Industry and Veracity.

There are some virtues which seem to have a peculiar affinity for one another, each strengthening and developing the other by its own power of growth. Such are industry and veracity. Of course we cannot say that the busiest people are invariably the most truthful, but only that the tendency of industry as such is in that direction. It is true that industrial occupations sometimes offer temptations to untruthfulness, and might thereby seem calculated to retard rather than to stimulate the virtue of veracity. The inducements to prevarication in regard to the quality and quantity of goods and labor, and still more to the suppression of facts which would affect their value, are numerous and strong, and some undoubtedly yield to them.

We have, however, thoroughly learned the lesson that mutual confidence is the cornerstone of all social industries, and that truthfulness in word and deed is the only basis of mutual confidence. Truthfulness, therefore, naturally acquires a much higher rank in the minds of an industrious community than it can in any other. With us, in public estimation at least, it occupies the post of honor, and though doubtless many people infringe it in secret, none can be found bold enough to defend it. It is held as a test of noble character that a man is candid, sincere, and trustworthy, that his word is reliable and his promises secure. On the other hand, falsehood, evasion, and deceit are esteemed disgraceful, and those who deal in them are chiefly concerned lest they should be found out.

Mr. Lecky, in his History of European Morals, asserts that different ages and nations have different rudimentary virtues, or virtues upon which they lay the emphasis. Sometimes it has been loyalty to a leader, sometimes patriotism, sometimes the reverential spirit, sometimes independence, sometimes humility. Whoever in any particular community is decidedly lacking in such a rudimentary virtue is below the average of moral excellence, because he has neglected what is generally esteemed the very first element of righteousness. Our own term "common honesty" implies that this is at least one of our rudimentary virtues, without which no one can hope to rise in the scale of moral progress.

If we compare our state of things in this respect with that which exists among indolent nations of southern climes, or other thriftless communities that love ease better than labor, we shall find a marked difference. Instead of feeling vain in our fancied superiority to such people, perhaps if we compared our practical devotion to what appeals to us as the foundation of all virtue, with their devotion to something else that occupies that place to them, we might feel cause rather for self-abasement. We may rightly feel glad that we have learned the value of veracity, that our industries have proved it to be one of the foundations of all social welfare, of all true business relations, of all progress in morality and civilization. And yet, how far are some from embodying this accepted belief in their daily practice! How many are the evasions, concealments, and insincerities of which men are guilty, how many silences where truth demands speech, how many promises unredeemed, or kept to the letter, but broken in the spirit! It is for what we admit, for what we believe, for what we know, that we are responsible; and if we hold truthfulness in such high repute that we plume ourselves over others on account of it, then we are doubly blamable if we disown it in the conduct of our daily life. Increasing civilization and increasing knowledge open up to us more and more the nature and respective value of the qualities that constitute true manhood. But that manhood can only be realized by constantly infusing the knowledge we gain into our daily life, by vitalizing it in our hearts and conduct, by following closely the ideal we form, and by giving the whole allegiance of our nature to those principles which we honor in our thoughts and with our lips.—*Phila. Ledger.*

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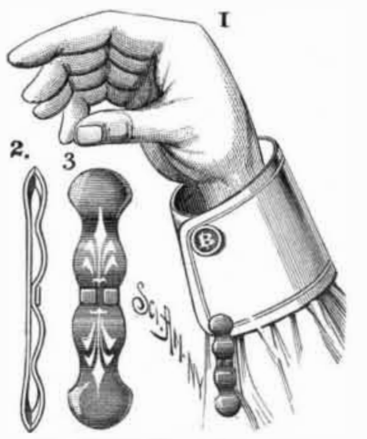
A French Wheat Cleaner.

At the recent Nice Exhibition was a machine shown by M. A. Maurel, of Marseilles. In the upper part of this machine is placed a hopper immediately over a cylindrical and open topped receiver. Horizontal stirrers on a vertical shaft work in this receiver, motion being given by bevel gearing and a pulley driven off the main shaft of the implement. The wheat to be treated is fed into the hopper and falls thence into the cylindrical receiver beneath, where it is subjected to the action of water delivered at a sufficient pressure to keep the sound wheat at the level of a discharge opening in the side of the receiver, the stones and heavy impurities falling to the bottom, and dust, chaff, etc., floating to the top, where they pass off by an overflow. The sound wheat being carried as described through an opening below the water level, is taken with the stream along a slightly inclined trunk rectangular in section, and in the bottom of which is set a series of catch plates to receive and hold any stones that may have been brought over with the wheat. From this trunk the wheat falls into the bottom of a vertical drying cylinder, after having been previously separated from a part of the water by means of a centrifugal fan. The drying columns, of which there are one or more, have perforated sides containing a series of inclined blades mounted on a vertical shaft and driven at a considerable velocity. By this means the weight is raised to the top of the first column, where it passes out by a discharge to the bottom of the second column, and is again raised, by which time the operation of cleaning and drying is supposed to be complete.

