AMERICAN INDUSTRIES—No. 80.

THE MANUFACTURE OF ENGINES, MILLS, MINING MACHINERY, AND WOOD-WORKING MACHINERY.

We give herewith illustrations of the extensive foundry and machine works of the Lane & Bodley Company, situated at the foot of John street, Cincinnati, Ohio. The machines manufactured at these works are sold in nearly every State in the Union, and there is a foreign demand from the East Indies, Russia, England, Sweden, France, Germany, West Indies, and South America.

Among the special lines of machinery manufactured by this company we may mention stationary and portable steam engines, boilers, grist and merchant flour mills, mining machinery, sawmills, shafting, hangers and pulleys, hub and spoke machinery, graduated stroke power mortisers, iron and brass castings, etc.

The works are divided into several departments, each of which is under a competent foreman, with tools and appliances especially adapted to the class of work to be done.

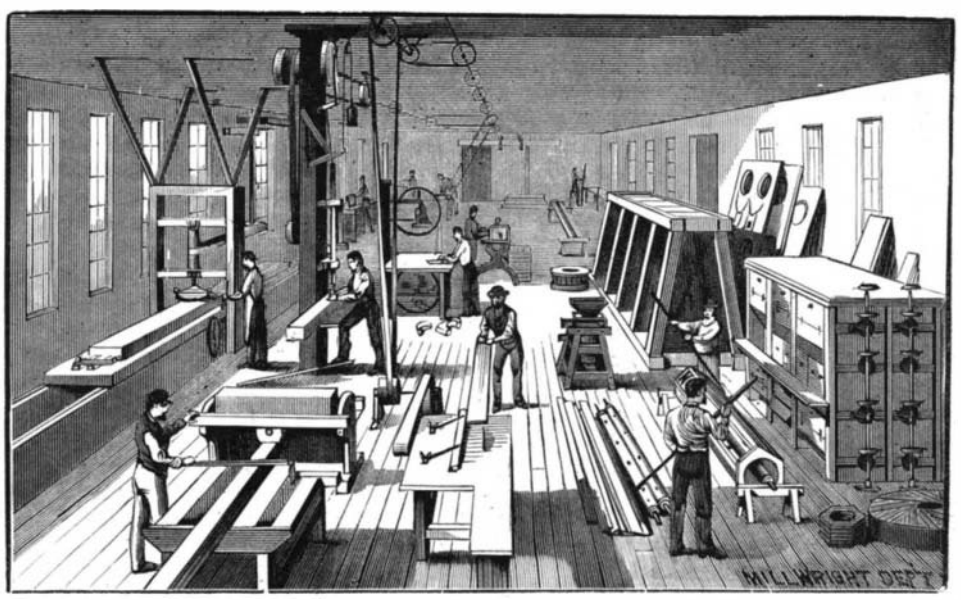
A large percentage of the product of this establishment is a class of machines which accompany the pioneer in opening up the vast wildernesses of our country to make homes for the coming millions. For example, sawmills are made by this company so simple and portable that the pioneer can transport them to his frontier home and propel them with horses (if no other motor be available), to furnish the small amount of lumber necessary to complete his cabin; or, if water power is at hand, simple appliances can be furnished to enable him to utilize the running stream to grind corn and to saw and dress the lumber, to complete the buildings, and to drive the machinery of the infant colony.

With the portable steam engines and sawmills made at these works, the railroad contractor cuts the timbers for the new railroad which pushes its way beyond the lines of civilization; and as soon as the whistle of the locomotive is heard in the virgin forests, the commercial demand begins. Naturally the first thing required is machinery for utilizing the resources of the wilderness to render the materials available for the various purposes for which they are required. The different kinds of machinery funished by this company are intended to meet such wants as these, and outfits are furnished with any required capacity.

We understand that this company was the first to construct a sawmill which could be profitably driven by the agricultural engines now so numerous in wheat-growing sections. This enables the owners of such engines to keep them profitably employed after the thrashing season is over, and thus save quantities of timber which would otherwise go to decay and be lost.

Nearly every farm in a timbered section reserves more or less of forest to supply them with firewood, timber, and lumber for future use; and with the agricultural engine and the Lane & Bodley Company's No. 1 sawmill the sawing of a neighborhood can be cheaply and profitably done.

The stationary engines made by this company range from eight to two hundred horse power. They are acknowledged to be the best of their class, and the demand for them often exceeds the means of supply. They are known as the center line, box bed, slide-valve engine. It has been the object of the company to produce a steam engine of the greatest efficiency and durability with the fewest parts, each part being easily accessible without disturbing any other. Another point has been to make it possible for any machine shop to make repairs cheaply, and not subject the owner to the expense of sending the engine or any of its parts to the builder for repairs. The department for manufacturing shafting, hangers, pulleys, couplings, gearing, and other appliances for the transmission of power, is as complete in its appointments as any in the country. Their pulley and hanger patterns, numbered by hundreds, are all constructed with due reference to the requisite strength, without excessive weight. They are made in all sizes up to twenty feet in diameter. This company has a fine assortment of new gear patterns, and they use a gear moulding machine, which enables them to make odd wheels with little expense for patterns. They have gear cutting and dressing machines that will handle wheels up to six feet in diameter.

