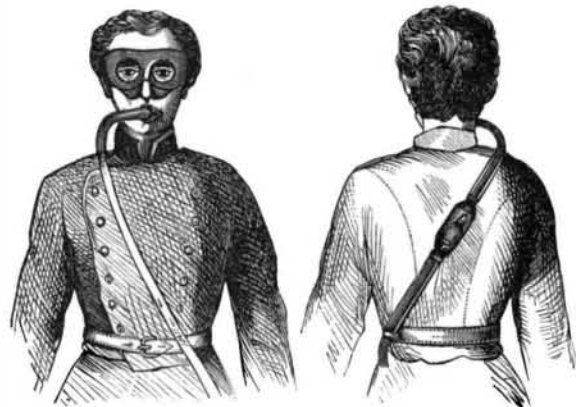


APPLIANCES FOR SUPPORTING LIFE IN IRRESPIRABLE MEDIA.

In 1853 the Belgian Academy of Sciences offered a prize for the best appliances which should enable the miner to penetrate at once, and to a great distance, into a pit filled with choke-damp; to remain there several hours; to carry his lamp with him without danger; and to retain the free use of his arms. Of the competing apparatus sent in, the Galibert, Fayol, and Denayrouze aërophores were the principal ones which survived the test of actual experience.

The Galibert respirator consists of an air-tight reservoir of waterproof cloth, carried on the back like a knapsack,



Figs. 1 and 2.—Rouquayrol's Respirator.—Front and Rear.

from which the wearer draws his air supply, and into which he exhales the products of respiration. The limited supply of air and danger of injuring the reservoir rendered this plan of little use. The original apparatus of M. Fayol was very similar; but the respired air was ejected through a valve opening upward. A small tube also led the air supply to a lamp. This respirator lasted about fifteen minutes. An improvement was introduced in connecting several respirators, by flexible tubes, with a central reservoir, into which air was forced by a pump. In this form the Fayol respirator has been used with success, but the complication of flexible tubes forms a great obstacle to its extended application.

In 1875, the apparatus invented by M. Rouquayrol, and improved by M. Denayrouze, of Paris, was awarded the Montyon prize of 2,500 francs. Considerable improvements have since been made on the plan, as the following description and cuts (taken from *Iron*) will best explain:

The respirator, shown at Figs. 1 and 2, consists of a tube, light, strong, and flexible, terminating in a mouthpiece held between the teeth, while a flange of suitable shape is adjusted between the lips and gums for keeping it in place. The tube passes across the back of the wearer, being held by a belt and cross strap; while fitting in the hollow of the back is the valve box, shown enlarged at Figs. 3 and 4, the latter being partly in section. The valve box is of metal, and is provided with two reed valves; they consist of two flat sheets of India-rubber, stuck together at the edges, so as to remain closed until the internal pressure exceeds the external. These valves are arranged to open in opposite directions; that in the interior of the box permits the outer air from the tube to enter the box, while the other allows the respired air to escape at the proper moment. On account of

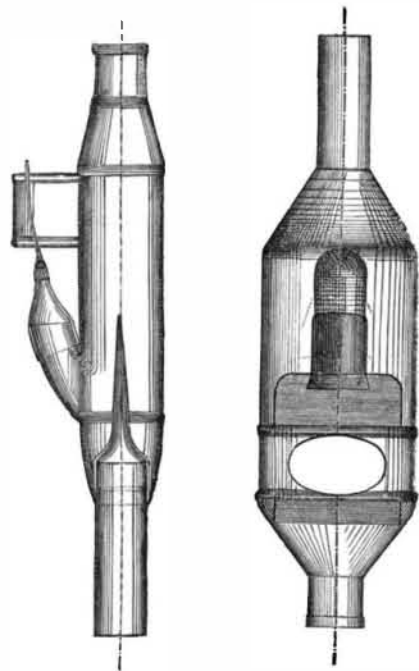


Fig. 3.—Valve Box of Rouquayrol's Apparatus. Fig. 4.—Valve Box, Enlarged and in Section.

the nature of these valves, the slightest excess of pressure between the two elastic leaves causes them to separate and yield passage to the air, so that breathing is effected with the greatest facility. The nostrils are closed by the mask, shown separately at Fig. 5, which combines the goggles for protecting the eyes with a nose clip. The latter consists of a pad made of double India-rubber cloth, the space between being inflated with air, so as to form a soft cushion, which adapts itself to the face. In this respirator the outer end of the tube is simply put in communication with the outer air; but for distances greater than 100 feet respiration becomes

difficult, and a pump or pair of bellows must be brought into requisition for giving the air supply.

