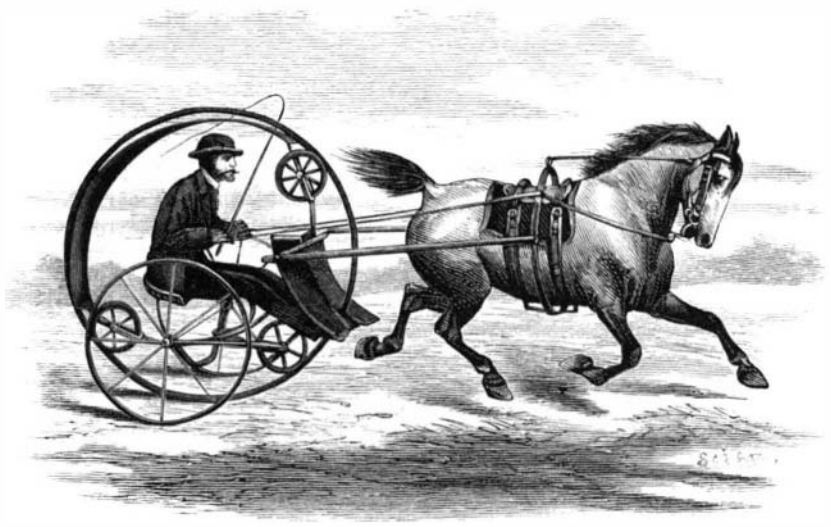
An ice making machine of 1½ tons capacity can be seen in operation at the warerooms of the Pictet Artificial Ice Company, Limited, 142 Greenwich street, New York. A personal examination of this machine gives a very good insight, not only into the Pictet system, but also into the process and *modus operandi* of the machinery, which is exceedingly simple, economical, and efficient. The company build ice making machines of different capacities varying from 1,200 pounds to 25 tons of ice in twenty-four hours; also air cooling machines especially constructed for cooling breweries, pork packing establishments, cold storage warehouses, hospitals, etc.

Further information may be had on application to the company whose address is given above, and whose advertisement may be found in another part of this paper.

THE new ship canal which is to connect the Baltic and the North Sea will save nearly 600 miles of the water journey now made around the Danish peninsula. The cut, as proposed, will be from Gluckstadt to Kiel, and the length will be about half that of the Suez Canal, or some fifty miles.

NOVEL ROAD VEHICLE.

The vehicle represented in the annexed engraving is a very novel and ingenious contrivance, as the reader will observe. Whether the invention is as useful as it is novel, is a matter of considerable doubt. It consists of a ring within which the seat of the rider is supported by a frame provided with three or more small grooved wheels resting against and running on the inner edge of the ring. The frame is provided with an axle carrying a balancing or staying wheel at each end, and with a mud guard and thills to which two hinged rings, provided with a saddle, are attached for hitching the horse to the thills. The vehicle is made entirely of iron, and is balanced by the side wheels and the thills. If the road is very narrow, the side wheels can be dispensed with. The vehicle is specially adapted for country roads and for the use of mail carriers, sportsmen, etc., it is claimed by the inventor, Mr. F. von Grubinski.—*Neueste Erfindungen und Erfahrungen.*