CUFF HOLDER.

The invention herewith illustrated was recently patented by Mr. H. D. Bishop, of West Hampton, N. Y. Fig. 1 shows the device in place on the sleeve, Fig. 2 is a longitudinal section, and Fig. 3 is a face view. Two thin strips of spring metal are so constructed as to form concave jaws, brought to an edge at their point of contact. The outer strip is of corrugated shape on its face between the jaws, thus forming swells upon opposite sides of the center, where it is united to the center of the other strip, which is provided with side wings that are turned over upon the outer strip. The outer strip is properly tempered so as to retain its bent form, and its spring is strong enough to hold the sleeve and cuff between the jaws. Pressure upon either of the swells causes the depressed portion beyond the swells to bear on the under strip, there by opening the adjacent jaws to allow the entrance of the cuff or sleeve.



BISHOP'S CUFF HOLDER.

The device, while being cheap, simple, efficient, and easy to work, may be manufactured so as to present an ornamental appearance.

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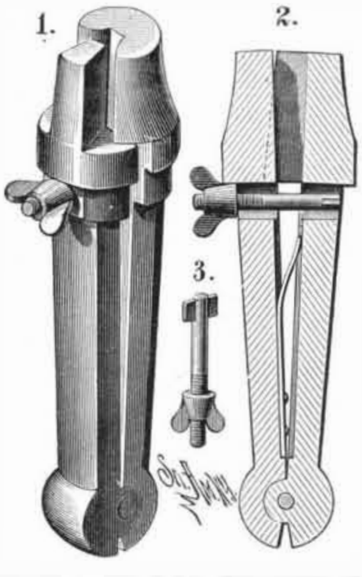
WATCH MAKER'S HAND VISE AND RING BENDER.

The main jaw is formed at one end with a cylindrical head that is so cut away as to form diverging cheeks. The opposite jaw is reduced in size at its upper end to form a nose, which closes in between the cheeks of the first jaw for grasping a wire, ring, or other object. The jaws are pivoted together at their lower ends, and between them is placed a spring by which they are forced apart. Passing through corresponding openings in the jaws is a bolt (Fig. 3), which is locked in the opening at one end and is provided at the other with a thumb nut, by turning which the jaws may be opened or closed.

When the tool is to be used for bending rings, the bolt will be removed; and in order that this may be done without taking off the nut, the head is formed with a small plate which passes through slots in the openings; the bolt is locked in place in the jaws by turning it so that the plate or crosshead will be at right angles to the slots when it enters shallow recesses formed at the back of the jaw. When used as a ring bender, the tool will be placed in an ordinary bench vise, and the ring placed between the jaws, which will be forcibly brought together by the vise. Various other uses to which this tool can be put will be readily perceived.



WATCHMAKER'S HAND VISE AND RING BENDER.

Further particulars may be obtained from the inventor, Mr. C. B. Rubert, of Owego, N. Y.

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How to Determine Expansion.

Mr. C. E. Emery made a very complete series of experiments some years ago upon the engines of the United States revenue cutters Rush, Dexter, Dallas, and Gallatin, from which he deduced the following simple rule (subject to certain limitations) for the best ratio of expansion in steam engines:

Rule—Add 37 to the steam pressure as shown by the gauge; divide the sum by 22; the quotient will be the proper ratio of expansion.

Example: An engine is running with a pressure of 90 pounds per square inch; what should be the ratio of expansion? $90+37=127\div22=5{\cdot}77$=the best ratio of expansion.

Temperature of the Earth at Different Depths.

At a recent meeting in this city of the American Society of Civil Engineers, observations upon the temperatures of the earth as shown by deep mines were presented by Messrs. Hamilton Smith, Jr., and Edward B. Dorsey. Mr. Smith said that the temperatures of the earth vary very greatly at different localities and in different geological formations. There are decided exceptions to the general law that the temperature increased with the depth. At the New Almaden quicksilver mine at California, at a depth of about 600 feet, the temperature was very high—some 115 degrees; but in the deepest part of the same mine, 1,800 feet below the surface and 500 feet below sea level, the temperature is very pleasant, probably less than 80 degrees.

