part of vessel, A, by tube, E, rises, and attacks the iron. The hydrogen produced escapes by the tube, G. The sulphate of iron in solution runs off by the U-tube, H, and is diverted by the conduits, L L, into a large vat, M. The water as it enters raises, by its effervescence, the iron turnings, and it is said that the elements of the reaction are so constantly in such intimate contact that the production of gas, for equal weight of substances, is thirty times greater than in the ordinary apparatus. The vessel, A, is lined with thick sheets of lead.

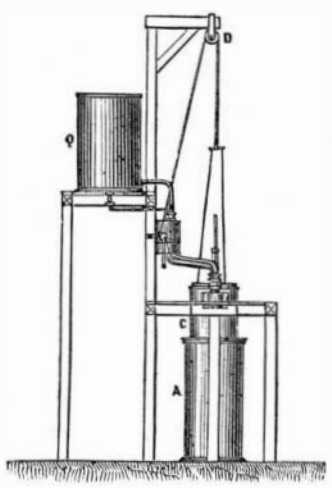


Fig. 4.—Lateral Section of Apparatus, Fig. 2.

The sulphuric acid, before being mingled with the water, is placed in a reservoir, O. A pump, P, raises it into an upper basin, Q, where a float constantly shows the level. A lower tube, having a gilded valve (so that the acid will not attack the metal), leads the acid into a tank, *b*. Water is similarly led to the tank, *b'*. Two floats automatically check the flow of the liquids when a certain level is reached. If the water supply fails, the float in the water vessel lowering, acts by a rod on the acid float and determines the closing of the supply tube for the acid, Fig. 5, so that the entire apparatus works automatically and regularly.

The acid passes from the vessel, *b*, into the vessel, *c*, and the water into *c'*. The flow may be regulated by screw valves. The vessels, *c* and *c'*, have underneath an adjutage of invariable section. By regulating the flow of the liquids in the vessels so that their level remains constant, it is rendered certain that the outflow by the lower adjutage is perfectly regular, Figs. 2 and 5. The water and acid next pass into the cylinder, E, by the U-tubes shown. In this cylinder are shelves over which the liquids fall, thus becoming intimately mingled. Finally, the diluted acid reaches the reservoir, A. At *m m'* are manometers which register the pressure in A and the frictional resistance determined by the flow of the liquid in the tube, E.

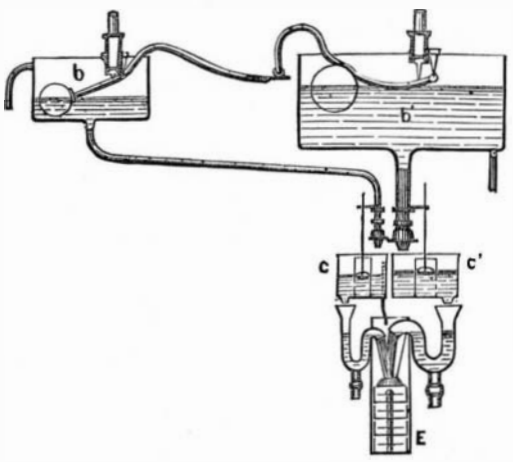


Fig. 5.—Detail of Vessels, *b* and *b'* and the Water and Acid Measurers, *c* and *c'*, Fig. 2.