Another high pressure aërophore, shown in use at Fig. 6, is composed of three stout cylindrical chambers of sheet steel connected together and carried on the back like a knapsack. The apparatus, filled with air compressed to 30 atmospheres, affords a supply capable of lasting half an hour. The air, after passing through an ingeniously designed



Fig. 7.—Schultz's Aërophore.

regulating valve, which enables the wearer to breathe with perfect ease, is conveyed to the mouth by a tube terminating in a flange inserted between the lips and teeth, while the exhaled air is discharged through the reed valve at the side. There are two smaller tubes, one in connection with a safety-lamp, and the other connected with a pressure gauge for showing how far the air supply is becoming exhausted.

The aërophore devised by Herr Schultz, captain of the fire brigade at Aschaffenburg, Bavaria, depends upon the regeneration of the exhaled air, the oxygen being produced as it is consumed. It consists of a simple reservoir of sheet iron, into which the products of respiration are returned. The respired air is led from the mouth by a flexible pipe to a cylindrical tube containing a layer of wadding to intercept dust; and pieces of pumice-stone saturated with caustic potash absorb the carbonic acid. This tube is in direct communication with the reservoir, as is also another tube on the other side containing pumice-stone saturated with dilute acetic acid and sprinkled with crystals of permanganate of potass. This latter is for replacing the oxygen absorbed in respiration, and for adding a certain amount of humidity to the air, which makes it fresher for breathing. Fig. 7 shows a German fireman provided with the apparatus. The flex-



Fig. 6.—High Pressure Aërophore.

ible tubes for inhalation and exhalation are connected to the bottom of the reservoir. The apparatus only weighs about 10 lbs., and may be used for half an hour together.

It is easy to foresee the possibilities of a further development of this principle. It may be instrumental in saving life not only on the recurrence of mining accidents, such as occur almost weekly in the Pennsylvania mining districts, but when, for instance, a house is on fire, and it is impossible, on account of the smoke, to reach those whose means of escape is cut off, and who must in too many instances, as in the Hale pianoforte factory fire, be left to perish in the flames. In chemical works and breweries, also, persons overcome by mephitic gas might frequently be saved were there some simple and efficacious means for effecting a rescue without danger to the rescuer. If hung in bedrooms, it would save the inmates, who might not awake until the fire was far advanced.

Miscellaneous Notes.

PEROXIDE OF HYDROGEN is recommended to prevent the spread of scarlet fever and small-pox, as it contains a larger amount of oxygen than any other known substance, and one half of which is loosely combined and in a highly active condition, ready to combine with any organic matter with which it may be brought in contact.

It would seem, therefore, to be an agent specially suited for the destruction of the poison germs of scarlet fever, small-pox, and other epidemic diseases.

As a disinfectant it is recommended, and may be sprinkled over letters, papers, and articles of clothing, and may be combined with any perfume, preferably with toilet vinegar or eau de cologne, in the proportion of about a drachm to the ounce.

WHY THE MEDICAL PROFESSION IS CROWDED.—In the United States, with a population of 44,874,814, there are 62,388 doctors, being 1 doctor to every 600 persons. In France the population is 36,100,000; the physicians 19,902, being 1 doctor to every 1,814 persons. Great Britain, with a population of 32,412,010, has 19,385 doctors, or 1 physician to every 1,672 persons. In the German Empire there are 13,686 doctors for a population of 41,060,695—1 doctor to every 3,000. Austro-Hungarian Empire, population 35,904,435, and 14,361 doctors, being 1 physician to every 2,500 persons.