At the Eureka mines in California, the air 1,200 feet below the surface appears nearly as cool as 100 feet below the surface. The normal temperature of the earth at a depth of 50 or 60 feet is probably near the mean annual temperature of the air at the particular place. At the Comstock mines some years since the miners could remain but a few moments at a time on account of the heat. Some ice water was given them as an experiment; it produced no ill effects, but the men worked to much better advantage, and since that time ice water is furnished in all these mines and drunk with apparently no bad results.

Mr. E. B. Dorsey said that the mines on the Comstock vein, Nevada, were exceptionally hot. At depths of 1,500 to 2,000 feet, the thermometer placed in a fresh drilled hole will show 130 degrees.

Very large bodies of water have run for years at 155 degrees, and smaller bodies at 170 degrees.

The temperature of the air is kept down to 110 degrees by forcing in fresh air cooled over ice.

Captain Wheeler, U. S. Engineers, estimated the heat extracted annually from the Comstock by means of the water pumped out and cold air forced in as equal to that generated by the combustion of 55,560 tons of anthracite coal or 97,700 cords of wood. Observations were then given upon temperature at every 100 feet in the Forman shaft of the Overman mine, running from 53 degrees at a depth of 100 feet to 121·2 degrees at a depth of 2,300 feet. The temperature increased:

100 to 1,000 feet deep, increase 1° in 29 feet.
100 to 1,800 " " " 1° in 30·5 "
100 to 2,300 " " " 1° in 32·3 "

A table was presented giving the temperatures of a large number of deep mines, tunnels, and artesian wells. The two coolest mines or tunnels are in limestone, namely, Chanarcillo mines and Mt. Cenis tunnel, and the two hottest are in trachyte and the "coal measures," viz, the Comstock mines in trachyte and the South Balgray in the "coal measures." Mr. Dorsey considered that experience showed that limestone was the coolest formation.

Mr. Theodore Cooper gave a description of a curious slide or slump which recently occurred near Dover, New Hampshire, a large section of a clay formation having gone bodily into the adjacent river, moving trees with it, but leaving between the river and the cavity a bank of considerable width

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Bleaching Sponges.

As is well known, chlorine and its compounds cannot be used for bleaching sponges, as they impart a yellow color to the latter, which in addition become hard and lose their fine texture. The method now generally employed is a water solution of sulphurous acid, and requires from six to eight days, and considerable manipulation. According to the latest researches made in Germany, the bleaching of sponges can be performed more conveniently and expeditiously by means of bromine dissolved in water. As is well known, one part of bromine requires thirty parts of water to dissolve it, and thus a concentrated solution can easily be obtained by dropping a few drops of the former into a bottle of distilled water and shaking it. The sponges are submerged in this solution, and after the lapse of a few hours their brown color changes to a lighter one, the dark red bromine solution, changing at the same time to light yellow. By treating the sponges to a second immersion of a fresh solution, they acquire the desired light color in a short time. They are improved still more if finally dipped in dilute sulphuric acid and washed with cold water. It seems strange that such closely allied bodies as chlorine and bromine should act so differently toward the coloring matter in sponges.

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Cooking and Heating with Gas.

Dr. J. B. Rich, of this city (37 West 22d Street), has been conducting for some time past interesting experiments with gas stoves. The Doctor weighs the articles he bakes, boils, roasts, or otherwise cooks, and keeps an exact record of the quantity of gas consumed and the time occupied in cooking each article, or all together. The manner in which the experiments are conducted impart interest in the Doctor's investigations, and will insure, when completed, a pretty accurate conclusion as to the relative cost of coal and gas for cooking and heating purposes.

The gas stoves used in the experiments are from different manufacturers, and the Doctor has one of his own invention; but unlike most sanguine persons he does not think his stove much better than some others. But that there is vast economy in the use of gas for all kinds of domestic purposes the Doctor has not a doubt, and when through with his experiments the gas companies, gas stove makers, and the public are all to have the benefit of his investigations.

The Colosseum.

This remarkable edifice formed the subject of a lecture lately given at the Royal Institution by Mr. Hodder M. Westropp. The vast size, massive proportions, and repetition of simple features in the Colosseum inspired us, the author remarked, with a sense of grandeur and magnificence which silenced criticism, although, as a matter of fact, there was no single feature free from blame. It was built for the exhibition of gladiatorial shows to amuse the Roman people, and was elliptical in form, consisting of the auditoria of two classic theaters, built face to face so as to permit the largest number of people seeing and hearing at the same time.

