publishers had done me wrong, and I feared that my criticism might not be without prejudice. I like to meet an assailant openly. With a coming defense, just written, of myself against a craftily devised array of injurious misstatements, of which the Riverside Shakspere has been made the occasion, I hope and intend that my casual and compelled contributions to this unlovely department of literature shall end.

Richard Grant White.

April 14, 1884.

Recent Improvements and Inventions.

IN photography the most recent improvement is a new style of camera for the rapid gathering of photographic memoranda. The instrument we have examined makes a picture 4 × 5 inches; it is a simple wooden box with a handle on top, and looks like an ordinary traveling bag or sample case. It is designed to be used only with instantaneous dry plates, and as such work does not require a fixed support, it needs no tripod. The adjustment for focus is attained in the usual way, by means of a ground-glass slide placed at the back of the box. To move this there is a brass arm on the top of the box, pivoted at one end, the free end traversing a segment, and fitted with a set-screw so that it can be secured in any position. By moving this arm over the segment the glass slide is moved forward or back in the box, and shifted as the focus requires. The camera is set up before some object, say twenty feet away. The arm is moved while looking at the glass, and when the focus is sharp a mark is made on the segment to indicate that in that position of the arm the focus is good for that distance. In like manner the focus is found and marked for other distances, when the glass is removed, and the rear of the box permanently closed. Thereafter, to get the focus, estimate the distance of the subject, bring the arm to the proper mark on the segment, and fix it there by means of the screw. The focus can even be decided upon in advance, and the exposure can be made when the operator, walking toward the subject, sees that the distance decided upon has been reached. To secure the picture evenly upon the plate, a small "finder" or supplementary camera is placed in the box near the top, and by raising a wooden lid a small square of ground glass is seen, on which the projected image is visible in the same relative position in which it will appear on the plate. To make an exposure a finger-knob is pressed, and the shutter within the box is moved. The lens, plate-holder, and shutter are all inclosed in the box, so that the apparatus has nothing of the conventional camera about it. In using the camera, it is held in the hand or on the arm or supported on any convenient object. Instantaneous pictures can be taken while running, while on a boat or car, and in the most crowded streets, without attracting attention. Portraits and pictures of groups, incidents in the street, or the behavior of men and animals can be caught during the most rapid action, and without the knowledge of the subjects. For reporters, detectives, and amateurs the camera will, no doubt, prove of great value in obtaining legal evidence in case of accidents, fires, robbery, or riot, and in studying the habits of birds and wild or timid animals. The camera is called Schmid's detective camera, and costs, with good lens and one 4 × 5-inch plate-holder, about fifty-five dollars.

While the number of patents issued each month in this country for electrical appliances is very great, only a few appear to be of general interest or to mark any great and radical advance in this field. Two recent patents appear of interest from their suggestiveness or promise of future usefulness to the people. The most simple one (properly a new application of an older invention), is the application of the incandescent electric lamp to dentistry. The lamps examined by the writer are inclosed in glass bulbs of the usual shape, an inch long and less than half an inch wide, the source of power being a simple battery of four cells holding perhaps one quart each. To protect the mouth of the patient from the heat of the lamp, the bulb is placed in a casing of hard rubber having an opening at one side covered with glass. The whole apparatus exclusive of the handle is about as large as a teaspoon, and is easily held in the mouth. Placed in the mouth with the lips closed over the handle, the entire front formation of the patient's face was visible, showing the position and shape of every bone and tooth through the skin, even the interior of the nasal passages being plainly visible. On holding the lamp behind the teeth with the mouth open, the entire formation of the teeth could be fully seen. A filling could be traced completely, and the progress of decay in the interior of one tooth (which was not visible at all on the outside) could be plainly seen. In like manner every portion of the mouth could be completely explored in a manner that could not be done by any mirrors reflecting daylight or lamp-light into the mouth. The lamp was left in the patient's mouth for some time, and yet no more inconvenience was said to be experienced than from a drink of hot coffee. To the dentist and surgeon the invention certainly seems, from the examination made, to promise a useful method of diagnosis. It gives information of the interior portions of the bones of the face and the teeth that could be obtained in no other way. When developed and perhaps tried in other shapes, and with different styles of lamps, holders, and reflectors, the invention will no doubt prove of great value.