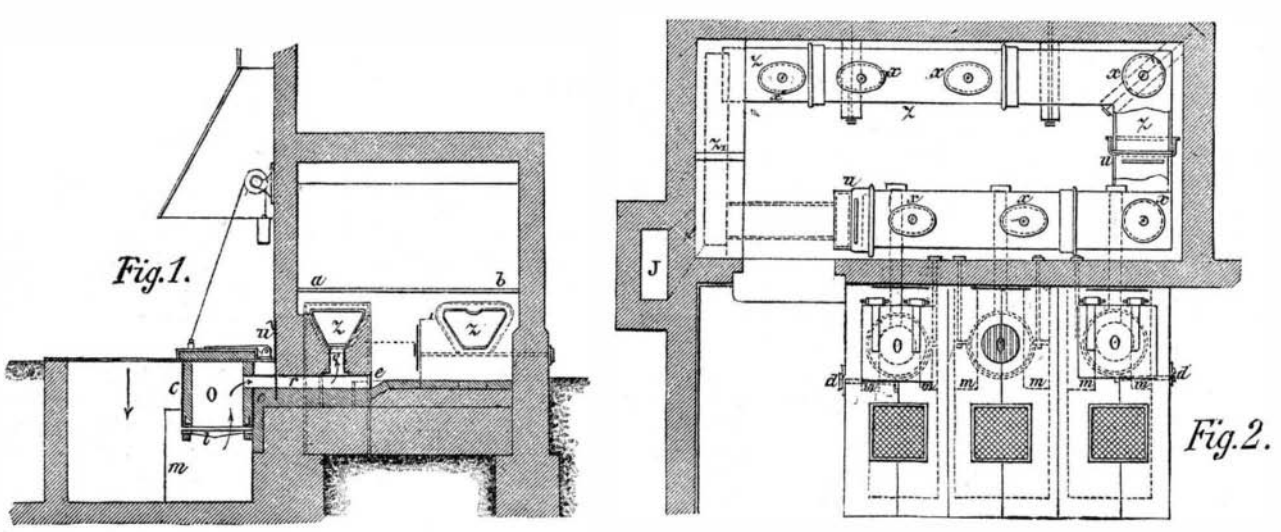
NOVEL ROAD VEHICLE.

OBERSTADT'S MELTING FURNACE WITH DRYING CHAMBER.

Generally, small furnaces in which metals are melted in the crucible are united closely to a chimney; and often there is added to the melting furnace a drying chamber for cores and small moulding frames, although it seems preferable to separate the drier from the furnace, since the long flat channels of these driers become easily choked up with ashes, and respond only imperfectly to the end in view.

The inconveniences attending the ordinary arrangement of these apparatus appear to be entirely got rid of in the furnace shown in Figs. 1 and 2, and described by Mr. Oberstadt in his work entitled "Die Technologie von Eisenbahnwerkstätten." Cast iron boxes constitute here heating flues which may be easily cleaned and freed from ashes, and which serve at the same time as tables for the frames to be dried.

The furnace consists of wrought iron cylinders, *c*, provided at their lower extremity with angle iron rings, upon which is arranged an inner lining of refractory bricks. The fireplaces rest on walls, *m*, which are also lined with firebricks, and are anchored by the rods, *d*, and carry the grates, *l*. Channels, *r*, with register at *e*, for convenience of cleaning, lead the gases due to combustion through small tnbulures, *o*, into the horizontal iron smoke conduits, *z*, and from thence into the chimney, J. The upper wall of these conduits is arranged so that it may serve as a table for the cores and frames to be dried. The cleaning of the conduits, *z*, is effected through the apertures, *x*, which may be closed by covers. The extremity of these conduits are connected by a channel, z^1, which is covered by two cast iron plates, *a* and *b*, placed one alongside of the other, and which are likewise utilized as drying tables. Registers, *u*, permit of regulating the direction of the hot gases, and, consequently, the temperature of the drier.



MELTING FURNACE WITH DRYING CHAMBER.

Mother-of-Pearl.

This beautiful material, which is so much used in many kinds of artistic productions, is chiefly obtained from the pearl oysters (*Meleagrina margaritifera*) which are found in the Gulf of California, at Panama and Colagua, at Ceylon and Madagascar, at the Swan River in Manila, and at the Society Islands. The black lipped mussels from Manila bring the best prices. The Society Islands produce the silver lipped mussels, and Panama the so-called "Bullacks."

The peculiar and varied tints and colors exhibited by mother-of-pearl are due to the structure of the surface, which is covered with innumerable fine plates—often several thousand to the inch—which break up the rays of light falling on it, and reflect it in all different tints. The oyster pearl has a lamellar structure, and can actually be split off in scales, but they are very rarely divided in this way, as there is always danger of destroying it. In working mother-of-pearl, says Wieck's *Illustrated Art Journal*, the saw, file, and polishing stone play the principal parts. A mussel shell is selected that is covered with the peculiar pearly substance to such a thickness as is necessary for the work in hand.