SIMPLE METHOD OF PREPARING STEREOPTICON SLIDES.—We are indebted to the Rev. W. H. Dallinger, of England, the well known microscopist, for a simple method by which a lecturer can prepare his own slides. Take a piece of glass of the proper size to suit your lantern, that is carefully

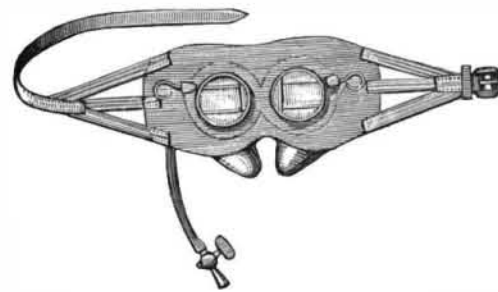


Fig. 5.—Rouquayrol's Apparatus.—The Mask.

ground on one side, like the focusing glass of a camera. Now place the glass with ground side up over a piece of white paper and make your sketch, or place it over the illustration in a book, or upon any drawing you wish to copy, and trace the outline, and afterward delicately shade with H.H. H.H. and H.H.H. pencils, and for deep shadows H.B. By delicate employment of the pencil, shadows softer than can be procured in lithography may be made.

Color can now be added, if necessary, cleanly and carefully over the shading. Thus one layer of color will suffice.

To make it a transparency, thin some good pale Canada balsam with benzine to about the consistency of cream, and simply float it over the ground surface of the glass. Pour off until the drop comes very sluggishly, then reverse so that the corner from which the balsam was flowing off be placed upward. Let the return flow reach about the middle; then reverse it again, and move it in several directions to get the balsam level. This may be done with a very little practice, so that the surface shall be undistinguishable from glass.

We have now a perfect transparency, and to complete keep the glass level for 24 hours for hardening, and then fasten another square of glass on to it by strips of paper at the edges, with small pieces of card at the corners to prevent contact, and you have an admirable lantern transparency. Microscopical drawings can thus be taken direct from the camera lucida, and the most complicated drawings easily prepared for the lecture-room and screen.

NATURALISTS residing in or near New York should take advantage of the immense variety of living forms of aquatic life to be met with at the New York Aquarium. Every facility is offered to students, and perfect courtesy may be relied on from every official in the building.

Dr. Dorner, the manager, has just completed an excellent catalogue, in which a suitable scientific classification has been made, with interesting information. It is a most creditable work, and when revised, in the next edition, will give an additional importance to the collection.

Here even in midwinter living specimens from our own coast, and from Bermuda, England, and various points on

the European coast, can be seen and studied. Professor Burt G. Wilder, of Cornell, with all the energy and enthusiasm of true genius, expressed his regret that such a storehouse of Nature was not within his reach, and begged for the dead specimens. Is there no naturalist in our city with a kindred spirit, who will collect a little band of students, and garner the rich harvest of knowledge that now neglectfully lies ready to be harvested?

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

From the following figures, showing the issues during the months of January, 1877 and 1878, the Patent Office business appears to be still increasing:

	Patents.	Reissues.	Designs.	Trademarks.	Labels.
January, 1877.....	1,105	33	43	83	27
January, 1878.....	1,168	48	40	137	58

The office has received from the English Patent Office a duplicate set of English patents, which are to be classified according to the nature of the invention and distributed in the examiners' rooms, so that they may be more readily examined in making searches as to the novelty of alleged new inventions. It will take considerable time and money to properly mount the drawings and classify them, but when done its cost will soon be paid for by the increased facilities given the examiners in their work, and it will prevent the granting of many useless and invalid patents that would otherwise be granted for inventions already shown in foreign patents, but which cannot now be found under the present system.