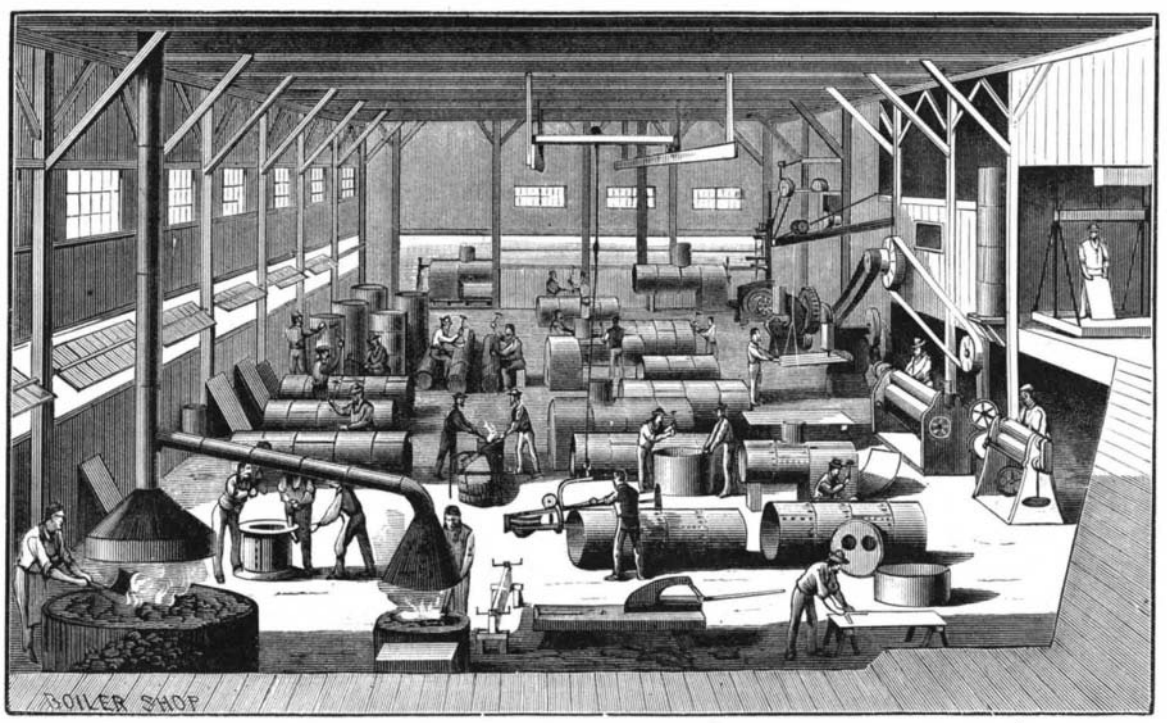


MILLWRIGHT DEPARTMENT.

The Lane & Bodley Company were the first Western manufacturers of the famous Blanchard lathe for turning irregular forms, such as ox yokes, shoe lasts, hobby horses, gun stocks, wagon spokes, etc. They have added many improvements to the details and minor parts of this machine, which make it a great favorite with all manufacturers of that class of goods.

They were the first to construct a power mortising machine with a graduated stroke, which made it possible to successfully mortise hard wood, such as wagon and buggy hubs, railroad car work, etc. These machines are now in use in all parts of the United States and in foreign countries.

The iron foundry connected with these works is one of the best machine foundries in the country. The building is 170 feet long, 70 feet wide, and 20 feet in the clear of trusses, and 35 feet from roof to floor. The boiler yard, smith shop, brass foundry, and pattern shop are supplied with modern tools, and the entire plant represents the best appliances of the day for the economical manufacture of the class of machines made by them.

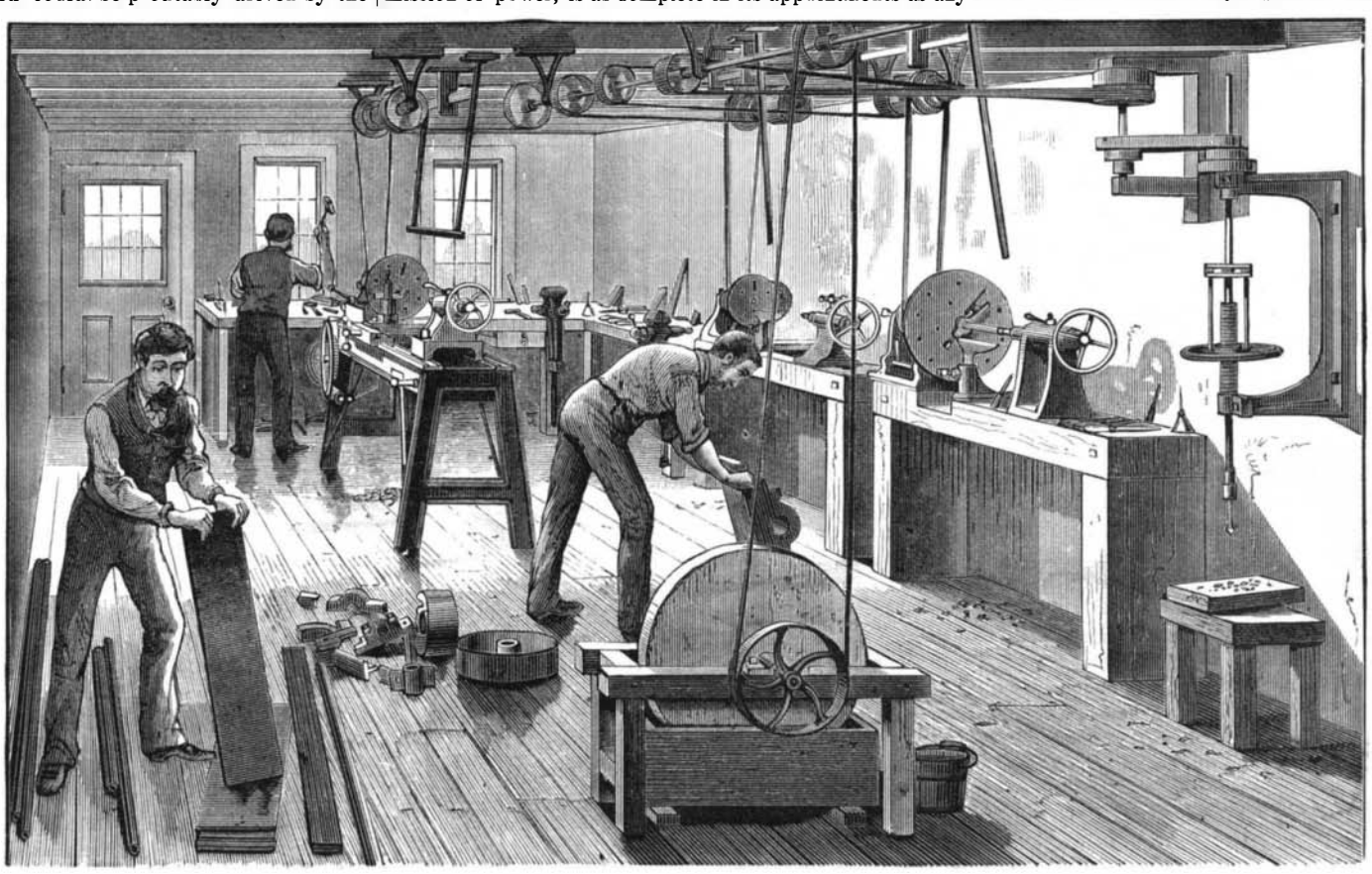


BOILER SHOP.

Cincinnati is one of the cheapest iron and timber markets in the country, and has always possessed an abundance of intelligent workmen. The central location geographically and as to food supply, great and rapidly increasing railroad facilities to coal and iron fields, give the manufacturing industries in this place superior advantages.

Since 1876 the business has been carried on as a corporate company, with a capital of $500,000, including real estate. P. P. Lane is president and C. F. Thompson secretary and treasurer.