Another invention examined seems to mark a very decided step toward a reduction in the cost of telegraphy. In its main idea it is a modification and improvement of inventions made before, so that its novelty, as well as its value, consists in the bringing of older ideas to a practical result. It is essentially the subdivision of a telegraph wire so that a great number of messages may be sent over one wire at the same time. To accomplish this, M. La Cour's phonic wheel is employed as a means of connecting the ends of a line-wire with a series of branch wires. M. La Cour's wheel consists of a horizontal wheel divided into, say, sixty radial sections or spaces. Above the wheel is a trailing arm supported by an upright spindle that passes through the center of the wheel. Every alternate section is connected through the apparatus with the ground or "to earth." The intervening sections are connected through the trailing arm with the line-wire. It may be supposed that the wheels at each end of the line-wire are so placed that the trailing arm of each is

resting, say, on section No. 1. The two wheels are now connected and a current will pass. Both wheels move forward together, and the trailing arms at the same instant reach No. 2, which is to earth, and the line is discharged. The two wheels advance together to No. 3, and the circuit is closed again. Now it is easy to imagine that every tenth section of each wheel is connected with a branch wire. Every fifth section is connected with another branch wire. Now, if the two wheels are moving rapidly and exactly together, say at a speed of sixty sections a second, one branch is connected with the line and thrown off again six times a second, while the other branch is connected five times and a half in one second, or at the same speed as the other, but alternating with it. Six times a second each operator on one branch has the line to himself, and, if he telegraphs slowly, he will hardly perceive that the line has been taken from him and returned again. Increase the proportion and connect the branch, say, ten or twenty times a second, and the operator cannot realize that he is sharing the line with any one else. This division of the sections may be even more minute. One branch may be connected with the line at the first, third, sixth, ninth, etc., section, and another with the second, fifth, eighth, etc. Each branch will have the line so many times in a second, but so rapid is the movement of the wheel that to the operators there is no break. Each operator at the end of his branch sends or receives, and to the ear no loss of continuity can be perceived. By using a printing telegraph at the end of each branch, the connections with the line need not exceed twice a second, and by means of wheels of the proper proportion of sections seventy-two messages can be sent slowly over one wire at apparently the same time. Actually the seventy-two messages are marching in procession one after the other in confused fragments. Tap the main line, and nothing can be learned of the messages, as each is traveling in detached parts of words and letters; yet at the end of the line the wheel distributes to each branch its proper fraction from the confused medley of signals, and each printing apparatus pieces together its own letters to spell out its message. It will be seen that this multiplex telegraphic system depends wholly on exact correspondence between the two wheels. If one is in Boston and the other in Providence, they must move together or the messages will be confused. There appears to be no mechanical device for accomplishing this, and it has been thought that it could not be accomplished. The chief value of the improvement of the system is found in an invention for moving the wheels, and for causing one wheel to control the other. The motive power is a local battery that by means of an electro-magnet sets in vibration a tuning-fork. The swing of the arms of such a vibrating-fork makes and breaks a second circuit, that by means of an electro-magnet causes the wheel to revolve. On the wheel are two sections somewhat wider than the others. When the two wheels, each moved by its tuning-fork electro-motor, are moving exactly together, they reach the wider sections at the same instant. If one for any reason reaches the section before the other, it operates, by means of a special branch and magnet, a switch that tends to throw more resistance into the motor circuit, and the tuning-fork vibrates more slowly, and the wheel is retarded till the second wheel overtakes it, when they move together again. This correction takes place continually, many times in a minute, so that the variations will never be so great as to impair the continuity of any one of the seventy-two branches using the single main line. This, in brief, is the Delany synchronous multiplex telegraphy. At an examination of the system in operation over the equivalent of two hundred miles of line-wire, six Morse instruments were in use at once, and each had the line virtually to itself. The printing telegraph worked fast enough for all business purposes, and it certainly had the merit of being quite independent of any Morse instruments or other printers that might be used at the same time. The system is soon to be tried on a commercial scale, and its results will be watched with interest, as it is in its present experimental stage the most promising invention in this field of work.