The work of photo-lithographing the back issues of drawings has made considerable progress, all being now done except the following sub-classes: artificial limbs, builders' hardware, coffins, coopering, cutlery, dentistry, locks and latches, locomotives, nut-locks, safes, steam boilers, steam engines, boiler furnaces, steam valves, surgery, wheelwrights' machines, wood sawing, wood turning, woodwork, and wood working tools. These are under way, and will, it is believed, all be finished by the end of the year, so that printed copies of the drawing of any United States patent may then be readily obtained at a moderate price.

The Secretary of the Interior has prepared a communication, which will probably be sent to Congress ere this is printed, calling the attention of that body to the present condition of the roof of the Patent Office, and asking for an immediate appropriation to repair the building in conformity with the recommendations and suggestions made by the commission appointed by the President to examine into the condition of the executive departments. The recommendations of that commission were transmitted to Congress during the extrasection, but nothing has yet been done in reference to the matter, and the condition of the Patent Office calls for prompt action, in order that the structure may at an early day be restored and rendered as nearly fireproof as possible. Much of the work of the office is now done to great disadvantage from the overcrowded state of the rooms, and some that should be done in the office is now, to the great inconvenience of attorneys and examiners, done in outside buildings.

CONGRESSIONAL MATTERS.

In addition to the bills relating to the Patent law given in my previous letters, I find the following recently introduced:

House bill 2,345, introduced by Mr. Hartzell, enacts that section 4,898 shall be repealed and the following substituted therefor:

"Sec. 4,898. Every patent, design, trademark, label, or copyright, or any interest therein, shall be assignable in law by an instrument in writing which shall be acknowledged before some officer authorized to take the acknowledgment of deeds where such instrument is executed; and the patentee or owner of the franchise, or his assignee or legal representative, may, in like manner, grant and convey an exclusive right under his patent or other franchise to the whole or any specified part of the United States. Every assignment, grant, conveyance, mortgage, power of attorney, license, shopright, or any other interest in or under any patent, design, trademark, label, or copyright shall be recorded in the Patent Office of the United States; and every such assignment, grant, conveyance, mortgage, power of attorney, license, shopright not so recorded shall be void as against any subsequent purchaser in good faith, and for a valuable consideration, of the same patent, design, trademark, label, or copyright, or any interest therein, whose assignment or conveyance shall be first duly recorded. But no instrument in writing as described in this section shall be deemed invalid or void for want of such acknowledgment if executed before the passage of this act."

The House bill 2,522, introduced by Mr. Blair, adds to section 3 of chapter 301 of the Revised Statutes, relating to the registration of labels, the following:

"And the same right of proceeding against any person who has registered a label pursuant to the provisions of this section shall be allowed, from and after the date of the passage of this act, as is now allowed in relation to trademarks by act approved August fourteenth, eighteen hundred and seventy-six, and entitled 'An act to punish the counterfeiting of trademark goods and the sale or dealing in of counterfeit trademark goods.'"

Another bill (No. 2,524), introduced into the House by Mr. Briggs, will, if it becomes a law, change the fee for registering trade marks from \$25 to \$5.

Mr. Glover has introduced a bill (No. 2,607) which enacts that section 482 of the Patent law shall read as follows:

"Sec. 482. The Examiners-in-Chief shall be persons learned in the law, whose duty it shall be, on the written petition of the appellant, to revise and determine upon the validity of the adverse decisions of examiners upon applications for patents, and for reissues of patents, and in interference cases; and the Commissioner of Patents is hereby forbidden from exercising, or attempting to exercise, any power or influence over the Examiners-in-Chief in regard to the decision of cases which are before them on appeal from the primary examiners. The decisions of the Examiners-in-Chief shall hereafter be published in the Patent Office Official Gazette, in the same manner as the decisions of the Commissioner of Patents and the Assistant Commissioner of Patents are now published; and the Examiners-in-Chief shall select such of their decisions for publication as they shall deem to be of public and general interest."

A bill (No. 2,628), introduced by Mr. Sampson, strikes out from the Patent law section 4,910, which allows an appeal to the Commissioner, and changes section 4,911 so as to allow any person dissatisfied with the decision of the Examiners-in-Chief to appeal direct to the Supreme Court of the District of Columbia sitting *in banc*.