The business was commenced by the president, P. P. Lane, in 1850, and in 1853 J. T. Bodley became associated with him as an equal partner, which continued until his death in 1868. In conversation with Mr. Lane, senior partner of this establishment, he said it was in the year 1850 that, being then a journeyman machinist, the evidences of this country's growth and development made him reflect upon the necessity of growing with it, and, if possible, to assist in the progressive movement. With that end in view, and a few dollars (altogether less than $500), and the ownership of two lathes of his own making—a single and back-geared hand lathe, mounted on wooden shears—and a few small bench tools, he purchased an engine or slide lathe for $200, from a furniture manufacturer, to be paid for afterwards in repairs of his machinery. A room at 196 Pearl street, Cincinnati, 15 x 30 feet, was then rented at $25 per month, with power from a co-tenant drug mill. A main line of shafting, suspended on rude hangers, was



THE OLD SHOP.

added. This shafting was unturned, and it had flange couplings, the whole corresponding with the ideas of that period. Necessity required the addition of vises, three of which were procured, and of grindstones. For about a year the single-geared hand lathe answered the double purpose of a drill press and metal hand-turning lathe, after which further progress was manifested by the addition of an upright drill press.

This, then, is the complete shop of the firm of Lane & Bodley in the beginning of the year 1852. One of the views in our engraving faithfully represents the old shop.

It is worthy of remark that this firm, as usual with them, incurred no debts, nor was surplus capital solicited for any of the improvements; but each year paid for and added its fund for additional enlargement. The rapid change in the affairs of this company soon demanded greater room and more complete equipments.

In 1856 the establishment was removed, and one half of the second story of the present site occupied, which, being too small, was soon enlarged to two-thirds of the same floor. In 1859 the whole property at present occupied, 150 x 400 feet, came into the possession of the firm, necessity thus early showing their ultimate needs. Since that time warehouse property has been added, 40 x 120 feet, on the adjoining corner.

The drill press, boring, and slide lathes are yet in use in the shop, except that the boring lathe has a good iron shear in place of the wood, and are yet doing fair work. They are well cared for and preserved as souvenirs of the past.

In this interesting history of the development of one of our great industries, it is instructive and important to note the fact that a dollar of capital was never borrowed to advance the interests of the concern, and nothing in the way of capital, excepting that which has accumulated from the regular operation of the works, has been used. This capital has been freely devoted to extensions demanded by the business.

American Cars Lighted by American Electric Lamps in England.

A regular train of Pullman cars is now run upon the London, Brighton, and South Coast Railway, England. The train includes a parlor car, a drawing-room car, with ladies' boudoir and dressing room, a restaurant car, and a smoking car, while a compartment at each end of the train next to the luggage compartment is provided for servants. The cars are kept at an equable temperature by means of hot water pipes. There is electric communication between the parlor, drawing-room, and smoking cars and the restaurant car, and in many ways the comfort of passengers is provided for. The most important and novel feature of the train is, however, that it is lighted throughout by electricity.

The lamps used are Edison's incandescent lamps, 29 being used. On the very successful trial trip the electricity was supplied by Faure accumulators, of which 80 were carried. Mr. W. Lachlan, the engineer, representing the Société la Force et la Lumière, who was in charge of the batteries, reported that but 30 were brought into use on the down journey, and only a portion of the electricity stored in these was expended. On the up journey these and four fresh boxes were brought into operation. For the present the accumulators will be charged each evening at the society's depot at Charing Cross, but as soon as the necessary arrangements can be made it is intended that the recharging shall be done at Victoria with a dynamo machine worked by a small stationary engine. It is not improbable, however, that before long the electricity required may be generated on the train itself, the chief practical difficulty in the way of this saving of force arising, the London *Times* says, from the unavoidable alterations in the speed of the train—a mechanical difficulty in the way of charging the accumulators in this way which the ingenuity of the electrical engineers will no doubt soon overcome.

Chloride of Gold.

The mode of procedure is to dissolve the gold, throw it down to obtain pure gold, wash the precipitate, and redissolve. A solution of the salt is then obtained.

To dissolve the gold, a mixture of pure nitric and hydrochloric acids in the proportion of one to three is used. The usual manufacturers use an ounce of gold to four ounces of the mixture, though in our own practice we usually find double that quantity needed, as a considerable loss of chlorine takes place during the prolonged digestion. A porcelain or glass vessel should be employed, on account of the value of the contents. The kind we have found most useful is one that can be obtained from any dealer in chemical apparatus; in shape it may be likened to an egg with one end widened out. A useful glass vessel is made specially for such purposes, though we prefer the porcelain, particularly when the operations may not all be carried on by a principal himself.

This glass vessel is a bulb blown at the end of a long tube, and is so constructed with the object of avoiding waste through splashing. We place the gold in the porcelain vessel, pour over it the mixed acid, and put the whole in a sand bath; a tin canister almost filled with sand will answer all purposes. The whole is then put in a place where the fumes will not do any harm. The hob of an open fireplace is very good for the purpose, as the draught from the fire takes up the fumes, and the heat facilitates the dissolution of the metal. If such a place be chosen, care must be taken that no officious housemaid knocks the vessel and its valuable contents over.

In a few hours the gold will be dissolved. Should it not be, however, the liquid must be poured off and a fresh supply of acid put upon it, and a gentle heat again applied. When all is dissolved the liquid is next to be transferred to an evaporating dish, which should again be placed upon a sand bath and heated till the bulk of the liquid is driven away. It must not be made *dry*, or there will be a loss of gold by the production of an insoluble salt; and, further, for the after operations it is desirable to have some quantity of acid present.

The solution being thus brought to a small bulk it must be transferred to a precipitating glass, water added to reduce its strength, and a filtered solution of sulphate of iron poured in. For safety two ounces of sulphate may be added for each sovereign piece. A deep brown precipitate, sometimes appearing green when looking through the vessel, is then produced; it is pure metallic silver. This must be allowed to settle till the supernatant liquid is quite clear, and when this happens in may be poured or siphoned off, fresh pure water added, the precipitate stirred and allowed to settle, the fluid again poured off, and water added, etc., till all the iron is washed away. The precipitate then may be transferred to the porcelain holder again, and either heated to drive off the water or allowed to stand till the precipitate occupies a small space, when almost all the water may be removed.

All that is now required is to redissolve this precipitate in the smallest possible quantity of acid and slightly to evaporate, when a solution of acid terchloride of gold, or chloride of gold and hydrogen, is at hand, and it may be kept, with a little water added, with far more convenience than if it were in the solid state.—*British Journal of Photography.*

A Plague of Worms.