Charles Barnard.

The Tax on Whisky.

THE national tax on spirits should not be repealed. Thirty-two quarts of corn make almost sixteen quarts of whisky. The corn is worth from fifty to sixty cents, and the wholesaler will receive for the whisky from ten to twelve, and the retailer from twenty to twenty-five dollars. Profits so great appeal with irresistible force to the cupidity of men, and the result is twelve hundred and fifty registered distilleries and two hundred thousand liquor-dealers in the United States. The average consumption of domestic spirits is about 75,000,000 gallons a year; but the greed of the distillers has, for the last four years, raised the production to an average of over 90,000,000 gallons; so that on June 30th, 1883, there was a stock on hand in the United States of 116,000,000 gallons, of which 80,000,000 were still in the bonded warehouses and the tax unpaid. By means of warehouse receipts this has passed largely into the hands of speculators, or capitalists who have advanced money on it. Seventy-two million dollars' tax on this whisky will soon be due the Government, much of it in the next few months.

If the tax could be repealed, this money would remain in the pockets of the whisky owners, who are the most active and energetic workers for the removal of the excise. A second class who favor repeal are the "moonshiners" of the South, who regard the right to convert the product of their own fields into "a necessary article of daily diet" as an "inalienable" right secured by the Constitution; their representatives therefore favor the repeal. But the chief strength of the movement for free whisky lies in another direction. The internal revenue, mostly from liquors and tobacco, amounts to more than $100,000,000 a year. The import duties amount to $200,000,000 more. These sums, with the other sources of income, furnish $100,000,000 a year more than the Government needs, and shrewd men foresee that the people will not long continue to pay into the national treasury such a surplus to serve as a corruption fund to Congress. Hence the friends of the present tariff would willingly strike off the tax on spirits and tobacco, in order that the Government shall be compelled to retain the present high duties. One or the other must go, either the tax on

tor Resartus"; nor do Richardson, Latham, and the rest come much nearer the scientific ideal. They are monuments of literary taste, skill, knowledge, and even of genius, but they are not truly scientific; for not one of them recognizes that, as a man of science, the lexicographer has no right to express an opinion until all the facts upon which that opinion *ought* to be founded are before him. They exhibit everywhere the freedom of the *littérateur*. But the editors of the "New Dictionary" have proceeded differently. First, with the aid of hundreds of others, they have collected millions of facts, and only when these were all in their hands have they ventured to express their opinions as to the meaning of any. This is the true scientific spirit; and that it has taken firm hold of lexicography in all its branches is indicated by the similar scheme for a great Latin lexicon, which is being carried into execution by Professor Wölfflin. Is not this a sign of the times. And may we not hope that the same spirit will soon drive out the personal element, the arbitrariness of individual opinion and feeling, from the remaining departments of scientific thought, from literary criticism, æsthetics, biography, and philosophy? Certainly the fact that over one thousand persons (readers) have been found who have not only appreciated the scientific aim which the Philological Society has set before them, but have also enthusiastically devoted themselves to its promotion, ought to encourage those who are working for this grand result.

Detailed criticism of the book will undoubtedly reveal many errors. In the relatively small part of it (A–Ant) which has been published, critics have already discovered a number of omissions and other more serious imperfections. But the critics and all will do well to bear in mind what Dr. Murray, in a recent number of "Notes and Queries," suggests, that omissions are due not so much to those who *did* accept his general invitation to work as to those who *did not.* There is yet time for repentance. Let all who have any information which can be of use to Dr. Murray send it to him at once. *S.*

Recent Inventions.—Domestic Refrigeration.

