Boring an Oil Well.

A letter from Bradford, Pa., to the *Drug Reporter* gives a very clear description of the above operation as follows:

The machinery used in boring one of these deep oil wells, while simple enough in itself, requires nice adjustment and skill in operating. First comes the derrick, sixty feet high, crowned by a massive pulley.

The derrick is a most essential part of the mechanism, and its shape and height are needed in handling the long rods, piping, casting, and other fittings which have to be inserted perpendicularly. The bore or drill used is not much different from the ordinary hand arm of the stone cutters, and the blade is exactly the same, but is of massive size, three or four inches across, about four feet long, and weighing 100 or 200 pounds. A long solid rod, some thirty feet long, three inches in diameter, and called the "stem," is screwed on the drill. This stem weighs almost a ton, and its weight is the hammer relied on for driving the drill through dirt and rock. Next come the "jars," two long loose links of hardened iron playing along each other about a foot.

The object of the jars is to raise the drill with a shock, so as to detach it when so tightly fixed that a steady pull would break the machinery. The upper part of the two jars is solidly welded to another long iron rod called the sinker bar, to the upper end of which, in turn, is attached the rope leading up to the derrick pulley, and thence to a stationary steam engine. In boring the stem and drill are raised a foot or two, dropped, then raised with a shock by the jars, and the operation repeated.

If I may hazard a further illustration of the internal boring machinery of the well, let the reader link loosely together the thumbs and forefingers of his two hands, then bring his forearms into a straight line. Conceiving this line to be a perpendicular one, the point of one elbow would represent the drill blade, the adjacent forearm and hand the stem, the linked fingers the jars, and the other hand and form the sinker bar, with the derrick cord attached at a point represented by the second elbow. By remembering the immense and concentrated weight of the upright drill and stem, the tremendous force of even a short fall may be conceived. The drill will bore many feet in a single day through solid rock, and a few hours sometimes suffices to force it fifty feet through dirt or gravel. When the debris accumulates too thickly around the drill, the latter is drawn up rapidly. The debris has previously been reduced to mud by keeping the drill surrounded by water. A sand pump, not unlike an ordinary syringe, is then let down, the mud sucked up, lifted, and then the drill sent down to begin its pounding anew. Great deftness and experience are needed to work the drill without breaking the jars or connected machinery, and in case of accident there are grapples, hooks, knives, and other devices without number, to be used in recovering lost drills, cutting the rope, and other emergencies, the briefest explanation of which would exceed the limits of this letter.

The exciting moment in boring a well is when a drill is penetrating the upper covering of sand rock which overlies the oil. The force with which the compressed gas and petroleum rushes upward almost surpasses belief. Drills, jars, and sinker bars are sometimes shot out along with debris, oil, and hissing gas. Sometimes this gas and oil take fire, and last summer one of the wells thus ignited burned so fiercely that a number of days elapsed before the flames could be extinguished. More often the tankage provided is insufficient, and thousands of barrels escape. Two or three years ago, at the height of the oil production of the Bradford region, 8,000 barrels a day were thus running to waste. But those halcyon days of Bradford have gone forever. Although nineteen-twentieths of the wells sunk in this region "struck" oil and flowed freely, most of them now flow sluggishly or have to be "pumped" two or three times a week.

"Piping" and "casing," terms substantially identical, and meaning the lining of the well with iron pipe several inches in the interior diameter, complete the labor of boring. The well, if a good flowing one, does all the rest of the work itself, forcing the fluid into the local tanks, whence it is distributed into the tanks of the pipe-line companies, and is carried from them to the refineries. The pipe lines now reach from the oil regions to the seaboard, carrying the petroleum over hill and valley hundreds of miles to tide-water.

A Historical Expedition.

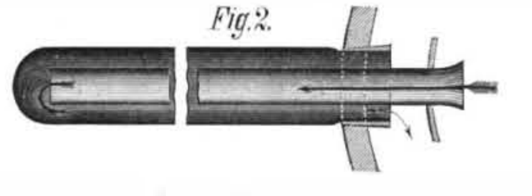
Professor Nordenskiöld's present expedition to the northern regions is not connected with ordinary polar researches, as his efforts will be mainly devoted to attempts to reach the interior of Greenland, the coast of which presents a forbidding wall of "icy mountains," as designated in Bishop Heber's hymn, "From Greenland's Icy Mountains." The professor believes that the interior of Greenland is not only habitable, but measurably fertile. As a supplement to his interior explorations, Nordenskiöld will seek on the southeast coast for relics of the old Norse colonies which were founded in the eleventh century, and which gradually passed into oblivion after a historical existence of several hundred years, their principal records being found in the Icelandic sagas, and a memory of them in occasional historical references. The poet Montgomery, in one of his longer poems, gives a semi-historical account of the Greenland settlements and their destruction based on the theory of a cataclysm of intense cold.