House bill No. 2,634, introduced by Mr. Oliver, proposes to amend sections 493, 4,897, and 4,911 of the Patent law, so that uncertified printed copies of patents shall be sold at an advance of fifty per centum above the actual cost of printing; that forfeited applications shall be allowed to be revived in the same manner as rejected cases now are, notwithstanding two years may have elapsed without action; and that a party to an interference shall be allowed an appeal to the Supreme Court of the District of Columbia.

In addition to these, I find a number of private bills relating to extensions of the following patents: R. & G. B. Reynolds, June 21, 1859, power loom brake; Cook & Jenkins, January 14, 1862, working siliceous and other calamine ores; H. A. Stone, March 21, 1861, making cheese; J. D. Sarven, June 9, 1857, carriage wheel; Walter Hunt, July 25, 1854, paper collars; F. Cook, March 2, 1853, bale ties; E. A. Leland, August 14, 1861, paint cans; A. B. Travis, April 8, 1862, cultivators; J. A. Conover, May 15, 1855, wood-splitting machine; J. C. Birdsell, May 18, 1858, hulling and thrashing clover; Ira Gill, January 13, 1857, machine for forming hat bodies; S. S. Hartshorn, buckles.

The House Committee on Public Buildings have decided to report favorably a bill for the erection of a building on the Smithsonian grounds to be used as a National Museum, and appropriating \$250,000 for the purpose. This building is mainly intended for the reception of the exhibits at the Centennial donated by different foreign governments to the United States, and now stored away in the old arsenal in this city until such time as sufficient room can be obtained for their proper exhibition.

The annual report of the Librarian of Congress, recently presented, shows that this important institution has made gratifying progress during the past year, so far as accumulation of material is concerned. More than 20,000 volumes, besides pamphlets, periodicals, engravings, etc., were added to its treasures. The total number of volumes is now 331,118, and of pamphlets, 110,000. The rate at which this library is increasing will soon cause it to rival the most famous ones of Europe, a prospect which must be very pleasing to all who are interested in our national progress in literature and art. Its attractions draw to this city many scholars from various cities, who find in its alcoves books not to be found anywhere else on this continent. The great drawback to it is the inconvenient and overcrowded space it now occupies, which is so small for the amount of material it contains that about 70,000 volumes are piled upon the floor for want of shelf room.

UNITED STATES PATENT VS. STATE LAWS.

A case in which the question whether or not a patent is sufficient to overrule State laws has just been argued before the Supreme Court of the United States in the case of *Patterson vs. The Commonwealth of Kentucky*; error to the Kentucky Court of Appeals. The plaintiff in error having been indicted for the sale and use of a patented illuminating compound, known as "Aurora Oil," which article had been found by the Inspector of the State, by actual test, to be unsafe for illuminating purposes, and its use prohibited accordingly by the State authorities, brings the case to the Supreme Court on the ground that the authority of the patent is superior to the laws of the State, contending that if the patent does not guarantee the right to vend the patented article the patent is worthless and the protection of the United States no assurance to capital. On the other hand, it is said that the police power of the State is supreme in all cases where the safety of its citizens and their property is concerned, and that Congress has no power to control or regulate the sale of dangerous commodities such as these oils. No decision has yet been given by the Supreme Court at the time of this writing.

BOARD OF STEAMBOAT INSPECTORS.

The Supervising Steamboat Inspectors have been holding a convention in this city, and consulting on various matters connected with steamboats. Reports were received from various members in relation to improvements in boilers, grate bars, life boats, life preservers, testing oils, and other things pertaining to their duties in connection with steamboat service and to the safety of passengers. Several addresses were made by various parties interested in the adoption of alleged improvements in various appliances con-

nected with the general subject of steam transportation. They also had an address from Mr. Boole, of Chester, Pa., connected with Mr. John Roach's iron ship-building establishment, in relation to the deviation of the compass, whose object in addressing the board was to get it to suggest to the Secretary of the Treasury to recommend the further investigation of this important matter by a board of scientists, under the auspices of the government, with a view to the establishment of some standard for the use of mariners, whereby all variations may be readily computed and allowed for in making up a ship's reckoning.