A LOW temperature is often a sanitary necessity. The germs of disease can be controlled or destroyed by lowering the temperature. So clearly is this now seen that the power to lower the temperature of the air has come to be regarded in both the cure and prevention of disease. In all these domestic and sanitary applications of cold or refrigeration, ice has been the only material employed. In breweries, packing establishments, and abattoirs where refrigeration is required upon a large scale, or, in other words, where very great quantities of ice must be used, artificial refrigeration has in a large measure taken the place of natural ice.

Natural ice has several serious objections. It is heavy and cumbersome, wet and sloppy, exceedingly wasteful, and may be the vehicle for disease. These objections are so serious that the question is now raised whether in our larger cities mechanical refrigeration would not be safer, cheaper, and better. Intensely cold liquids or air chilled to many degrees below zero can now be delivered from a central station through pipes in the streets to all the houses within any moderate area, say two blocks in every direction. The lofty apartment houses, accommodating in some instances one hundred families under one roof, can with equal facility deliver from a machine in the cellar any required degree of cold in the pantry or store-room of every tenant in the building. These refrigeration machines are now on a firm technical and commercial basis, and can be as safely depended on to do the work required as any ordinary machinery. Two types of these machines are made and used in New York; and from an examination of a number in actual operation it may be safely predicted that they will in time be largely used to supply domestic refrigerators in place of ice. These two classes of machines are the anhydrous-ammonia machines and the compressed-air machines. In theory the anhydrous-ammonia machines produce cold upon the following circle of operations. The ammonia is compressed in a compressor driven by a steam-engine. The immediate result, as in all compression, is heat. If now this heat is extracted by passing the ammonia through pipes cooled by water, the ammonia will be in the form of a liquid under pressure, and both eager to expand and greedy for heat. If it is now allowed to expand and to return to the form of a gas, it will absorb heat from everything near it. If allowed to expand in pipes submerged in water, the water will immediately freeze. By mixing salt with the water, it will part with its heat and become intensely cold without freezing. If the machine is to make ice, it is only necessary to sink metal cans filled with pure water in this cold brine, and they are soon frozen, and when lifted out can be dipped in warm water and the solid block of ice will fall out. If it is not intended to make ice, but only to refrigerate a meat-safe, or cold-storage room, it is only necessary to place coils of pipe in the chill-room and to pump the cold brine through them, when the brine will absorb the heat of the room and lower the temperature to any degree required. In a cold-storage warehouse examined, the temperatures ranged in the different rooms (according to the material stored in them) from eighteen above zero to forty above, each room being of a fixed temperature. In the colder rooms fish and poultry frozen hard were said to have been in that condition for many months.

The compressed-air machines are in theory essentially the same. The machines examined are known as the "dense-air" machines, the air following a closed circle and never expanding to the normal atmospheric pressure as in some of the European machines. Air is compressed by a steam-engine, developing heat which is removed by passing the air through pipes submerged in cold water. It is then allowed to expand, but in a wholly different manner from the ammonia machines. The air expands in a motor while doing work, and this motor is directly coupled with the steam-engine and assists it to drive the compressor. The exhaust of this air-engine is intensely cold. Two methods may now be pursued. The cold air may be led through pipes in a tank of brine and the brine circulated through the cold rooms, or the air-pipes may pass through the rooms and be the immediate agent of refrigeration. The air is not allowed to escape in the circle, but is condensed to a pressure of two hundred and twenty pounds to the inch, and expands in

the air-engine to a pressure of sixty pounds to the inch. In the machine examined, the temperature of the air in the pipes was, on starting the engine, sixty-four degrees Fahr., and in twenty minutes had fallen to thirty-two below zero, while in a few minutes after starting the pipes in the brine-tank were coated with frost.

There seems to be no reason why both of these types of machines may not be used to supply cold to domestic refrigerators by circulating either brine or cold air through a coil of pipes. The system would certainly be clearly safe in a sanitary sense (for only brine or air enters the house in closed pipes), and probably cheaper than ice. All the refrigerators in the stalls of the new Washington Market are to be kept cold by pipes filled with brine sent from a central station through the streets. One large apartment house has already this plan under consideration for supplying cold to all the tenants.