The hydrogen formed escapes by G, and goes to the washer, R, thence to the dessicator, S, in which quicklime is placed and thence to the refrigerant, T, circulating in a continuous tube cooled by a current of cold water. Finally, by the pipe, Y, the gas reaches the bell glass, V, where there is a new and ingenious arrangement for measuring the supply. It consists of a large copper tube disposed vertically, and in which there is a thin lateral slit. This tube carries a hollow cylindrical valve, S, Fig. 6, which slides up and down without friction. When the gas enters the tube it lifts the valve and escapes by the lateral slit, and raises the valve the more as the disengagement is the more abundant. The height of slit opened is the direct measure of the supply. In the same vessel, V, are placed apparatus for showing the dryness, temperature and acidity of the gas. The liquid resulting from the reaction is saturated with sulphate of iron, which is allowed to crystallize and is sold. Deducting the value of this, the total cost of producing the hydrogen—which is reported to be as pure as it possibly can be made by any industrial process—is about $2 a thousand feet, or about the retail price of illuminating gas in Paris. M. Giffard intends to use the last described apparatus for the generation of the 650,000 cubic feet of hydrogen necessary for the inflation of the immense captive balloon which he proposes to exhibit at the Paris Exposition of 1878.

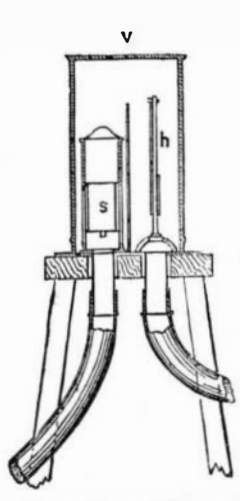


Fig. 6.—Detail of Vessel V, in Fig. 2.

Albuminoids in Foods.

We have already drawn attention, says the *Madras Times*, to the fact that many of the elaborate dietaries that have been drawn up, both in this country and at home, are unreliable, being based on unsound data. We pointed out that, under the method usually followed in determining the percentage of albuminoids, or flesh-formers, *i. e.*, food, it is usual to multiply the percentage of nitrogen found by 6·33, it being assumed that the whole of the nitrogen existed in the form of albuminoids. However, Professor Church, of the Royal Agricultural College, recently showed that this assumption is altogether incorrect—at any rate, as regards many vegetable productions, much of the nitrogen found being in the form of salts that possess no food value. Hence the albuminoids, in analyses calculated by the old method, are stated too high. As the percentage of albuminoids found in a food determines the value, or otherwise, of that food, it will be seen how serious is the error brought to notice. Professor Church appears to have made further investigation, and has discovered, as the following extract shows, some very serious differences in the percentage of albuminoids of certain garden products as determined by the old and new methods. It appears that in many of these products the albuminoids are only about one half what they were supposed to be. Even in grain, the albuminoids are greatly overestimated by the old method. It must be very gratifying to Dr. Lyon and others to find that their elaborate dietaries are altogether worthless. What a use Sir Richard Temple might have made of the facts we have disclosed, had they been shown to him!

Professor Church, in addressing the Cirencester Chamber of Commerce, recently said:

"It will, perhaps, be remembered by some members present to-day, that two years ago (December 5, 1875), in my annual report to this Chamber, I touched upon some experiments which had been carried out in my laboratory in order to ascertain the true feeding value of roots. These results were sufficiently startling, but they have since been amply confirmed by German chemists. The chief conclusion which must be drawn from them is this—that the flesh-forming values of many roots, and even of some other vegetable products, has been hitherto greatly overestimated by the ordinary process of analysis. The subject cannot be adequately discussed on the present occasion, but the annexed table will convey some notice of the differences between the old and new results:

Percentage of flesh-formers (albuminoids) in various farm and garden products, according to

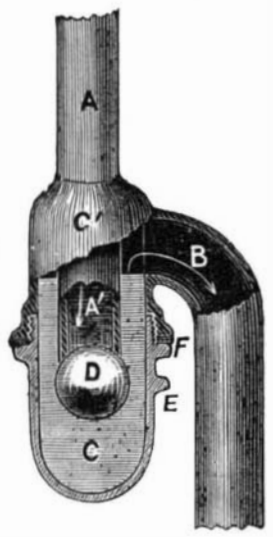
	New Method.	Old Method.
Potatoes	·95	1·83
Carrots	·55	·98
Lettuce	·71	1·53
Orange globe mangels	·48	·90
Cattle beet	·63	1·42
Yellow globe mangels	·59	1·33
Golden tankard mangels	·57	1·51
Long red mangels	·51	1·08
Pearl barley	5·73	6·22
Haricot beans	18·72	22·47

The New Coffee.