By the Romans it was considered the most wonderful structure ever erected, and this feeling of admiration continued throughout the middle ages, as the frequent reference to it by writers testified. So impressed by its size and appearance was the Venerable Bede, that he predicted that it would endure as long as Rome itself. Its name, the "Colosseum," was but a modern appellation, for it was known to the Romans as the Amphitheatrum Flavian, from the fact that it was commenced by the Emperor Vespasius Flavius. It was not, however, finished by him, having been only gradually developed in its ultimate completeness. Vespasian chose a site at the foot of the Esquiline, on the lowest level in the city, but was only able to inclose the arena and construct the three stages of seats around it. To these his son Titus added two more tiers, and dedicated the edifice with shows of the utmost magnificence in the year A.D. 80. It was finally completed in a manner which showed the tasteless extravagance of his age by Domitian, who constructed the upper portion of wood, and arranged in the arena docks, so that sea fights could be represented. In the time of Macrinus the woodwork forming the upper part was struck by lightning and consumed; it was partially restored by Heliogabalus and Alexander Severus, and early in the third century of our era was completed in stone by Gordian III.

The gladiatorial combats were continued with even greater luxuriance and waste of human life, and were not finally suppressed till 403, when an Oriental saint named Telemachus made a pilgrimage to Rome expressly to protest against these demoralizing and inhuman shows, and was, while making that protest, martyred in the arena of the Colosseum. The latest exhibition of wild beasts was in the reign of Theodoric. In 1130 the Colosseum became a fortress of the Frangipani, and in 1332 the benches were restored, and a bull fight, of which Gibbon has reproduced for us a graphic description, was held in the arena. In the fourteenth century the Colosseum was despoiled, the cramps binding the stones being cut out for the sake of the iron, and the masonry removed for building purposes, and even for burning into lime. For a time the depredations were checked, as Pope Eugene IV. granted it to the monks of the adjoining convent; but public opinion was against making it private property, and it was, after a time, resurrendered to the people. At a later period, it was again used as a quarry, and from it the palaces of the Farnisi and Barbarini families were largely built, but it was afterward again placed under the protection of the Popes, and is now national property.

The first archæological excavations in the arena were made between 1810 and 1814 by the French. They only went down some 10 feet below the surface, being deterred by the influx of water, and never reached the original floor level. In 1874–75 a fresh series of explorations was commenced by the Italian Government, at the instigation and under the direction of the late John Henry Parker. Twenty-one feet below the present level, the excavators were rewarded by discovering the original floor of the arena, with the wonderful series of substructures built upon it in the time of Commodus. Turning aside to give a general description of the building, Mr. Westropp mentioned that it was 650 feet along the major axis of the ellipse and 513 feet across, and rose, as completed, to a total height of 157 feet above the surrounding ground. This immense outer wall consisted of four stories, of which three were of Vespasian's structure, and the fourth, a loftier and very different one, represented Gordian's addition. Three stories were decorated with columns, and the upper one with pilasters, each of a different order. The columns were of equal diameter, and divided the circumference into 80 arcades on each level. That on the ground story, which was 30 feet in height, had a Doric order; the next, 38 feet high, was Tuscan; the next, also 38 feet high, was Ionic, and the upper stage, 44 feet high, which had no arcading, but instead a series of rectangular window openings, with shields between, had pilasters of the Composite order, a style which was excellently fitted for its lofty position by the boldness of its volutes and general treatment.

In the lower story seventy-six of the arches were ordinary entrances, aptly termed "vomitoria," and each bearing a distinctive number; the other four openings were reserved for the Emperor and other distinguished personages. Each voussoir in these three lower arcades had a mortise and tenon on its edge, so that they could be fitted to each other in each half of the arch, without necessitating the use of centering during construction. Behind these arches on each floor, and between the outer facade and the tiers of benches, was a spacious corridor leading to the seats, and to stair cases leading to the upper levels of the arena. Each stage was marked off by an entablature, and the whole was crowned by one of greater boldness, above which was an attic. This upper entablature was supported by brackets, and in it were pierced a series of holes through which formerly passed the ropes by which the telum or velarium, an immense curtain, protecting the spectators from the sun and rain, was drawn toward or from the mast in the center of the arena. The materials used for walling were marble and travertina for the exterior, pepinino for the internal walls, and tufa and brick for filling in. The seating was by movable wooden benches. The lowest level next the arena was known as the podium, and was protected from the animals by a low wall, and was reserved for the emperor, consuls, and other distinguished personages; above this was the mœnianum, or seats for the equestrian order; above these, those for the populace, and women were admitted to the upper gallery only. Great discrepancies existed between the statements as to the number of persons that could be accommodated in the Colosseum; but Mr. Fergusson, on a careful calculation, estimated that no fewer than 50,000 persons could be provided with seats. The excellent adaptation of the building to its purpose, and the skillful arrangements for free ingress and egress, deserved the highest commendation.