[Translated from the REVUE INDUSTRIELLE.]

RADIAL TUBULAR BOILER, BY L. HERVIER.

The engravings represent a unique steam boiler, in which the tubes are exterior to the boiler proper, and are double, providing an annular space around the central tube for the action of the heat, and also an annular space between the double walls of the boiler, the actual generation of steam taking place in the tubes and the annular chamber, the upright cylinder, corresponding to the upright boiler in general use, being mainly a water receptacle.

Fig. 1 shows the boiler, with a portion of its enveloping masonry removed to exhibit the tubes. The upper portion



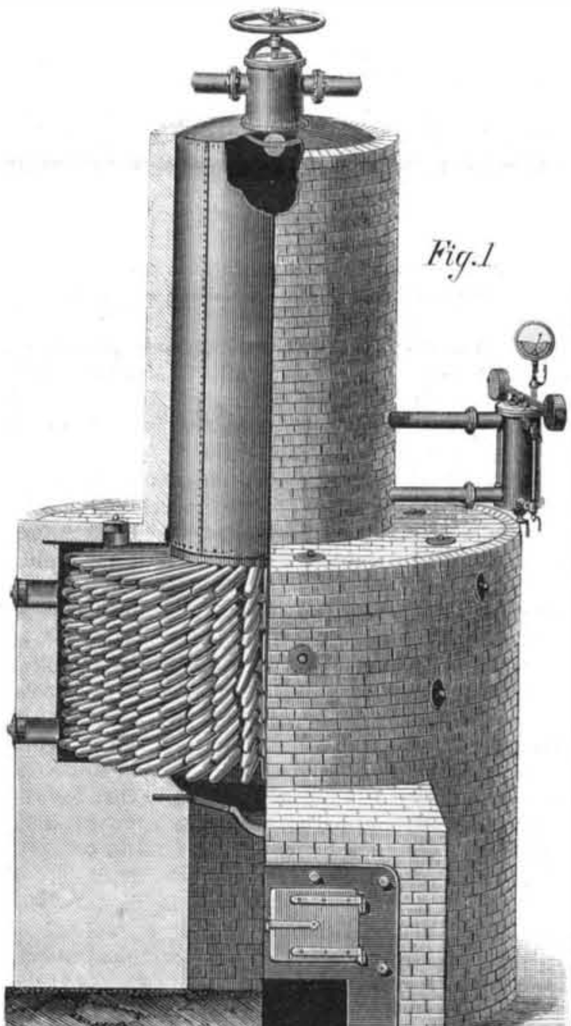
DOUBLE BOILER TUBE.

of the figure is a steam dome, from which steam is taken for use, and to which the safety valve and steam gauges are attached.

The lower portion, or the boiler proper, is double, the exterior walls receiving a large number of tubes, shown in section in Fig. 2, which project radially into the flame space of the furnace. These tubes are open at the boiler end, and closed at the outer end, and are secured firmly in the shell of the boiler by means of conical rings, as seen in Fig. 2.

The inner concentric shell is also pierced for tubes of a smaller diameter, which project into the closed outer tubes, and are open at their ends. These are fastened by being expanded at their inner ends in the usual way. The arrows in Fig. 2 show the course the water takes in its expansion by heat. It passes from the interior cylinder through the small tubes into the annular spaces surrounding them, and back through the larger tubes to the annular space between the outer and inner shells of the upright boiler or cylinder.

The inventor says that the projecting tubes, being exposed to the direct heat of the furnace, soon bring the boiler under pressure, even when it is filled with a large amount of



HERVIER'S TUBULAR BOILER.

water, because the steam does not pass through the body of the water in the interior of the boiler; but the mixture of water and steam which fills the annular envelope is less dense than that of the central portion, and as a result the steam rises in the annular space very rapidly, the water being displaced and drawn through the smaller internal tubes, as seen in Fig. 2.

This circulation is quite regular, and it favors the production of steam, and it hinders the deposition of scale, compelling it to settle through the body of cooler water to the bottom of the cylinder, whence it may be removed by a convenient hand hole.