We understand that persons interested in the extension of Liberian coffee cultivation contemplate sending out supplies of seed to the different coffee-growing countries, but from what we can learn there is only disappointment in store for them. Liberian coffee can be easily raised from seed at its place of growth, but its culture from imported seed experience has proved to be very precarious, only a small percentage of the seed germinating as a general rule. Mr. William Bull, of Chelsea, who has done much to bring this new and promising variety of coffee into notice, informs us that he has examined thousands of seeds on their arrival from the west coast of Africa, but he found that their embryos had perished. To the botanical student this may perhaps appear a curious fact, but it is not to be disregarded by those who are engaged in coffee planting. The *Coffea Liberica* is so robust, prolific, and altogether so important from a commercial point of view that it would be a pity if its cultivation were retarded by fruitless attempts to raise it from seed. Undoubtedly its introduction is likely to prove most successful where the young seedling plants are imported, and their transmission can be safely effected in plant cases specially designed for the purpose. Mr. Bull's case is employed with success. The plants are kept in boxes and pots, which are fixed in the cases with battens, so that when they arrive at their destination they can be taken out from the cases and transplanted without receiving any check. By this means the Liberian coffee has been sent in large quantities to the East Indies, Brazils, Java, etc., and in Ceylon alone thousands of acres will shortly be under cultivation. Favorable reports have been received from most places where its experimental culture has been started, and its vigorous, hardy nature enables it to grow and fructify where the more delicate species, the *Coffea Arabica*, would infallibly succumb. Whole tracts of land will, in various countries, now become valuable for coffee growing which have hitherto been unsuitable for the purpose, and, in short, the new product bids fair to revolutionize that industry. Writing from Dominica, Dr. Imray says, "If the cultivation of Liberian coffee is gradually taken up here, as I think it will be, there is a future for this little country. There are thousands of acres of splendid coffee land that might be cultivated in this island with no fear of the 'white fly' before the eyes of the planter for the Liberian tree bids defiance to its attacks. Indeed, there is a very eligible field for settlers here, with a little money in their pockets, who wish to cultivate coffee." And these remarks apply to many other parts of the world where coffee growing as an industry is either neglected altogether or in an embryonic stage of existence.—*British Trade Journal.*

PREVENTION OF GASEOUS EMANATIONS FROM DRAINS AND SEWERS.

Although our bookshelves contain a goodly number of volumes written upon the subject of ventilation, drainage, sanitary laws, and similar important questions, it is nevertheless a fact that the community at large have very crude ideas in regard to them. Hence we too often find imperfect arrangements and defective apparatus in use in houses even of the better class, while among persons of the lower class we too often find that the most stringent municipal laws are necessary to compel people to observe the most obvious rules of decency and hygiene. The injury arising from gaseous emanations from drains and sewers is a subject that should receive more general attention, and one to which sanitary engineers and others should devote studious investigation. There are those who endeavor to counteract the evil by the practical application of simple but effective appliances. Any device that proves to be efficient in preventing the escape of sewer gases should receive the attention it merits from all city officials, as well as from private citizens, on account of its importance in conducing to the health of our cities and towns. The device represented here is both simple and effective as a sewer gas trap. The ordinary S trap and other water seal traps have imperfections in operation which do not occur with the one shown here. It is constructed by Messrs. B. P. Bower & Co., of Nos. 104 and 106 St. Clair St., Cleveland, Ohio, and from the following description and annexed sectional drawing its distinctive features will be readily understood:



The inlet pipe of the trap descends about half way down into the cup-shaped chamber, C, which forms the water seal, the shape of which chamber is such as to render it scarcely possible for it to be emptied by siphonage. The chief peculiarity of the invention, however, is a floating valve, a hollow rubber ball, which, while it permits of the discharge of the waste waters from the closet, sink, etc., thereupon at once seats itself, in virtue of its buoyancy and the impossibility of its finding any other position of equilibrium, against the opening of the inlet pipe, A A', which may be connected with washstand or other fixture. B is an outlet connecting with sewer; C is a cup-shaped chamber filled with water and referred to above; D, a floating valve; E, lug for unscrewing cup; F, rubber flanges.