The arena itself was originally formed by Titus on the ground level, but this was found to be too low to be easily seen from the auditorium, and thus, probably in the time of Trajan, and certainly before that of Commodus, its level was raised 21 feet by means of substantial substructures, between which were left five longitudinal grooves or docks, three straight, the other two curved, which could be filled with water from a neighboring aqueduct for floating galleys upon, and also a numerous series of square pits in which were placed the cages of animals; in recesses under the podium and seating were other dens for wild beasts. The arena, as raised in the days of Commodus, had an internal diameter of 287 feet by 180 feet; it was paved with bricks over the solid substructure, and the docks and square apertures were covered in with boarding. In the central dock, during the recent excavations; part of the timber framework for raising decorations and scenery was found, and also the socket in which the velarium mast was lifted, and at one end was a drain protected by iron bars, through which the water was run off. It was evident that lifts were provided in the square holes for raising the animals' cages at the proper moment. In conclusion, the lecturer quoted descriptions of combats and pageants held in the Colosseum, and remarked upon the singular fact that, although this was one of the vastest and most greatly admired of ancient structures, the name of no architect who was concerned in its construction was known to us.

Gas in Iron and Steel.

The following is a summary of a highly interesting paper on the subject, published a short time ago by Dr. Friedrich C. G. Müller in our German contemporary, *Stahl und Eisen*, and forming a sequel to Dr. Müller's report on his previous experiments:

It is an undeniable fact that iron of every description, whether solid or liquid, and whatever the temperature may be, is possessed of the faculty of absorbing gases. This faculty applies in the highest degree to hydrogen, and in a smaller degree to oxide of carbon, carbonic acid, and nitrogen. From a series of experiments it would appear that hydrogen, the same as palladium, is able to form a sort of alloy with iron, and to exercise a very great influence on the physical properties of the metal alluded to.

Inasmuch as all iron obtained by known metallurgical processes comes into contact with the aforenamed gases while in the course of formation, it is obvious that it must necessarily absorb a larger or smaller quantity of such gases. In point of fact, gases of an undeniably combustible nature escape from it both in its liquid state and in the course of its solidification; but even after the iron has become solid and cold, gases may be extracted from it by heating in a vacuum, or by other physical or chemical methods. In each instance in which an analysis is resorted to, it points to the presence of a mixture of H, CO, N, and CO_2.

For the practical metallurgist the secretions of gas in bubble form which take place within the metal are of incomparably greater importance than the mere presence of gases or the silent emanations of gases which are invariably to be found in every smelting process. The phenomena of secretion are essentially of two kinds, viz., (1) scattering or spitting, and (2) rising. I have at all times attached great importance to this distinction, and shall continue to do so in the future, having fully satisfied myself that many fatal errors spring entirely from one of these two phenomena being taken for the other, and *vice versa.*

Scattering consists in a secretion of gas, which takes place within the liquid metal while it is cooling down to its point of solidification. In this case, as in that of a recently uncorked bottle of seltzer water, bubbles are formed throughout the liquid, and rise to its surface. While the surface of the iron remains in a liquid state, a frothing and fizzing takes place in consequence of this, but, as soon as the surface is solidified, the gases keep some minute channels open, through which they spit out particles of liquid metal. It is obvious that the bubbles which come up to the surface can do no direct harm whatever. Apart from the surface, which, of course, is not to be relied upon, there is no reason why steel of the description named should not yield sound ingots. The dangerous time is when there is but little liquid metal left, forming a narrow channel in the center of the block. If the width of this channel increases from the base upward, the block becomes dense and compact, but if it closes up at the top, the gas that escapes below must gather in larger quantities. It, therefore, stands to reason that, in casting a very restless sort of steel, it is as well to see that the casting increases in a regular way from the base upward.