The workmen employed in the St. Gothard Tunnel have all suffered from a painful disease not due in any way to the nature and conditions of their labors. In a memoir just published Dr. Bugnion traces the disease to the presence of the parasitic worms in the intestines of the subjects of the malady. This nematoid worm (*Ankylostoma duodenalis*) was first discovered in Milan in 1838; it has been met with in various parts of Italy; is extremely abundant in Egypt, and it has also been found in Abyssinia, India, the Sunda Isles, Rio de Janeiro, Cayenne, and the Antilles. In the intestines of the first tunnel workman who died of the disease (at Turin Hospital), more than 1,500 individual worms were counted. Many workmen have been severely afflicted, but the extent to which health must be compromised is strikingly indicated by the fact, stated by M. Bozzolo, that he found eggs of *Ankylostoma* in the stools of all workmen he examined without exception. The creature has prodigious fecundity. Happily the eggs are not developed in the person who harbors them; the development begins in the excrement or the moist earth, and gains admission to the intestines with unwholesome water.

Large numbers of laborers from the regions which furnished the workmen of St. Gothard have been brought to this country to engage in railway construction and similar rude employments. They bring their careless and uncleanly habits; and there is danger of their defiling springs and water courses where they are camped, and so spreading the worm pest along the lines of new railways.

The Largest Clock in the World.

The great Parliament House clock in London, England, usually called the Westminster clock, the largest clock in the world, says Mr. W. A. Hendrie, in the *Watchmaker and Metalworker*, was contracted for in the year of our Lord 1847, and started running in 1859, and started striking in July of the same year, although the construction was nearly completed in 1854 by the first Mr. Dent, a big name among watch and clock makers at the present day. The architect was Sir Edmund Beckett Dennison, who, as a designer in horology, has ably proved himself on the top perch.

The clock in its general design is of that kind known as the platform kind, and its plates measure 16 feet over all; the ends are built into the wall, while the bracing resembles the trussing of our bridges. There are three trains of wheels: the time train in center; hour strike train on the left; quarter train on the right. The main wheels are 40 inches in diameter, while the cam lifters for hammer tails are 38 inches diameter. There is only one cam lifter on main hour wheel, with 10 cams and 3½ inch faces of steel. In this connection the above strength is necessary on account of the weight of the hammer to be raised (420 lb.) to strike the great 15-ton bell. The quarter chime hammers are much lighter, being in proportion to the bells to be struck by them. There are four, and they weigh from 3 tons 18 cwt. down to 1 ton 1 cwt. The diameter of hoop wheel is 30 inches, and the flies are in the usual proportion, but as the flies are driven with one pair of miter wheels to throw them on end and reduce friction, the flies proper resemble a large sized barn door, and the way they make the wind blow is awful. I will now describe the time train.

The main wheel is 28 inches diameter, while the barrel is 16 inches, with a capacity for 2 feet of line. Great wheel has 180 teeth; center 120; third 120, with pinions of 12, 16, and 9. This brings me down to the escapement, which is the far-famed one—the gravity. This one is called the three-legged, and is formed of two wheels with three teeth each on same arbor, with space between, and in this space comes the lifting pallets, which are driven by the weight, and as soon as the pendulum swings against the partly lifted pallet it is released, thus allowing the pallet or arm to propel the pendulum on its opposite passage, where the same action takes place and a corresponding impulse is given. This escapement takes away all imperfections of trains, as the weight or pallet arm alone gives impulse. This clock beats two seconds; length of pendulum, 13·064 feet from suspension to line of oscillation; weight of ball, 685 lb.; length of suspension spring, 5 inches, 3 inches wide, and one sixtieth of an inch thick; glass used in dials, 2¼ tons, and with iron cost £5,334. Going part takes 20 minutes to wind; depth of well for weights, 174 feet; clock frame 4 feet 7 inches wide; dials 22½ feet diameter; weight of minute hand, 2 cwt.; length, 14 feet; the pendulum rod is compensating, with an appliance for regulating. The cost of this clock, in addition to dials and hands, as above noted, was a little under £3,400, making the clock when finished cost the sum of £8,734.

The writer of this will never forget the beautiful sounds of the bells which the clock gives out when striking. The large bell is heard ten miles off, and the small ones four to five. This clock is reported giving an error of only 90 seconds per annum; but the appliance for regulating by making it faster or slower, as our city observatory does, debars us from forming an idea what it might be if left alone for one year.

On a New Mode of Separation of Oxide of Iron from Alumina and Titanic Acid.

BY MR. ANTONY GUYARD (HUGO TAMM).

Analytical chemists know what difficulties attend the separation of oxide of iron from alumina and titanic acid by the methods usually employed in analysis.

With regard to the separation of oxide of iron and alumina really scientific methods require the use of elaborate apparatus and a considerable length of time, two elements which seriously interfere with the course of analysis which, in our days, where it is so much used for practical purposes, must be done with accuracy and at a short notice.

The separation of large quantities of alumina from small quantities of oxide of iron presents no serious difficulties, and the usual mode of separating those two substances by means of a solution of a caustic alkali is sufficiently accurate; but this physical mode of separation fails altogether so soon as the proportion of oxide of iron is increased, and when the proportion of alumina is small even fusion with alkalies effects but an imperfect separation.

Meanwhile the research of small quantities of titanic acid often proves fruitless when the known or chemical methods are employed.

The writer has for a long time been on the lookout for a true chemical method of separation of these substances, and has succeeded in devising the following, which offers most of the advantages needed in analysis:

The mixture of oxide of iron, alumina, and titanic acid obtained in the course of the analysis is calcined and weighed, and then dissolved in strong hydrochloric acid. Iron must be reduced to the state of protoxide, and this is best effected by means of a concentrated solution of hyposulphite of soda. A slight excess of this substance may be added without inconvenience.

The solution thus obtained is neutralized partly by means of ammonia or carbonate of soda and then precipitated by means of a solution of cyanide of potassium, which must be added in slight excess. The whole is then boiled and iron is completely dissolved in the state of ferrocyanide of potassium.

When the floating alumina, or mixture of alumina and titanic acid, is perfectly colorless, a small quantity of ammonia is added, as well as a few drops of sulphide of ammonium. The floating oxides should remain perfectly colorless and not assume even the faintest blackish or greenish tinge, showing that the separation is absolutely perfect.

The whole is then filtered and well washed, and alumina, titanic acid, and the almost ever-present phosphoric acid are separated and estimated by one of the known processes.

In this method iron had best been estimated by difference, or else determined by some distinct process on some other portion of the mixture.

Until now it was alumina which was thus estimated, and chemists will thus readily perceive how advantageous is this new method which enables them to see and to handle the alumina or the group of substances which is too often reported as alumina.

One of the advantages of the process is the facility with which even minute quantities of titanic acid can be detected and estimated.

In scientific or very delicate analyses the use of volatile reagents should be resorted to as much as possible, and in consequence hyposulphite of ammonia and cyanide of ammonium should be used to effect the separation here described. In this case, after boiling the solution of ferrocyanide of ammonium to expel any excess of cyanide of ammonium, iron might be estimated in a direct way in the state of ferrocyanide.

The new method is invaluable for a perfect separation of iron from titanic acid in the proportions usually found in titaniferous iron ore, separation which is extremely delicate by the known processes.