The utility of this simple device and its superiority to the simple water seal are obvious, for the greater the back pressure brought to bear upon the trap from any cause, the more firmly will the ball valve be pressed against, and the more firmly will it close the only opening through which the sewer gases can enter the house. The passage of sewer gas through the water seal, by absorption and emission, is likewise checked by the valve, which cuts off all communication between the water seal on the sewer side and that on the house side, in the inlet pipe above the ball. While the water in the chamber, C, next the sewer, may charge itself with the gaseous exhalations, that in A' remains unaffected.

In addition, the following incidental advantages are claimed for this device: That from the shape and position of chamber, C, it cannot be emptied and unsealed by siphonage; that it cannot become unsealed by evaporation, since the only free surface of the seal is on the sewer side, which is already fully saturated with moisture; that from the scouring action of the ball, during discharge, the trap cannot become choked with sediment; that the trap is not liable to burst by freezing, since the compressibility of the ball valve allows for the expansion during freezing; the lower section of the water chamber is a glass vessel, so that the operation and condition of the apparatus may be inspected without difficulty.

To secure the full benefit of the scouring qualities of the trap, the makers state that it should properly be put in with a free waste, and that there should not be another trap between it and the sewer, unless ventilated between them. They give preference to the "Jennings" closet (or one similar in construction), in which a solid, weighted plunger is used to close the main discharge, the trap in this case being connected to an independent overflow.

ADVICES from Pittsburgh show that nails have recently advanced in price; but it is not stated whether or not this is due to an expected enactment of a law by Congress making each tenpenny nail a legal tender in lieu of the silver dime.

Alizarine.

The remarkable and increasing prominence which carbon printing is daily attaining is shown by the continual flow of communications upon its various phases to which our pages bear constant witness. It is well known that when, as in its original form, carbon alone was used as the coloring addition to the gelatine, the finished prints possessed an unpleasant greenish tint, which was soon found to be undesirable and unpopular, and many substances have since been used either to supplant the carbon or to ameliorate its tone when added to it in the tissue. Various pigments have been employed—some of such a nature as seriously to mar for a time the reputation for permanency through the fugitiveness of their color. Among these have been aniline dyes and cochineal colors—most of the former, it is well known, being highly fugitive, and the latter only a few degrees less so. But, as Mr. Johnson's patent specification and Dr. van Monckhoven's letter will show, another agent has been the subject of experiment, and is likely to occupy a prominent position among the pigments used for making tissue. The substance we allude to is alizarine, which promises to be one of vast importance in the new photography, as we may call carbon printing, and has of late years become one of the most interesting of products known to chemists of the present day.

For a long time madder has been known as a substance (of vegetable origin) capable of giving dyes of great value, owing to their beauty and permanency. The various chemical principles it contained were long the subject of investigation by chemists, and their researches resulted in the isolation of several compounds new to science, chief of which were alizarine and purpurine. Madder was employed for various shades of reds and purples, and one of the chief difficulties of the dyer was the preservation of the beauty and brilliancy of the tints he obtained—Turkey red being a conspicuous example of difficulties overcome, originally by means of a most protracted series of operations, which more lately, however, have been much simplified. Upon the isolation of the principles named a fresh impetus was given to dyeing with madder, tints still more beautiful being obtained.

The extraction of alizarine in a state of purity was a work of considerable difficulty—so much so, indeed, that for some time the actual formula representing its composition was matter of discussion; but a very few years ago it was solved in a manner which alone is a trophy of the scientific thought of this century. The investigations connected with the synthesis and analysis of its allied compounds resulted, by the aid of a bold conception, in the production for the first time in the history of chemistry of a vegetable coloring matter by artificial means.