The Refuse of Furnaces for Building Purposes.

On the utilization of the refuse material from blast furnaces for mortar for building purposes, Mr. W. Mattieu Williams, F.S.A., relates some interesting experiences. It is far from a new idea to make a conglomerate from the slag of a furnace for building purposes, and Mr. Williams thinks he has heard of its use in finer work, and he concludes from the chemical nature of the cinder heaps found around furnaces that their composition renders them well suited for many purposes where lime mortar is now used.

The slag refuse is composed of silicates of lime and alumina, intermingled with silicates of iron, manganese, and magnesia in variable proportions. When the silica is in excess they are glassy; when the proportion of lime is greater they are earthy. These earthy cinders pulverize spontaneously, and are those which, I believe, have been used directly for cement; but I should expect the best result from the glassy cinders (or "slags," as they are improperly called), as these contain sufficient silica to combine actively with the lime of mortar and thereby harden efficiently.

While on the subject I may mention a little device which I adopted in building the brickwork setting for the retorts, premising, however, that I began at this work quite as a novice, a purely amateur builder. At first I contracted in the usual manner with the bricklayer, at so much per cubic foot measured all over, I finding all materials, he only doing the work. The work was badly done in spite of all my vigilance, and the discharging of three or four bricklayers in succession, the fault being that the bricks were not laid closely enough, and the thick joints of mortar crumbled when the whole structure was heated. At last I found a remedy for this which was very simple. Instead of finding *all* the materials I only found the bricks, leaving the contracting workman to supply his own mortar, and of course paying him accordingly. The difficulty of making each brick to rest in firm contact with its neighbor with no more mortar between each than was necessary for filling up inequalities of surface, immediately disappeared.

Ready-made Houses.

The *Northwestern Lumberman* (Chicago) predicts, from the large number of inquiries regarding the ready-made house business, that it will eventually become a large industry and consume a large amount of lumber.

A gentleman visited the *Lumberman* office recently who wanted from twenty-five to fifty houses for a colony that is about starting to Dakota. Such houses for the people settling in that territory, and often in other sections, are just what is needed. In many parts of Dakota it is impossible to buy lumber, and often when lumber can be obtained the services of a carpenter are hard to secure. A ready-made house can be shipped to its destination and erected by any man of ordinary ingenuity. It saves all bother of running around the country after building material and men to put it together. A gentleman called at the office of the same paper a few days ago who wanted a house to set up on a lot in the city limits. He could rent the lot during the summer for a small sum, and thus avoid paying big rent, and at the same time have a house of his own to live in that could be handily moved whenever it was desired to do so. A late inquiry from Philadelphia was made regarding ready-made houses for export, and the same day came letters of inquiry relating to the same subject from West Virginia and New York. These letters, and hundreds of others, show that the ready-made house business is not carried on extensively enough to meet the demand. There is no good reason why a manufacturer of knock-down houses should not use 100,000,000 feet of lumber yearly in this city alone.

The Chicago Cable Roads.

By the courtesy of Superintendent Holmes your correspondent was allowed to examine the cable system of street railroads in operation at Chicago. There are four lines operated from the station on State Street, and one branch line on which the cars are moved by horses after leaving the cable. The cables enter the station at right angles from the street and pass around the driving drums, of which there are two of fourteen feet diameter for each cable. The drums are geared directly to a shaft operated by two engines of 1,000 horse power each, moving the cables at a speed of seven and eight miles an hour. The cables run over rollers in the tube laid between the rails, and are raised about eight or ten inches by the clutch when griped. This causes a slackening and tightening of the cables, and requires an automatic take up of the slack. For that purpose, at the station the cables pass around a tension drum carried by a sliding carriage that is connected to a weighted chain, which draws the carriage back more or less according to the slack on the cables. There is a constant back and forth movement of the carriage varying from six inches to three feet, the longer movement being when the most trains are running. The longest cable is operated a distance of two and a half miles, that being the length of the line.

These roads are no doubt a success on the point of economy, and there is no reason why the system should not entirely supersede horse roads. For some reason, injuries by running over persons have been frequent, though why it should be so more than with horse cars is not apparent, as the speed is not greater and the stoppages can be made as quick. It may be from the fact that there is no driver at the front of the grip car to watch passers by, the gripping lever being at the middle of the car. W.

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Metallic Nickel and its Uses.