The writer expects that the same method, with perhaps slight modifications, will prove useful in the separation of iron from substances other than alumina and titanic acid, but further researches are needed.

Uses of Compressed Air.

A paper was lately read before the Society of Arts by J. A. Berly, on the "Distribution of Time by a System of Pneumatic Clocks," heretofore described in the SCIENTIFIC AMERICAN. In this paper the author enumerates some of the many purposes for which compressed air has been employed. Air, compressed at pressures varying from a little over up to over a hundred times above the atmospheric or natural pressure, has, and is used in reference to, among many others, the following processes or manufactures:

The blowing of glass and bottles, etc.

The blowpipe, so much used in chemistry and industrial processes.

The "blow cane," for killing birds, as used by the natives of Guiana for killing paradise birds without destroying their valuable feathers.

The common bellows used for firesides; in the slaughtering houses, etc., and also in blacksmith shops, etc.

The blowing of organs.

Blasting in foundries, forges, cupolas, etc.

Diving Bells.—A description of this apparatus, in its primitive form, is given in Aristotle's "Problems," as far back as in the fourth century B.C.

Diving Dresses.—Those have almost superseded the diving bells, which only allowed the workers, or divers, to extend their operations over a very limited area at one time, when, with the diving dress, the worker is capable of moving to and fro, having only to carry with him the pipe which conveys to his mouth the air compressed at the surface by means of pumps of special description.

Sinking Bridge Piles.—With the progress of metallurgy, the construction of metallic bridges come gradually into use, as also the use of cast iron tubular pillars. Air compressed at a pressure sufficient to keep the water out of the pile during the process of sinking, in order to enable the workmen to work at the bottom of the water, is forced into the tubular cast iron pipe and maintained at the required pressure, the top part of the cylinder being shut, and a special contrivance or air chamber provided for the letting in and out of the men and materials excavated.

Floating Sunken Vessels.—Various devices are in existence for floating sunken vessels, the means generally employed being the pumping out of the water contained in the hold, combined with the use of air bags surrounding the vessel, to which they are attached in suitable positions by divers.

Locomotion.—We have examples of railway locomotion by means of air pressure in the atmospheric railways of St. Germain, in France, which was at work in the year 1847, and of Dalkey, in Ireland; also in the compressed air locomotive of Mr. Ribourt, a French engineer, as constructed at the Creusot works, and used in the St. Gothard tunnel works, and of that of Lieutenant-Colonel Beaumont, as tried at Woolwich some time ago.

Brakes.—Powerful railway brakes, now well familiar to us, are also worked by air pressure, such as the well-known Westinghouse compressed air and Smith vacuum brake.

Tramways are also worked by compressed air, and the most successful of the existing system is, judging by the number of applications which it has received, the Mekarski system, in which the air, compressed at a very high pressure (and which is carried in cylindrical receivers attached underneath the tramcar), instead of being used alone, is caused, before producing its expanding effects, to pass through boiling water, a load of which is also taken with the tramcar on its starting journey.

Rock Drilling.—The drilling of holes for blasting rock by means of gunpowder or dynamite in mines, quarries, and tunneling, is also effected by means of air compressed by machines actuated by steam engines, water wheels, or turbines, at the surface of the works or entrance to the tunnels, stored into proper receivers, and conveyed to the perforators or rock-drilling machines at almost any distance, in any direction, and at any altitude, by means of pipes connecting the air receivers to the said perforators. The tunnels of the Mont Cenis and the St. Gothard, one over eight and the other over nine miles in length (14,920 meters), have been evacuated throughout by means of such machines so worked by compressed air.

Coal Cutting.—For working coal-cutting machines underground in the same way as rock-drilling machines are worked.

Transmission of Power.—For transmitting power in any direction, at any distance or altitude; any ordinary steam engine, steam winch, steam crane, etc., being capable of being actuated by compressed air in exactly the same manner as the said engines, machines, or apparatus can be actuated by steam.

Ventilation of mines and public buildings.

Pneumatic Post.—Messages are now carried from one place to another, through underground, in some of the most important European capitals—London, Paris, Berlin, Vienna—vacuum and compressed air being used for the purpose.

The use of compressed air is also brought nearer home to us in our daily dealings in the shape of pneumatic bells, apparatus for opening doors (as used by the Paris *concierges*), spray producers, fountains, air guns, toys, etc.

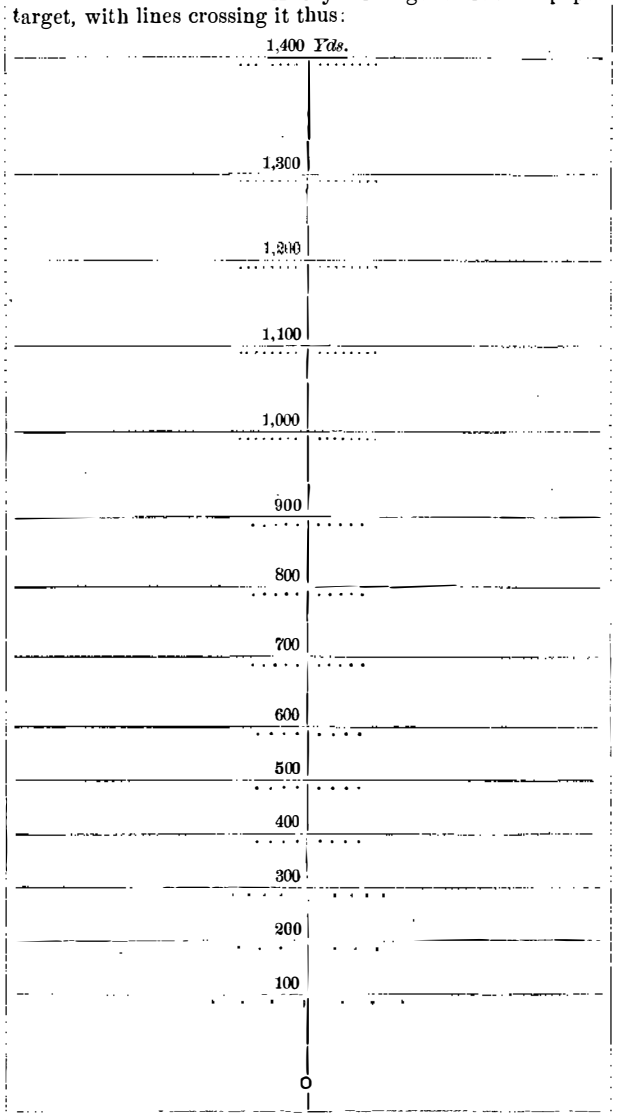
Compressed air is also used in sugar manufactories, breweries, iron and steel works (the blowing engines in these last being a very important feature in the processes of metallurgy); also for artificial ice making and cold producing, as in the Giffard process, in which the cold resulting from the distention of compressed air into the atmosphere is utilized: in submarine vessels, propelling of torpedoes, pneumatic dredgers, such as the Duckham's, the Bazin's, the C. Ball's; water lever indicators, and, finally, in a variety of works, processes, and purposes which it would take too much time to describe.