CONSULAR REPORT ON TRADES UNIONS IN ENGLAND.

Our consul at Leeds sends to the Department of State an interesting analysis of the effect which the trades unions exercise upon the industrial enterprises of Great Britain. In his judgment, the original and principal cause of the decline of British industry is traceable directly to the arbitrary regulations of those unions, the organization of which is more perfect in England than elsewhere, so much so that it is to be regretted that they are not as potential for good as they are for evil. But they are too often led by turbulent spirits, who provoke continual conflicts and demand concession after concession until the enhanced cost of production paralyzes the employers' hands, and further concession becomes impossible, which results in a strike, with all its attendant misery, most of which falls upon the innocent non-producers—the wives and children of the strikers. As long as the funds of the union hold out, a bare existence is doled out to the striker, but when exhausted, which soon happens, public charity is the only resource to allay the misery which ensues. The strikes generally end in submission, a result mainly due to the folly of the unions. Another way in which unions impede production and enhance its cost is by forbidding a mechanic of more than average skill to do more than a certain quantity of work in a given time; thus a smart bricklayer can lay no more than his slower brother unionist, lest he should therefore jeopardize his chance of obtaining work. In this and other ways the real amount of labor is lessened and made dearer, the quantity of manufactures diminished, industries paralyzed, and exports lessened, and, with the consequent decrease of profits and outward flow of capital from the country, the necessaries of life become dearer, which weighs most upon the laboring classes, and they are thus the ignorant cause of many of their own misfortunes. Almost all branches of industry suffer from this cause except agriculture, because unions and their resultant strikes are rare among farm laborers.

TECHNICAL EDUCATION.

The Commissioner of Education has returned from the Convention of Presidents of Agricultural and Industrial Colleges held at Cleveland recently, and expresses himself much pleased with the general results of the convention, which was the first of the kind ever held in this country, but he hopes not the last, as he thinks that such conventions cannot fail to promote all branches of technical education. In these matters he says we have fallen behind several of the countries of Europe. American colleges compare favorably with similar institutions abroad in teaching the classics, history, the sciences, and general literature, and our technical schools have made a fair beginning, promising valuable results. In technical instruction he thinks that Germany is somewhat in advance of most other countries. There young men and women may receive instruction in schools in any industrial pursuit they may wish to follow. For example, pupils are taught in these schools to sample and test oils, to judge the quality and grade of different textile fabrics, and to classify grains; and in metals they may learn the whole process of working, from the time the ore is taken from the earth until it leaves the machine shop a finished tool.

THE NATIONAL PARK.

Several gentlemen interested in the care of the Yellowstone Park have been holding a convention in this city. Professor Comstock, the geologist, of Cornell University, is their chairman, and Mr. P. W. Norris, at present the Superintendent of the park, is here in conference with them. It is understood that the association favor the establishment of signal stations, the employment of a paid superintendent, a survey of the boundaries, and other measures for the proper care and preservation of the park in the interests of science. While this wonderful region is the property of the United States, and abounds in natural beauties, mineral formation, and natural curiosities such as perhaps can be found in no other spot in the world, no care has ever been bestowed upon its preservation from depredation and despoilment. It is the object of these gentlemen to make such suggestions as may seem needful to this end, and to urge their adoption by adequate legislation by Congress.

Washington, D. C.

OCCASIONAL.

A Practical Puzzle.

To the Editor of the Scientific American:

A civil engineer working on a railroad in Illinois recently had occasion to weigh one of the iron rails. The rail was 30 feet long, and was supposed to weigh about 400 pounds. His only means of weighing was a pair of balance scales capable of weighing only 25 pounds. Query: How can he weigh the rail correctly with such scales? J. T. C. Rockville, Ind.

[Our correspondent sends us an ingenious answer to this problem, but we withhold it for the present to admit of our readers trying their skill at a solution.—Eds.]