Nickel belongs, says the *Metallarbeiter*, to the metallic elements that cannot be chemically decomposed into its constituents, such as gold, silver, platinum, iron, copper, tin, mercury, lead, zinc, aluminum, etc., as distinguished from composition metals like brass, bronze, red metal, German silver, argentan, Britannia metal, etc., which are composed of different substances of unlike chemical and physical properties. Unfortunately the names of these compounds, or alloys, are entirely arbitrary, and owing to this uncertainty it would be very desirable to introduce a nomenclature founded on their composition.

A comparison of the properties of nickel with the other metals will furnish an indication of the uses to which this metal may be applied. The specific properties of nickel are the following:

Conductivity for electricity: nickel, 13·11; iron, 16·18; copper, 99·9; silver, 100.

Specific gravity of nickel, 8·90; that of iron, 7·84; copper, 8·95; platinum, 21·50; lead, 11·40; silver, 10·55; gold, 19·50. These numbers show how many pounds a pint of each metal would weigh.

Nickel melts at 1,400° C. (2,552° Fahr.); iron at 1,500° to 1,600°; steel at 1,300° to 1,400°; copper, 900°; gold, 1,250°; silver, 1,000°; platinum, at 2,500° C.

Its strength is equal to that of hard iron.

The chemical symbol of nickel is Ni; atomic weight, 58·7, which means that in chemical compounds of nickel 58·7 parts of nickel are combined with the atomic number of the other substance. For example, the oxide of nickel contains one equivalent each of nickel and oxygen.

The atomic weight of Ni is	58·7
Equivalent of oxygen	16·0
Hence the equivalent of the oxide of nickel is	47·7

Nickel ranks between silver and gold in oxidizable qualities, but nearer the latter.

Nickel ore is found in Germany, Sweden, America, New Caledonia (a French island in Australasia), and in Austria.

The ore generally contains iron, copper, and cobalt. Cobalt and its preparations, as well as copper, are by-products in the nickel preparation; the cheaper iron occurring as an impurity is thrown away.

Metallic nickel has been known quite a long time, but did not find much technical use until Dr. Fleitmann, a pupil of Liebig, succeeded in preparing it in a very pure state economically. The valuable properties of nickel were then first recognized, and to-day castings are made of it, and it is rolled and drawn, while it was not long ago considered to be infusible and incapable of being drawn. This was due in part to foreign substances contained in it, and in part to a lack of suitable apparatus for melting it, which have since been brought to a high degree of perfection, owing to the advance made in the iron industries.

Owing to its relatively poor conductivity for electricity, nickel will find a limited use in electro technics, especially as a substitute for lead in Faure's secondary batteries (accumulators). Nickel is a better conductor (13·11) than lead (8·32), is lighter than lead, and does not oxidize so much.

Since nickel has the strength of iron, the strongest metal, while it is as unoxidizable as the noble metals, even excelling silver, it will evidently find extensive use in the future, since it possesses the properties of a noble metal at comparatively low price, and even excels silver in its reaction toward oxygen, and far exceeds all the other noble metals in strength. Of course, when these properties are recognized the increased use of the metal will raise its price, if the production of nickel does not keep pace with its increased uses, which is very doubtful.

For years the use of nickel was limited almost entirely to the manufacture of pinchbeck, and afterward to other nickel alloys, new silver, China silver, alpacca, alfenide, argentan, now euphemistically baptized "nickelin," the quantity of nickel varying in them from 6 to 31 per cent.

The price and fineness of the composition depend on the quantity of nickel in it, so that first quality of argentan (nickelin) with 31 per cent of nickel would follow the Chinese new silver with 36 8 per cent. It would be desirable if the manufacturers would state the percentage of nickel for the guidance of buyers, whereby they might to a certain extent combat the competition of those who prefer to make these nickel alloys without any nickel in them.

The next advance in point of time, that recognized the inoxidizable quality of nickel, was for nickel plating the more oxidizable metals, like brass, pinchbeck, zinc, iron copper, etc. In nickel plating, nickel anodes and nickel salts are employed. Articles suspended in the bath, to be plated, are called cathodes. The object of the anode is to replace the nickel taken out of the bath by the cathodes under the action of the galvanic current.