Briefly it was as follows: There is a class of compounds known as "quinones," and in investigating them Graebe, a German chemist, ascertained the composition of a body not unlike alizarine which had been known for some years. It was derived from naphthaline, and by heating with zinc dust naphthaline was reproduced from it. From various analogies he was led to heat madder alizarine, and this was converted into a well known substance called "anthracene," which is usually obtained from coal tar. Drawing the inference that the relationship between these compounds pointed to the probability of the similar treatment of anthracene leading to the production of alizarine, he tried the process, with the result of obtaining from a gas tar product the colored principle, one of the most valuable dye stuffs. In the process bromine was employed, and the new product was in consequence too dear to compete effectively with the old one; but very shortly a means of substituting sulphuric acid in place of bromine was discovered, and now the manufacture is one of the most important of the day among dye manufacturers. Already it has caused the importation of madder to be most materially reduced, with the necessary consequence of a reduction in the price.

This artificial alizarine, as supplied to the dyer and printer, is not pure, and its color with alumina salts is redder than madder colors, owing, it has been said, to the presence of purpurine; but this is evidently an error, as Dr. Schunk has proved.

The exact shade it is capable of taking will be a matter of considerable importance in pigment printing, and, according to Perkins, this quality is under the control of the manufacturer to a considerable extent. For instance, alterations in the temperature cause a difference in the shades of color. Some doubt has been thrown upon the product obtained as explained above being truly identical with alizarine; but, according to the authority just named, there is no doubt as to its resemblance, seeing that to every known test it behaves in an identical manner with the alizarine extracted from the madder itself. This material, as first produced, and in a condition obtainable in commerce under the name of "alizarine," is by no means a pure product, it being contaminated with various compounds injurious to the production of the brightest colors. A method recommended by Auerbach is to dissolve the crude product in caustic soda, and then pass carbonic acid through the solution. A precipitate composed variously of alizarine and soda combined in various ways is produced. This precipitate, after being washed, is decomposed with an acid, when fine orange colored flocks are obtained, which dissolve in caustic soda with a blue tint.

When alizarine is used for dyeing Turkey red the usual process is to subject the fabric to the process of oiling, then to treat it with alumina, and, finally, the coloring matter is applied. By the new method the first and last operations are combined, the alizarine being dissolved with the aid of soap, and sulphuric acid being added to neutrality. The alizarine then separates in combination with fatty acids, very permanent and brilliant colors being produced. There would seem to be here the germs of a process which might be made use of in pigment printing by autotype; but the scope of the present article is more especially to put our readers in possession of facts relative to alizarine, so that each may, if he think fit, institute experiments on his own account.

With regard to its properties, its solubility, and its action with various reagents, the following notes will be received with interest: It can be sublimed without change, and in the anhydrous state forms prismatic crystals of shades between orange and red. With water in combination it forms gold-like crystals. It is very slightly soluble in water, even when boiling, but is soluble in alcohol and ether. It is soluble in hydrochloric acid, with a brown color in sulphuric acid, and is thrown down by water from the latter solution. In caustic soda, potassa, and ammonia it is soluble with a deep purple color, and is precipitated from these solutions by acids.

Alumina throws down the alizarine from its alcoholic solutions in the form of a beautiful red lake; and a precipitate is likewise given in solutions of alizarine in ammonia by various metallic salts—magnesium, iron, copper, silver, etc. These precipitates are known under the name of "lakes," the term being applied to precipitates of coloring matters by means of earthy or metallic oxides. It is these lakes which are of more especial interest to photographers, they, so far, being the form in which alizarine has been recommended to be employed.