The square or angular pieces are sawed out with a small saw, the piece being held in the hand or clamped in a vise. Buttons and similar round pieces are cut with a crown saw attached to a spindle. All the tools employed in working mother-of-pearl must be kept continually moist to prevent their sticking fast. The pieces are generally shaped on a polishing stone, the rim of which must be ribbed to avoid daubing and smearing. The stone, of course, must be kept wet while in use; a weak soapsuds works better than water alone. When the pieces have been brought to the proper shape on the stone, they are then polished with pumice and water. In many cases it is well to shape the piece of pumice so as to fit the form of the article to be polished, and then the latter can be fastened to a handle and rotated in a lathe. It is afterward polished with finely powdered pumice on a cork or wet rag, while the final polishing is done with English tripoli, moistened with dilute sulphuric acid. The acid brings out the structure of the pearl very beautifully. In many articles it is necessary to use emery before the tripoli is applied, and then employ oil instead of acid. Knife and razor handles have the holes bored in them after they are cut in the proper shape, and are then lightly riveted together, polished on the stone, and finished as before described.

In many workshops the polishing is performed on wheels covered with a wet cloth which holds the polishing material. For common work some pulverized chalk or Spanish white is substituted for the English tripoli.

Mother-of-pearl is frequently etched like copper. The design is put on with asphalt varnish, which protects the parts that are not to be etched, and the piece is then put in nitric acid. When the exposed portions have been sufficiently corroded by the acid, the article is rinsed with water, and the varnish dissolved off with turpentine or benzole.

Thin pieces of pearl which are to have the same shape are glued together, and all cut and bored at once like a single piece, and afterward separated by putting them in hot water.

In ordinary inlaid work of mother-of-pearl, scales or very thin pieces of pearl are fastened on iron or some foundation, usually made of papier mache, with Japanese varnish. The plate is first cleansed and dried, then coated with varnish; when the latter is nearly dry, cut pieces of mother-of-pearl are pressed into the varnish by the artist so as to adhere to it. The plate is then baked in an oven until the varnish hardens, when a second coating is put over the entire article, which is then polished again.

Besides the white and aurora-like mussels above mentioned, the sparkling green snail shells sometimes find use; these exhibit dark or light tints of green, yellow, or pink, or one shade passing into another.—*Deutsche Industrie Zeitung.*

MR. WAKE, engineer of the River Wear Commissioners, and Mr. Irish, manager of the Northern District Telephone Company, in England, have made some interesting experiments in the use of the telephone by divers. The length of the cable connecting the receiver in the diver's helmet with the transmitter above water was 600 yards. It was found that the diver could converse with ease, and ask for tools in any position in which his work might require him to place himself.

Hydrogen Peroxide.

MM. Paul Bert and P. Regnard have studied the action of hydrogen peroxide upon various forms of organic matter and upon fermentations, and find that it possesses very remarkable antiseptic properties. All fermentation due to an organized ferment is immediately and definitely arrested by hydrogen peroxide, the ferment is killed, and even after the removal of the hydrogen peroxide by one of the substances which destroys it most rapidly, the fermentation does not recommence. The yeast of beer is in this manner killed instantly, although it possesses itself the property of decomposing hydrogen peroxide. Specimens of wine, urine, and milk, each containing a few drops of hydrogen peroxide, have been exposed for several months in open vessels without exhibiting the least sign of alteration, while other specimens of the same identical liquids, without the addition of hydrogen peroxide, placed beside them, were in a state of complete decomposition. Although organized ferments are destroyed by hydrogen peroxide, soluble ferments do not seem to be affected by it, saliva, diastase, the gastric and pancreatic fluids continue to act in solutions containing hydrogen peroxide. MM. Bert and Regnard have also studied the action of hydrogen peroxide upon various organic materials, including the albuminoid substances and all the tissues composing the animal body in a healthy or pathological state. The results of their investigations may be summed up as follows:

1. Hydrogen peroxide, even when very dilute, arrests fermentations due to the development of living organisms, and the putrefaction of all substances which do not decompose it.

2. It has no effect upon diastase fermentations.

3. Dilute hydrogen peroxide is not destroyed by fats, starches, soluble ferments, egg albumen, casein, the peptones, creatine, creatinine, or urea.