The author suggests that an exhibition of the various industries connected with the use of compressed air be held in any convenient spot. It is his opinion that it would prove of an immense interest, and attract almost as much attention as the electrical exhibition of Paris, so numerous and varied being the valuable ends to which it is applied.

New System of Aiming and Sighting.

The *United Service Gazette*, describing a system of aiming and sighting devised by a Mr. Morris, says:

"All musketry instructors know what dreary work aiming drill is, and how it is hated by both officers and men; indeed it may be said to be given as a punishment to bad shots. Moreover, as at present practiced, it is very nearly useless, because it does not test a man's aim at the moment of firing. Mr. Morris's system teaches the recruit the why and wherefore of raising the sight, and makes him dexterous in its manipulation. Mr. Morris' apparatus consists of a most accurately made rifled tube, which extends the whole length of the rifle. This tube is fixed in the rifle in such a way that the loading and extracting are precisely the same as with the service ammunition. A tiny cartridge is fired at a paper target, with lines crossing it thus:



"This target has a small spot at the bottom, which is the point to be aimed at. If a paper target is placed in the line of fire, and the soldier is made to aim at one given spot on this target, it is evident that the bullets will pass through the paper at places corresponding to the elevation of the rifle. When he puts up his sight, say to 500 yards, and aims over it to the spot at the bottom of the target, he unconsciously raises the muzzle of the rifle, and of course the bullet hits the target, at a place higher than when he was aiming at the same spot with the sight fixed for 100 yards. The places where the bullets should hit are shown on Mr. Morris' target by the horizontal lines, and the lateral deviation is shown by divisions marked on the horizontal lines. Mr. Morris' plan enables every man to use his own rifle in the barrack room or yard, at distances varying from ten yards to one hundred. The cost of the introduction of this system of musketry practice is so small that every battalion of the British army could, it is estimated, be supplied with twenty of Mr. Morris' tubes for less than £3,000. The price of the ammunition is very low, as the cartridge cases and lead are all recovered. Further, if the government supplied this ammunition to the men at one shilling per hundred rounds, many men would buy it, as matches can be shot on Mr. Morris' system exactly the same as at the regular target. Mr. Morris' invention has met with a very favorable reception at the Horse Guards, and it is hoped that this most useful invention will soon be in general use in the British army and navy."

Mineral Tanning.

The new form of tanning, in which mineral salts take the place of tannic acid for preserving hides, is thought by some to be an improvement on the old process, while others say it is not a success. It is probable that some time will elapse before the new method will reach that perfection which will secure for it general recognition. Ihrig, in a recent lecture on the subject, said that shoemakers and chemists had expressed doubts in regard to it, and even the mineral tanners, many of them, agree that the old method of bark tanning is not going to be driven out of the world just yet; that mineral tanned leather is at present not fit for the parlor and never will be; it does not last as long as ordinary leather, not to speak of the finer leather; without the use of oak bark there can be no leather that is not poor and cheap; the new method will go out of use, as many new things have done before. This, he said, was the average opinion of practical as well as scientific men.

Reuss, in Aschaffenburg, has been experimenting upon the new leather for two years, and, in the *Gerber*, he says it cannot compete with bark-tanned leather. It must be admitted that mineral or chrome leather is an advance, and that it is distinguished for being waterproof, and seems excellently adapted to certain uses, such as belting. For softness and external appearance it is far behind the other leather; neither will it take a polish like it. When we remember that in the old process the easily decomposable substances in the hide are all gradually removed, while in mineral tanning they are only partially destroyed, this, too, must make a difference.

Glycerine Leather Polish.

Mix intimately together 3 or 4 pounds lampblack and ½ pound of burned bones with 5 pounds glycerine and 5 pounds sirup. Then gently warm 2¾ ounces of gutta percha in an iron or copper kettle until it flows easily, then add 10 ounces of olive oil, and, when completely dissolved, 1 ounce stearine. This solution while still warm is poured into the former and well mixed. Then add 5 ounces gum senegal dissolved in 1½ pounds water, and ½ ounce of lavender or other oil to flavor it. For use it is diluted with 3 or 4 parts of water. It is said to give a fine polish, is free from acid, and the glycerine keeps the leather soft and pliable.—*Polytech. Notizblatt*

Heating Gas Distribution in St. Louis.

At the intersection of Clark and Tayon avenues, St. Louis, two square brick buildings of little apparent significance have been erected during the past few months. One of the buildings, situated on the northwest corner of the above thoroughfares, is evidently intended for an office. The adjoining structure, however, is constructed in a manner that immediately claims the attention of a close observer. It is a small, unpretentious building, measuring only 29 x 41 feet, ground measurement, with an altitude of 35 feet. The roof is of iron, with a rectangular opening on the ridge, surmounted by an iron ventilator. The basement is deeper than ordinary, and through the lower windows glimpses are gained of massive cylinders, connected by a bewildering array of immense tubes with a number of upright boilers. Their purpose cannot be explained by any of the well-known principles of mechanics, as the complicated arrangements conform to no acknowledged mechanism seen in operation in that city.

Inquiry divulged the fact that the building was the central establishment and headquarters of the St. Louis Heat and Power Supply Company, a close corporation, in which the stockholders are members of the firm of Shickle, Harrison & Co., and Eastern capitalists interested in the introduction of a patent for distributing hydrogen gas for heating and power purposes. The gas is manufactured under the Low process, which has been successfully applied in Yonkers and Winchester, N. Y. Mr. John Atkinson, late engineer and superintendent of the St. Louis Gas Company, is in charge of the works, and from him a reporter obtained the following information.

The works are the largest and most extensive in the country, and when in operation will have a capacity of 300,000 cubic feet a day. The gas is not adapted for illumination, and will only be supplied to tenants requiring it in place of coal for heating, steam generation, and running gas engines. It will be formed under pressure, and at a cost of $1.50 per 1,000 cubic feet.

The process of its manufacture can be briefly illustrated as follows: Anthracite coal is fed to an upright generator, where it is worked up to a white heat by the agency of a blower, which is driven at a high rate of speed by a 50 horse power engine. As soon as the coal arrives at the proper heat, superheated steam is admitted, and, impelled by the pressure of the blast, passes through the furnace and thence through superheating chambers and carbureters. In the passage the generated gas is washed and after passing through a series of tile pipes is returned to the condenser ready for distribution to the consumer. The surplus supply is conducted to a gas holder in the yard, which has a capacity for storing 30,000 cubic feet.