There are few vegetable coloring matters which cannot be precipitated in this manner to form lakes of more or less beauty, from yellow to purple; but, fortunately, experience with all their varieties has already been obtained by painters in water color and oil, and the verdict of "fugitive" has been passed against all but the madder lakes. The beautiful crimson lake and still more beautiful carmine are prepared from cochineal, but are useless when permanency is required, as will be easily seen by referring to many an old miniature, where, in place of cherry lips and glowing carnations, we have cadaverous lines and shades of blue and green. We feel confident, however, that, in the hands of practical dyers and chemists, some compound of alizarine will be found which shall give us pigments to render our blacks as lasting as the most durable of the artist's palette. Beyond that we cannot ask more.—*British Journal of Photography.*

New Inventions.

Mr. Chester L. Crowell, of Rockdale, N. Y., has devised an ingenious form of Weighing Scale, in which the scale pan is always kept accurately in balance and any weight placed upon it conveniently read off.

Type Cases have remained much the same since the days of old Ben. Franklin, but now comes Mr. Julius Ropes, of Ishpeming, Mich., with a decided innovation, consisting mainly in making the case of circular shape and adding two pivoted covers which keep out the dust. This case is also adapted to holding other articles than type.

Mr. Theodore G. Ames, of Denton, Texas, has patented an Apparatus for Preserving Meat, etc. It is used for fumigating substances used as food, and also for impregnating water with sulphurous acid gas, for the purpose of preserving such substances by the antiseptic quality of sulphur.

Mr. Chas. H. Bear, of Manchester, York Co., Pa., has patented a Hitching Device. It is designed to hold the animal at a sufficient distance from the object to which he is hitched to prevent him from rubbing or biting the same. It consists of a stiff and strong standard having at its outer or upper end a loosely connected snap hook, and provided at its lower end with three divergent feet, or tripod support, braced and held by a circular metallic ring, and provided with a strap at the junction of its three feet which is adapted to secure the device to any immovable object, the arrangement being such as to permit the device to be attached to a ring in the pavement, a post, tree, fence, or the wheel of the vehicle.

A Lubricator, patented by Messrs. A. M. Higgins and Newton Devereux, of Manton, R. I., consists of a chamber formed at the ends of the engine slide, for receiving cotton waste or other fibrous material, and in a oil receptacle having a perforated bottom and fitted to the chamber in the slide, for supplying oil to the cotton waste. The slide is thus kept constantly lubricated and free from dirt.

Mr. Claus Raabe, of Clifton, N. Y., has invented a new and improved Self-adjusting Head Section for Couches, which forms a convenient and comfortable support for the head of a person lying upon the couch.

An improvement in Brushes, for whitewash, varnish, paint, paste and other purposes, has been patented by Messrs. Wm. B. Burtnett and George W. Cook, of New York city. In this new form of brush the bristles are confined by a metal band in such manner that they are held more firmly in place, the nails cannot be drawn from the band by swelling, and the side parts of the band act as a spring to render the brush more elastic.

A cheap and simple Fire Escape has been invented by Messrs. Geo. Lee Whaley, of Bachelor, Mo., and John K. Hassler, of Shamrock, Mo., which is claimed to be durable, always ready and not in the way.

A remarkably strong Wooden Basket, which is said to be cheaper than equivalent ones made of willow, is the invention of Mr. Jacob W. Sickler, of Tompkinsville, Pa. The novelty consists in the peculiar shape of the wood sections, connected at the upper edge by inner and outer hoops or rims, at the middle part by one or more bindings of wire, and at the bottom by a recessed stiffening disk, to which the sections are nailed.

Mr. Edward K. Burke, of New York city, has invented a Box for Books, the object of which is to furnish a receptacle for costly, rare, and beautiful books, and which is so constructed that their covers, sides and ends may be turned down into a horizontal position to enable a book to be used without being removed from the box.

A simple and inexpensive Shutter Fastener has been invented by Mr. Daniel Ward, of New York city, which operates by a coiled spring contained in a cylinder and acting upon the edge of the pivoted latch.