4. It is rapidly destroyed by nitrogenous collagens, by musculin, fibrin of the blood, and various nitrogenous vegetable matters.

5. This action is definitely arrested by a temperature above 70°. Putrefaction, however, leaves it entirely intact.

As it appeared from the powerful antiseptic properties of hydrogen peroxide that it might prove of value in surgery, experiments were made upon the point by MM. Péan and Baldy at the hospital of St. Louis, with very successful results.

The hydrogen peroxide, in solutions containing from two to six times its volume of oxygen, according to the circumstances of the case, was used, both externally, as a dressing for wounds, ulcers, etc., and also given internally in certain affections, in doses of from three to five grains, containing six times its volume of oxygen. As a result of their experiments, MM. Pean and Baldy consider themselves justified in stating:

1. Hydrogen peroxide containing, according to circumstances, from two to six times its volume of oxygen, appears to be capable of advantageously replacing alcohol and carbolic acid.

2. It can be employed, externally, for the dressing of wounds and ulcerations of all natures, in injections and in vaporizations, and internally.

3. The results obtained, even in the case of the largest operations, are, up to the present, in the highest degree satisfactory. Not only fresh wounds, but also old ones, proceed rapidly to cicatrization, and reunion by first intention of amputation wounds appears to be encouraged by this mode of dressing.

4. The general as well as the local state appears to be favorably influenced.

5. The advantages of hydrogen peroxide over carbolized water are its not having any poisonous effect nor unpleasant odor, while its application is entirely painless.

M. Bert calls attention to the fact that hydrogen peroxide for surgical use must be entirely neutral, while that obtained from the greater number of dealers in chemicals frequently contains a considerable quantity of sulphuric acid, so that its use would not be without danger.—*Comptes Rendus.*

Alleged Human Footprints in Tennessee Rocks.

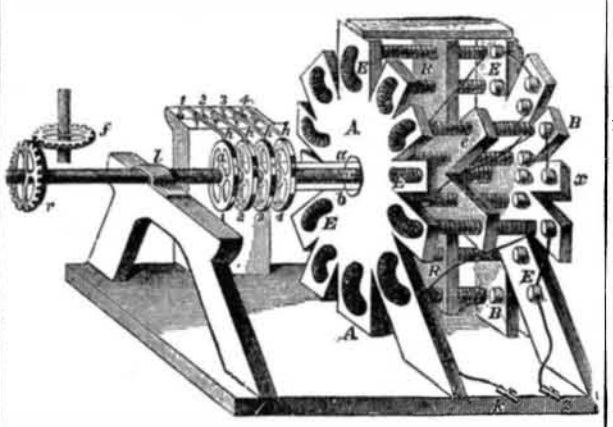
A correspondent of the Nashville *American* tells of some curious footprints in sandrock at a place about twenty miles west of Nashville. "At this point Harpeth River forms a horseshoe bend, making a circuit of six miles, and doubling back on itself to within 80 or 90 yards. In the heel of the shoe rises a ridge, forming almost a perpendicular bluff on both sides, extending about half a mile south in the direction of the toe of the shoe. It rises to the height of about 400 feet, and at the highest point is not more than eight feet wide on the top, with a perpendicular face on the east side for 100 feet or more—that is, a plumb line suspended from the edge of the precipice at the top would hang clear for 100 feet or more before it would encounter any obstruction. The ridge at the bed of the river is some 90 yards wide, but the slope which brings it to that width at the bottom is mostly on the western side.

"At the highest point on the crest of this ridge is a flat surface rock, and on that rock are imprinted six and a half tracks of human feet. These tracks are indented into the rock as much as a quarter of an inch, or in some places more. The tracks are of bare feet, toes all pointing in the same direction—toward the east. Most of the tracks are as perfect as if they had been imprinted on moist sand or earth. They are in three pairs. The first or largest pair is furthest north. They are less than the average size man's foot, and larger than the average size woman's foot, one a little in advance of the other. The next pair is on the south side, but near to the first. In size and appearance they represent the tracks of a child fifteen or eighteen months old. The track of the right foot of this pair is turned in a little at the toes, and the toes of that foot are turned down, as we often see children, when first learning to walk, seem to endeavor to clutch the floor with their toes, as if to avoid falling or slipping. The topographical relation of these tracks to the large ones indicates that the child might have been holding to the finger or hand of the larger person.