Charles Barnard.

Booth's Escape.

HAVING read the account of Booth's escape from Maryland into Virginia, in your April number, I cannot let the matter pass without correcting some errors in the narrative, as far as concerns the adventures of the fugitive and his appearance at Dr. Stuart's.

I was a guest at the home of Dr. Richard Stuart (not Stewart) when the unfortunate man came to the house. He asked to see Dr. Stuart, saying that he "was suffering from a broken leg, and wanted medical aid." The family had just risen from the evening meal (supper, not breakfast); there were a number of friends in the house just returned from Lee's army; every room and bed was occupied. Dr. Stuart was absent. Mrs. Stuart received the two men,— none of us knew who they were,—and, according to the usual custom of the family, they were invited in and given their supper. Booth, as one of them afterward proved to be, requested lodging. It was impossible to accommodate him, nor would any one unknown to the family have been taken in. A party of strangers who had been entertained on a former occasion proved to be spies. They afterward arrested Dr. Stuart, and conveyed him to the Old Capitol Prison, where he had remained many weary months. Profiting by this experience, no one was ever afterward received under suspicious circumstances, such as surrounded these men.

At bed-time the strangers were shown the way to the house of a respectable colored woman — a tenant of the Doctor's — near by, who had a spare room, where they slept that night. It frequently occurred that belated travelers were lodged there.

Dr. Stuart's fortunate absence in all probability saved the whole family from prison; and Mr. Townsend has neglected to state that, although the Doctor was away from home, and in fact never saw Booth, at that time or subsequent thereto, he was for this simple act of hospitality on the part of his family arrested again and thrown into solitary confinement, where he remained many weeks.

The letter which Mr. Townsend mentions was written from the woman's house, and though couched in polite but sorrowful language, interlarded with quotations from Shakspere, was very mortifying to the family. However, it afterward proved to be the key which opened the prison doors to the Doctor — a noble Christian gentleman, the very soul of hospitality, a man who was never known to turn from his door the poor, the unfortunate, or the distressed.

Although the shot fired in the theater by Booth was the greatest disaster that ever befell the Southern people,— I do not except the fall of Richmond or the surrender of Lee,— yet to my dying day I can never think but with pity of the sad, handsome face of the poor wanderer as, with all hope dead within him, suffering agony in body and mind, leaning upon a broken oar, and wrapped in a heavy fringed shawl, which fell in graceful folds from his right shoulder, he slowly and painfully passed out into the night.

E. G. D. G.

Church Music: A Letter to the Rev. Dr. Robinson.

MY DEAR SIR: No one interested in church music can be otherwise than edified by your admirable letter in THE CENTURY for April. The error in it is, however, fundamental. You write of church congregations as assembled *for the worship of God*. Nothing could be further from the truth. The buildings and trimmings of churches are simply the survival of a practice around which a multitude of pleasant and tender recollections twine, but the true and original spirit of which has utterly perished. Indeed, the churches have very aptly been styled the dress-parade of modern civilization. Leaving out of sight, for argument, the consideration of the purpose for which people are in theory supposed to attend churches, and falling back on your own actual personal experience, ask yourself what are the real objects which engage the thoughts and attention of the persons whom you yourself actually know. Unless your experience differs vastly from mine, you will admit that these objects are, at one end of the church, dignified and polished oratory; at the other, sensuous and ravishing strains of music; and in the territory between, unexceptionable manners and rich and stylish apparel. When people are leaving church, what subjects other than these form the staple of conversation? And when the clergyman makes a "pastoral" (!) visit, in what other topics does he hope to interest his parishioners? I say it without a particle of irreverence, and with no desire to wound the feelings of any one, that modern church-going is simply a form of decorous Sunday amusement, differing only in degrees from the so-called "sacred" concert. If this be so, as I am very sure it is, and if it be found that the best music is furnished by foreigners, why should the easy-going German and the dark-browed son of Italy be banished from our organ-lofts? And if people want fine music, good oratory, and brave millinery, why should they not have them?

Sincerely yours,

A Pew-owner.