Aside from the electromotive power employed, whether battery or dynamo-electrical machine, the discussion of which would be foreign to our present paper, the purity of the anodes and of the nickel salts that the bath is made of are of first importance in determining the quality of the plating. To obtain good results red and blue litmus paper should always be at hand to test the acid or basic nature of the nickel bath. It may be observed that the white nickeling generally preferred is obtained by acid baths, while a basic bath gives a darker colored coating; hence, in the latter case ammonia or the liver of sulphur is added to the nickel bath if the so-called "black" nickel is wanted. Acid baths redden blue litmus, basic baths turn the red litmus blue.

Complaint is often heard against white nickeling not succeeding. This may be due to the current, that is too weak or too strong, or to the composition of the bath, but frequently the cause is to be sought in the nickel film being too thin, so that the metal beneath, which is generally brass, shows through. In the case of iron this is not so striking, owing to the similarity in the color of iron and nickel. But here there is another disadvantage of thin nickeling, that the iron rusts. There is always danger of rusting, even when well plated, if the iron has been cleansed in acid. This evil may be entirely overcome by using the sand blast instead of acid pickle. Another advantage gained is that the surface is roughened and the nickel adheres to it better, while subsequent polishing is unnecessary.

Experience has shown that scythes cannot be put in pickle before nickeling, as they soon become checked or cracked in the bath. The author had some scythes polished with sand blast and then nickel plated with entire success. This would seem to solve the problem of how to best protect scythes from rust, for the innumerable experiments and attempts to protect them with varnishes have always given negative results.

The nickel plating of sheet zinc has already become quite extended, so that it has become a commercial article. (Where?)

The use of nickel for protecting other metals is far more extensive in America than in Germany. The nickel steel factory at St. Veit, near Vienna, deserves mention as a model establishment. The articles made there are very handsome and at a reasonable price. This large establishment has a fifty horse power steam engine, three electro dynamos, and one hundred and five nickel baths.

One difficulty often met with in nickel plating brass and zinc should not go unmentioned. These and other metals which are flexible, yet only slightly elastic, do not quite return to their original shape after the bending force has been removed, while nickel is so elastic that it endeavors to return to its former position.

This is frequently the cause of nickel plate getting loose when deposited on these metals. A thin layer of nickel sticks better, but, as already mentioned, does not prevent the other metal from showing through, while it offers little or no protection against oxidation.

In concluding the subject of nickel plating we may refer to a quite extensive fraud. We frequently see on price lists, business cards, labels, and in show windows the expressions, watches with nickel works, nickel attachments, watch chains, genuine nickel, warranted nickel, etc., yet they have no nickel about them except a thin plating. The public can protect themselves to a certain extent by testing it with a magnet, which attracts iron and pure nickel. Nickeled iron and steel might deceive any one, but the fraud is usually with brass, pinchbeck, etc., hence the magnet test suffices to show whether it is pure nickel or some cheaper metal.

In recent times the valuable properties of metallic nickel—its strength and permanence—are utilized in many other ways.

We shall now attempt to lay before our readers the new and more important uses of solid nickel, following the order of their introduction.

Oxide of nickel now finds a modest but increasing use in the enameled glass and ceramic industry.

The introduction of the regenerative furnace in iron making afforded the means of casting nickel, that had long been considered infusible. It was also found that the addition of a little tin would render nickel fusible in ordinary furnaces.

At present cast nickel is used for different articles which combine in them the strength and malleability of soft cast iron with the permanence of the noble metals. Malleable nickel castings are used also for surgical instruments, harness ornaments, art castings, spurs, etc.

Nickel coins contain 25 per cent nickel and 75 per cent copper; they have recently been introduced in Mexico, and it is proposed to adopt them in Servia. (They have long been in use in Belgium, and have more recently come into use in Germany.)

Dr. Fleitmann's discovery makes it possible to roll it out into extremely thin foil, and draw it out into very fine wire. Rolled nickel anodes consist of chemically pure nickel; still Fleitmann makes cast anodes that are very pure, although they cost less than the rolled ones.

The price of nickel foil is intermediate between real silver and German silver. From a hygienic aspect nickel is as harmless as iron, whereas German silver requires to be well silvered to make it harmless.

Fine nickel wire is used for lace and dress ornaments, while nickel filigree is used for ladies' ornaments.

The use of nickel for technical articles is also quite extensive, and wire nails of nickel are in the market. Pure nickel is also used for ornaments and enamels. It is particularly adapted to *Emaille cloisonne* with difficultly fusible fluxes.

By far the most important use, because the most extensive, is for covering sheets of other metals. In the method devised by Fleitmann, and named after him, sheets of iron, or copper and nickel alloy, receive a thin skin of nickel applied by welding and rolling.