"South of these little tracks, but near to them, is the third pair, indicating a child some four to six years old. These last were made by a beautiful pair of feet, and are as pretty tracks as a child ever made in the dust or soft earth. All of these tracks are within three or four feet of the edge of the precipice on the eastern side, as already described. But I have said there was a half track, which is the most interesting feature on the tablet. This half track is printed on the very edge of the precipice, and represents the heel and hinder half of the foot from the middle of the instep back, and would indicate that the toes and front part of the foot projected over the precipice, or that the rock had broken off at that point. This half track is of the large size foot, or foot of the adult person, and is immediately in front of the large pair of tracks already mentioned."

THE FIRST ELECTRIC BOAT.

The idea of propelling a boat through water by the motive power of electricity is no new one. The invention of the electro-magnet showed the power of an electric current to produce a mechanical force. It was no very difficult matter, therefore, for the electricians of fifty years ago to utilize the force of the electro-magnet to drive small electro-magnetic engines; and from the small beginnings of Dal Negro, Henry, Ritchie, and Page grew up a group of electric motors which only awaited a cheap production of electric currents to become valuable labor-saving appliances. Nor was it a very long stride to foresee that if a sufficiently powerful battery could be accommodated on board a boat, it might be possible to propel a vessel with electro-magnetic engines



THE ENGINE OF JACOBI'S ELECTRIC BOAT, 1838.

drawing their supply of currents from the batteries. This suggestion—one of the earliest, indeed, of the many applications of the electro-magnet—was made by Prof. Jacobi of St. Petersburg, who, in 1838, constructed an electric boat. Fig. 1 which we here reproduce, says *Nature*, from Hessler's "Lehrbuch der Technischen Physik," represents the rude electro-magnetic motor or engine which Jacobi devised for the driving of his boat. Two series of electro-magnets of horse-shoe form were fixed upon substantial wooden frames, and between them, centered upon a shaft which was connected to the paddle-wheels, rotated a third frame, carrying a set of straight electro-magnets. By means of a commutator made of notched copper wheels, which changed the direction of the current at appropriate intervals, the moving electro-magnets were first attracted toward the opposing poles, and then, as they neared them, were caused to be repelled past, so providing a means of keeping up a continuous rotation. This machine was worked at first by a Daniell's battery of 320 couples, containing plates of zinc and copper, 36 square inches each, and excited by a charge of sulphuric acid and sulphate of copper. The speed attained with this battery did not reach so much as 1¼ miles per hour. But in the following year, 1839, the improvement was made of substituting sixty-four Grove cells, in each of which the platinum plates were 36 square inches in area. The boat, which was about 28 feet long, 7½ broad, and not quite 3 feet in depth, was propelled, with a convoy of fourteen persons, along the river Neva, at a speed of 2¼ (English) miles per hour.

Hods: Their Construction and Use.

Hods are of two kinds. One form of hod is devised for carrying bricks, and the other for the transportation of mortar. While differing somewhat in purpose and balance, the two species of hod are yet so closely allied as to be utterly indistinguishable when apart. Indeed, it is a matter of grave interest to men that during the whirl of centuries, when every other inanimate thing has, through the indomitable perseverance of invention, been forced through a process of evolution that has robbed it of almost every semblance of its pristine nature, the hod remains to-day in structure, substance, and design exactly as the hod originally was. At present hods are cheap. Eighty-four cents will purchase one. The craze for all that is æsthetic, early English, Japanese, Etruscan, or antique has passed by the hod unchallenged. The early Irish hod still reigns supreme.

The dimensions of a mortar hod are as follows: Length of bowl, 22⅜ inches; mean depth of bowl, 9½ inches; greatest width of bowl, 9¼ inches; height of back piece, 12⅜ inches; width of pieces forming lateral sections of bowl, 11½ inches. The dimensions of a brick hod, it will be seen, are different. They are as follows: Length of bowl, 23⅜ inches; mean depth of bowl, 8 inches; greatest width of bowl, 8½ inches; height of back piece, 10¼ inches; width of pieces forming lateral sections of bowl, 8⅜ inches. It is generally conceded that the mortar hod is built larger than the brick hod so as to make the weight when both are loaded as nearly equal as possible.