Mr. Thomas Donohue, of New York city, has invented an improved Coat Hanger, by which the shape of garments is not impaired, a chain of short links being attached by split rings to metallic eyes fastened at suitable distance to the inner side of the collar or band.

An improved form of Stop Cock has been invented by Messrs. Samuel M. Denniston and Charles Simmons, of Prescott, Arizona. This invention consists in a tapering tube having at its larger end a hexagonal portion for receiving a wrench, and also a flange and a threaded portion for receiving a faucet. It is adapted to both barrels and cans and is a useful little affair.

A cheap and effective compound Vehicle Spring has been invented by Mr. Eugene T. Westerfield, of New York city, the elasticity of which under light or heavy burdens is equalized, and which is not liable to break by a sudden jolt or jar.

Mr. Albert L. Lincoln, of Bethel, Vt., has invented a new and improved Expansible Horseshoe, which is designed to restore contracted horse feet to a normal condition. This is accomplished by combining with a stationary toe piece and pivoted side pieces an adjustable frog pad and spurred connecting links or braces, for expanding and contracting the shoe and with it the hoof.

Lewis W. Drake, of Hazelton, Pa., has invented an improved Coffin, which has a peculiar construction of corner pieces, the object being to give a more ornamental form and finish, together with a stronger joint of the corners with the sides and ends. The corner piece has external end beads with rectangular end grooves, the latter being between angular tongues, the whole fitting in with the end and side pieces in a secure manner.

Messrs. Marcus M. Manville and Charles A. Bissett, of Whitehall, N. Y., have invented a new form of Hose Coupling which promises well, as by its use the hose may be coupled on the ground without being raised and without interrupting the flow of water.

An improved Gate has been invented by Mr. N. B. Cooksey, of Clay City, Ill. It is so constructed as not to sag, and can be opened by a person on horseback or in a vehicle without interfering with or frightening horse or team. This gate has a high upright, which carries supporting rods from a rear post to the gate, and thus keeps the latter horizontal. To the top of the upright is attached a long arm at right angles to the line of the gate when closed, which projects over the road, and when turned opens or closes the gate, as the case may be, without the latter touching the horse or team.

Mr. Paul Symons, of Plainfield, N. J., has devised an improved Grate for Cooking and Heating Stoves, in which the grate bars are made detachable, so that any one of them, on being burned out or warped, may be replaced without necessitating the insertion of an entirely new grate.

Mr. Andrew P. Freshman, of Marissa, Ill., has invented an improved Nursery Chair, combining a stool and a child's armchair, the latter being provided with a double seat, a folding foot-rest, and a detachable guard for holding the child in the chair.

An improved Folding Table has been invented by Mr. Geo. A. Trimble, of Crown Point, N. Y., which is so constructed as to enable the loose motion of the joints to be taken up, so that it will be held firmly and securely, and at the same time is simple in construction and convenient in use. The cross bars between the legs work on wrought iron bars of quadrant shape, and by tightening thumb screws the position of the legs is fixed. The legs and cross bars are so arranged that when folded the former overlap each other, thus making the table compact.

An improved Hot Blast Oven has been invented by Mr. Jesse M. Smith, of Newark, Ohio. This oven is heated by gas, which may be obtained from the waste gases of the blast furnace or from the distillation of coal, wood, or oil, and is designed for heating air or gas for the purpose of supplying blast furnaces, Bessemer converters, heating and other furnaces. It is circular in form, with a dome-shaped top. The gas is let into a combustion chamber at the bottom by suitable valves, and the flame and products of combustion pass out through a series of horizontal flues arranged one above the other and connected at alternate ends. In passing through this zigzag course, a large heating surface is exposed and the oven soon heated. Then the gas is turned off and the cold air which is to be heated is passed through the same flues. It is proposed to use these ovens in groups of two or more, so that while air is being heated in one group the others are being brought up to the required temperature by burning gas in them.