The power required in manufacturing the gas is supplied by a 60 horse power boiler and an ordinary engine of the same power. After operations begin the steam engine will be supplemented by a gas motor. Connection will be made with manufactories through ordinary 15-inch iron pipes, which will be laid underground in the same manner as gas pipes. For private houses and hotels, where the gas will be used as fuel, smaller mains will be employed. The condensation is so small that it is not considered necessary to incase the pipes in asphaltum, cement, or any other non-conducting material, and it is claimed that an efficient service will be obtained by these means.

The company at present only contemplate supplying gas in their immediate vicinity, and will under no consideration

extend their system so as to reduce the supply to tenants. They propose to build additional depots in the manufacturing districts as soon as they have practically demonstrated the feasibility of their plans. The erection of the works have been retarded by the freight blockade, which detained a quantity of machinery, but if nothing unforeseen occurs an experimental test will be made next month. Pipe laying will be begun this fall, and if the winter is favorable gas will be let into the system of tubes early in the spring. Applications for supplies are already in excess of the capacity of the company to meet.

Cellars as Centers of Malaria.

Dr. C. R. Agnew, writing from Florida, says: In this State a somewhat new problem presents itself, in the fact that all houses should be constructed without cellars, and so raised on underpinning as to allow a clean sweep of light and air beneath them. Indeed it is a question whether such a mode of construction should not be adopted everywhere for dwellings. I have for more than twenty years believed that cellar atmosphere is a most prolific cause of disease and death. I believe that it increases seventy-five per centum the risk from malarial disease all over our country. Through this State the native population, as by an instinct, raise their simple cabins three or four feet above the ground, and allow air and light to pervade the space so made beneath the ground floor. I advise all travelers to avoid those hotels and other domiciles in the South which are not so constructed.

Blue Milk.

The blue appearance which milk sometimes presents after standing a few days is due to an organism which is allied to bacteria, and can be transplanted into other samples of milk and various solutions. It thrives according to the proportion of acid present and the condition of the casein; it appears after a certain degree of acidification has taken place, and prevents the further formation of acid. The casein must also be unchanged; it is then held in solution during the bluing process. The bluing occurs only in presence of oxygen, and is attended with evolution of carbonic anhydride.—*F. Neelson, in Bied. Centr.*

IMPROVED UNIVERSAL CHUCK.

In general construction the chuck shown in the engraving resembles the universal screw chuck, the jaws being moved

Fig. 1.—THE SWEETLAND CHUCK—BACK VIEW.

to and from the center, universally, by means of geared screws connected with the circular rack which revolves in a recess in the back plate. The front and back plates are bolted together, thus incasing and protecting the gearing.

The design of the improvement is to make the chuck independent as well as universal, and reference to the accompanying engravings illustrates the means employed to attain this object.

Fig. 1 represents the entire mechanism of the Sweetland chuck, showing plainly the circular rack and pinion screws connected at *o* and disconnected at *c*. The recess in back plate is made deep enough to disconnect the gearing. In the recess, and underneath the rack, lie the cam blocks, beveled to correspond with the continuous bevel recess in the back of rack, as shown in Fig. 2.

These bevel cam blocks have radial motion, and when moved to the outer portion of the recess and rack they connect the gearing, making the chuck universal; and when they are moved inward, allow the rack to disengage from the pinion, thus making each screw independent.

The cam blocks are held in place by the convex spring washers, *o*, *e*, *c*, which allow them to slide to or from the center without disturbing the nuts, the friction being sufficient to hold them in place.

The jaws have a long bite on the inner end, are strong in the nut, which has a full thread, and can be taken out of the chuck, for the purpose of cleaning, without removing it from the lathe. They are ground perfectly true on face and bite, also outer end, after being case-hardened.

There are lines on face designed as a guide for setting the jaws true. For instance, the chuck having been used independent, the operator wishes to use it as universal, the jaws would be moved inwardly, so that the outer end would be perfectly even with the line on face; now engage the rack into gear with the pinions by sliding the spring washers outward, and the chuck is ready for universal work, and perfectly true. This chuck has a large hole in center, and will allow a drill or reamer to pass through work without injury.

The No. 1, or reverse jaw chuck, is used for holding drills, screws, pipes, etc., and is very convenient for this class of work, also for hand tool work, brass finishing, etc.

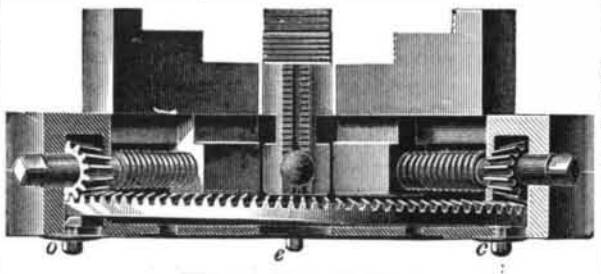


Fig. 2.—COMMON JAW.

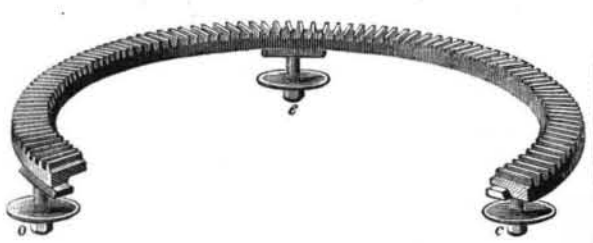


Fig. 3.—CIRCULAR RACK.

These chucks are furnished without the combination when desired, when they will be universal only. These chucks are made by Sweetland & Co., New Haven, Conn.

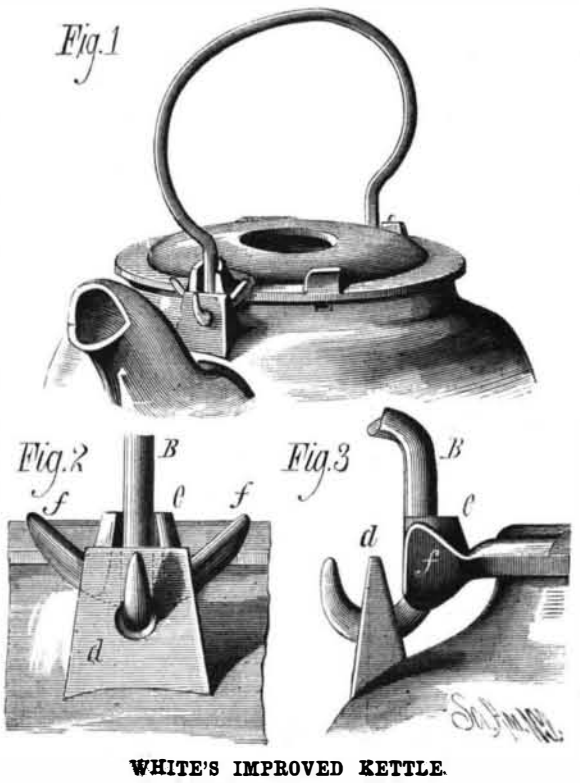
Good Living Easily Got.