In all the metallic branches of industry, there is a tendency to use iron and steel, the cheapest and strongest of all metals, for various utensils, and to prevent their oxidation by covering them with more permanent metals, among which nickel holds the first rank. For this purpose the nickel may be deposited by the galvanic current, or by Fleitmann's method.

The nickel copper alloy, with 10 per cent. of the former and 90 of the latter, plays a very modest part in this as compared with iron.

Copper in the United States.

At an extraordinary general meeting of the Arizona Copper Company (Limited), which was lately held in Edinburgh under the chairmanship of Sheriff Guthrie Smith, some very interesting statistics in reference to the production and price of copper in the United States were mentioned by Mr. James Duncan Smith, S.S.C., one of the directors of the company, who had just returned from a visit to the company's mines and smelting works. Commencing with the year 1872, when the production of copper in the United States was 28,000,000 pounds, he said it had risen to 88,000,000 pounds in the year 1882. Over the eleven years the quantities produced were as follows:

Year.	Quantity, pounds.
1872	28,000,000
1873	31,000,000
1874	34,000,000
1875	37,000,000
1876	40,000,000
1877	42,000,000
1878	43,000,000
1879	46,000,000
1880	57,000,000
1881	70,000,000
1882	88,000,000

The consumption of copper in the United States in 1872 was 34,000,000 pounds, and the quantity went on increasing until last year, when the consumption was 77,000,000 pounds. At first it was necessary to import copper, but almost nothing has been done in that direction for several years. The great increase in consumption commenced in 1880, when it reached 62,000,000 pounds, as against 34,000,000 pounds in 1872. This was due to the development of electric lighting business—62,000,000 pounds in 1880; 63,000,000 pounds in 1881; and 77,000,000 pounds in 1882. The average price in 1872 was 35 cents per pound, and taking the following years, the averages ranged as follows: 27, 22½, 22, 20, 18, 16, 18½, 20, 17½, and last year, 18½ cents. The highest price last year was 20⅛ cents, and the lowest 17¾ cents per pound.

Discoloration of Brick Walls.

Within late years the great popularity of brick as a building material and the great increase in the number of brick edifices which have been erected have brought into prominence a matter which could not have escaped the notice of the most casual observer, namely, the disfigurement of brick walls from a coating of white powder resembling in appearance hoar frost or mildew.

These deposits are usually formed in rainy weather, and for a long time it has been a mooted question how this substance comes to be collected, what it is, and what can be done to remove it or prevent its formation. The rains of this spring seem to have been especially favorable to the forming of these deposits, and old buildings even, which hitherto have never been defaced by this substance, have this year given up their ruddy appearance for a paler and less attractive complexion. Dr. Joseph Leidy, President of the Academy of Natural Sciences, in speaking of this subject recently said:

"The efflorescence is simply ordinary Epsom salts or sulphate of magnesia. The sulphurous acid, which results from the burning of coal, combines in the presence of moisture with the magnesia in the mortar or from the clay in the bricks. It was decided that it emanated from the former source. The sulphate of magnesia dissolves in the water, which runs over the bricks, and, evaporating, leaves the deposit. Some walls are covered with a black substance which seems at a distance to be smoke. This is a fungus, which flourishes in damp places, and is materially different from the white sulphate." Dr. Charles M. Cresson explains in a similar way the method by which the substance is deposited on the walls, but expresses the belief that it is sulphate of potash. Edwin F. Durang, the architect, said that sulphurous acid acting on the mortar decomposes it to such an extent that chimneys had often to be rebuilt on account of it. He thought the efflorescence was sulphate of lime.

Liquefied Carbonic Acid.

The use of liquefied carbonic acid in the preparation of carbonated beverages is recommended by Mr. Apotheker Volk, of Ratzeburg, who states that experiments have proved it to be the purest, most suitable, and best method of impregnating mineral waters. It is also claimed that by using the carbonic acid in this form the more expensive part of the apparatus now used in the manufacture could be dispensed with. It is evident, however, that even should a sufficiently cheap supply of pure liquefied carbonic acid be forthcoming, special precautions will have to be adopted as to the containing vessels and the manner in which they are stored, as the gas requires at 0° C. for its liquefaction a pressure of 36 atmospheres, which increases rapidly with a rise of temperature. It would be worth while to carry the experiment a little further and try the solidified acid, the relatively slow evaporation of which, even when exposed to the air, might facilitate manipulation.

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