The shank or handle is 4 feet 2½ inches for each species of hod, and the shoulder rest is always 9 inches long, 3 inches wide, and 1¼ inches thick. This shoulder rest is attached to the inverted ridge pole of the hod, and prevents the edge from cutting into the shoulder of the proprietor.

Touching the materials used in hod building, it may be said that the earliest ideas still obtain. Iron hods have been tried, but abandoned, because they were liable to rust and to become cracked when dropped six or seven stories by proprietors, who invariably and instantly relinquish all ideas and implements of labor at the stroke of 12 and of 6. The verdict of ages is that the bowl of the hod shall be of yellow pine, and the shank a hickory pole with the bark on. In constructing a hod, it is found necessary to use thirty-three nails for the brick species, and twenty-nine nails and four screws for the kind intended for mortar. The screws are used in the latter instance to fasten the two arms of the shank to the bowl, because screws do not leave holes, as do nails when they become loosened. Small holes allow mortar to escape, and are therefore open to objections. In making the bowl of a hod, eightpenny nails are used; fourpenny nails answer best for the shoulder rest, and shingle nails for securing a narrow strip of sheet iron that runs over the top of the back piece of the bowl for the purpose of imparting additional strength. All of the nails are machine made, with the exception of those used in fastening the shank to the bowl, which are hand made and highly malleable. The mortar hod, besides having four screws, is lined at the seams with white lead. It has been considered somewhat superior to the brick hod. The weight of hods one hour after completion is ascertained to be exactly as follows: Brick hod, 9 pounds 6 ounces; mortar hod, 10 pounds 3 ounces. Fifteen bricks are carried in the common hod.

There is a widespread impression that the shank of a hod is steamed after being split into the V-shape necessary to accommodate the bowl. This is erroneous. The shank, after being slit for a distance of 7⅝ inches, is violently forced asunder by pressure against the wedge-like base of the bowl, and is secured while in that position.

Very many hods are owned privately, and many thousands more are owned by a large company up town, which makes hods and rents them to builders along with its patent hod elevators. The introduction of hod elevators, oddly enough, met with no opposition from individual proprietors of hods, but, on the contrary, was warmly welcomed by them. The elevators do the work of many men, but as building has increased in a satisfactory ratio, there has always been enough work for men who decided to adopt the hod as a means of advancement or sustenance. Indeed, so well have the individual hod proprietors in question adapted themselves to the existing state of things, that they absolutely refuse to climb higher than the second story now, and builders must, perforce, employ the elevators for stories of a loftier pitch.

At no time in the annals of the city has the hod industry been at a higher tide of prosperity. Thus the outlook for the hod is as bright as its history has been unvarying.—*New York Sun.*

The Digestibility of Oysters.

Why oysters should be eaten raw is explained by Dr. William Roberts in his lecture on "Digestion." He says that the general practice of eating the oyster raw is evidence that the popular judgment upon matters of diet is usually trustworthy. The fawn colored mass, which is the delicious portion of the fish, is its liver, and is simply a mass of glycogen. Associated with the glycogen, but withheld from actual contact with it during life, is its appropriate digestive ferment—the hepatic diastase. The mere crushing of the oyster between the teeth brings these two bodies together, and the glycogen is at once digested without any other help than the diastase. The raw, or merely warmed, oyster is self-digestive. But the advantage of this provision is wholly lost by cooking; for the heat immediately destroys the associated ferment, and a cooked oyster has to be digested, like any other food, by the eater's own digestive powers.

"My dear sir, do you want to ruin your digestion?" asked Professor Houghton of Trinity College one day of a friend who had ordered brandy and water with his oysters in a Dublin restaurant.

Then he sent for a glass of brandy and a glass of Guinness's XX, and put an oyster in each. In a very short time there lay in the bottom of the glass of brandy a tough, leathery substance resembling the finger of a kid glove, while in the porter there was hardly a trace of the oyster to be found.