In a recent communication to the San Francisco *Bulletin*, Mr. J. B. Rumford, of Bakersfield, Kern county, Cal., asserts that a man can earn enough there by fifteen days of "ordinary labor" to keep him in the best of food for a year. He says: "I find that three of us, a growing boy of seventeen years, my wife, and self, do not together use on an average more than one and one-half pounds of wheat or other grain per day, and though supplied with Seckel, Winter Nellis, and other pears, peaches, apples, Muscat grapes, and other fruit —not more than eight pounds of fruit per day—thus making a total expense of 2¼ cents for grain and 16 cents for fruit per day. So we have a total of 18¼ cents per day, or $66.60 per year, or $22.20 for each person; and as wages here for ordinary work are $1.50 per day (if you board yourself), it would take less than fifteen days' labor to provision each one a year on a full supply of the best grain and choicest fruits, giving the best health and gustatory pleasure; and as in the experiment we used them all uncooked, the only work of preparation necessary to be performed was a few minutes' time each day preparing the grain in a steel hand-mill, not equal to more than five minutes for each person."

Living in this way all the family gained in health. Mr. Rumford adds: "I was, in two weeks, completely cured of dyspepsia, that has troubled me from boyhood until nearly fifty years of age, and my spectacles, which had become constant companions, were nearly put aside, and with them all an increase of mental if not of physical ability. Any one, from one acre well cultivated in fruits and grain, with one hour's work each day, can be supplied with a most wholesome and delightful diet of the finest fruits and continue in good health; and one hour more, well applied, will furnish good comfortable clothing. Why need it longer be said man is subject to the curse of earning his bread by the sweat of his brow?"

IMPROVEMENT IN KETTLES.

The annexed engraving shows an improvement in kettles recently patented by Mr. L. A. White, of Attleborough, Mass. The design of the improvement is to keep the bail cool by holding it out of contact with the body of the vessel.



WHITE'S IMPROVED KETTLE.

To accomplish this the bail is hinged in the lugs, *d*, and at some distance from the hinge is bent outward in the usual way.

A latch or fork, *e*, is attached to the lid, and surrounding the lower end of the bail and holding it so as to retain the vertical position. The latch, *e*, is provided with two wings, *f f*, one on each side of the latch. When the bail is raised it will come in contact with these wings and raise the cover sufficiently to allow the bent portion of the bail to pass under the wings and enter the latch, *e*, when the cover will again descend and hold the bail in the vertical position.

A Bad Case of Globus.

Dr. Myers, of Paterson, N. J., was recently summoned in great haste, at midnight, to see a woman who was suffering the most excruciating agonies from having swallowed a set of false upper teeth, sixteen in number. Several women were about her, who had been called in to help her. Anodynes were administered to relieve her temporarily. Dr. Myers then closely scrutinized her mouth and throat, but could find no evidence of laceration. Moreover she could swallow readily. He suggested that the teeth might have been mislaid, but this was indignantly scouted by the attendants, who declared that they had searched the house from top to bottom.

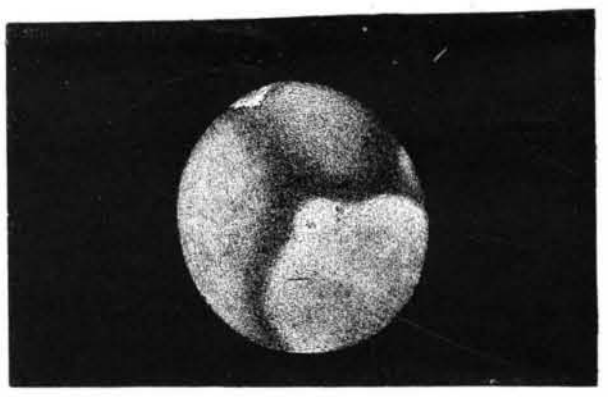
A further search under the pillow failed to disclose the missing property, and the case began to look serious, as the poor woman declared that she could not stand it any longer, as she felt the edge of the teeth cutting into the sides of her stomach. Finally, at the suggestion of the doctor, the inside of one of the pillow-cases was examined, and there the teeth were found, perfectly safe and harmless.

The patient, who had, a moment before, been suffering from the laceration of the teeth "against the edges of her stomach," recovered instantly, and the doctor was promptly dismissed.—*Medical Record.*

On the Probable Existence of Ocean Currents on Mars.

BY T. S. H. SHEARMEN.

The polar regions of Mars, like those of the earth, appear to be covered with a deposit of ice or snow. But there is a remarkable feature about the snow regions of Mars that has always puzzled astronomers. It is this: Their edges, instead of fading gradually as they should do if they melted by the direct action of the sun's rays alone, change in a



The planet Mars in its gibbous state, as seen on August 16, 1880, in the twenty-foot reflector at Slough, by Sir J. F. W. Herschel.

very sudden manner from snowy whiteness to an umbral blackness. The annexed sketch, taken many years ago, and when Mars was in a gibbous state, shows this appearance.

How shall we explain the absence of penumbræ to the Martial snow regions? After a thorough investigation, I venture to enunciate the theory that the phenomena mentioned are caused by the action of warm ocean currents, like our Gulf Stream, flowing from the equatorial regions of the planet. To my mind, no other rational explanation seems to offer.

Brantford, Canada.

Fireproof Paper and Printing.

BY L. FROBEEN, BERLIN.

Paper that is actually fireproof, *i. e.*, such as can endure a temperature of 800° C. (1,472° Fah.) in combination with writing ink or printer's ink, which would endure so high a temperature without being injured, has not yet been made. Some kinds of paper made with asbestos did, indeed, resist a temperature not too high, but it was not suitable for writing or printing. According to the German *Industrie Zeitung* a method has been invented for making paper, etc., having these fireproof properties.

Asbestos fiber of the best quality is washed in a solution of permanganate of potash and then bleached with sulphurous acid. Five parts of ground or finely divided wood fiber, such as is used for paper making, is mixed with ninety-five of the asbestos. The two are then mixed with glue water and borax in a Hollander, where they are very intimately mixed and worked over into a paper pulp, which yields a fine paper with smooth surface, and can be calendered for writing. It is claimed for this paper that it will resist a white heat.

For making a fireproof printing and writing ink a mixture of platinum chloride and oil of lavender is employed. Lampblack and varnish are added to give it a black color or for a writing ink the Chinese or India ink and gum arabic are added. Good results are obtained by the use of ten parts.