In the case of the second description of secretion of gas—*i. e.*, the rising, or ascent—the well known worm tubes, which spread radially, come to a development. While, in the case of scattering, the central portions of the block are most in danger, the parts immediately beneath the surface are principally endangered by the rising. When rising takes place, a quantity of the liquid metal in the interior, corresponding to the volume of the pores, is pushed with great violence toward the surface, which is thereby raised or broken. The experiments undertaken by me have shown that the gas intercepted in the pores of the cooled down steel is still possessed of a pressure of 60 pounds to the square inch; it must, therefore, be assumed that at the moment when it escapes its pressure cannot be less than 300 pounds to the square inch. If, while cooling down, the metal be exposed to a still greater artificial pressure, the gases will not be able to escape at all.

If the shell be closed up, blocks with very dense cores are always obtained in the case of steel that rises quietly, and it is to be assumed that in such like cases a good deal of gas oozes out into the open air through the thin outer crust.

However great the difference may be between scattering and rising, both phenomena may yet be found existing side by side in one and the same piece of metal. Thus, *e. g.*, Thomas-Gilchrist steel, which is restless and spits, shows yet a certain tendency to rising. The radial channels, which are found in a horizontal position in the ordinary description of blocks, are the outcome of an exhalation of gas from the metal—which, having already been solidified, has entered upon the transition stage—and cannot, by any possibility, be looked upon as gas bubbles formed in the liquid metal and intercepted, as it were, by the process of solidification. Both the form and the arrangement of the worm tubes are calculated to controvert such a theory.

In turning out the liquid core of a partly solidified block of rising steel, a hollow body shows itself, the inside of which, though perforated, is exceedingly smooth. Hence it becomes apparent that iron does not solidify like sulphur, the inside of which shows a whole mass of pointed crystals in the liquid part, which crystals might very well intercept rising gas bubbles. While in the case of properly rising steel the metal is found perforated like a honeycomb beneath a thin non-porous crust, it is quite another thing in those instances in which the rising tendency is but slight. In these cases the wreath of pores gets more and more into the interior, and the outer crust becomes thicker and stronger in proportion. At the same time the pores are getting more and more rounded off. This much is certain, that in those cases the secretion of gas is attended and supported by the well known phenomenon of contraction, which, even in the case of absolutely dense steel, produces deep central cavities. As regards the nature of the gas to which the formation of worm tubes is to be traced, Stead's experiments have corroborated the result of mine, viz., that the pores of the refrigerated steel contain hydrogen mixed with 15 per cent of nitrogen; but, on the other hand, they contain neither oxide of carbon nor carbonic acid, or at most but traces of these; the quantity of gas brought out was in keeping with the volume of the pores, and the pressure amounted, on an average, to 60 pounds to the square inch.

All these facts go to support the proposition set forth by me, that the immediate cause of the rising—not of the scattering—is to be sought in the secretion of absorbed hydrogen and nitrogen. In reality, this is not a hypothesis, but rather a self-evident statement of facts; the more so since hydrogen has, in each instance, shown up as an integral part of the gases whenever drilling experiments have been made or an analysis of the gases given out by iron and steel spontaneously or in a vacuum has been resorted to.—*Ironmonger.*

Purification of Water by Motion.

A discovery has been made by Dr. Pehl, of St. Petersburg, which promises to have a very important bearing on many industrial processes. The water of the river Neva is very free from bacteria, having only about 300 germs in a cubic centimeter. The canals of St. Petersburg, on the contrary, are infected with bacteria, their number reaching 110,000 in a cubic centimeter, even during good weather. The same is true with regard to the conduits of water for the supply of the city. While the chemical composition of the water passing through these city conduits hardly differs from that of the Neva (by which they are supplied), the number of bacteria reaches 70,000, against 300 in the water freely taken from the river; and the worst water was found in the chief conduit, although all details of its construction are the same as in the secondary conduits. Dr. Pehl explains this anomaly by the rapidity of the motion of the water, and he has made direct experiments in order to ascertain that. In fact, when water was brought into rapid motion for an hour, by means of the centrifugal machine, the number of developing germs was reduced by 90 per cent. Further experiments will show if this destruction of germs is due to the motion of the mass of water, or to molecular motion. If this discovery of Dr. Pehl's be confirmed, it will become possible to destroy bacteria, and render a water comparatively pure simply by passing it through a centrifugal machine. The subject is of special interest to brewers, who suffer, perhaps, more than any other manufacturers, from the attacks of bacteria.