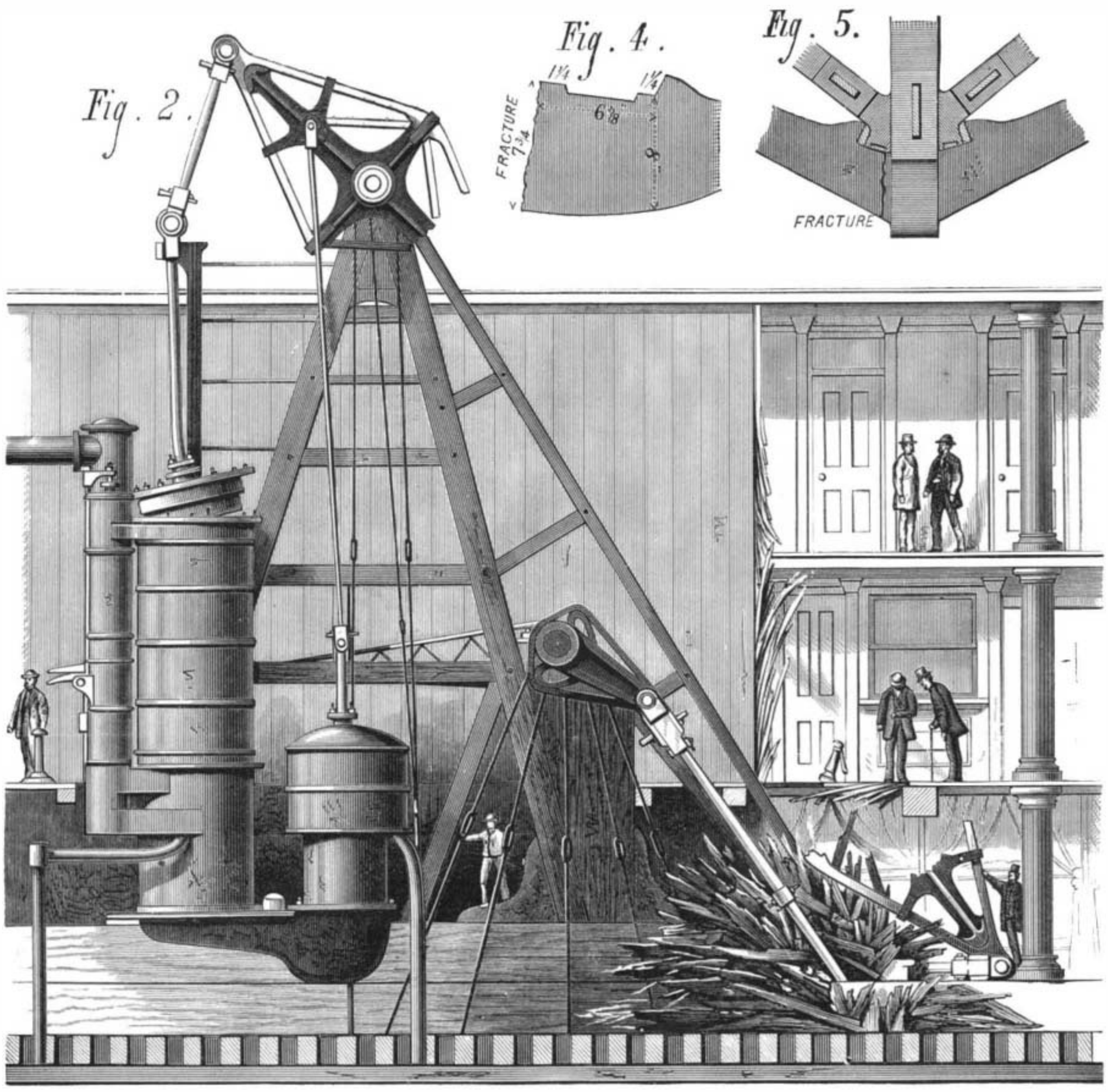
Light, or about two hours' run from Newport, to which place the Old Colony was being steered. The weather at the time was fine, the sea smooth, and the engine working remarkably well. The steam pressure was 27 pounds, cut-off at a little more than half stroke, and the engine making 16½ revolutions per minute. Without warning the lower strap of the beam broke near and aft the center strap, when the piston was taking steam for an upward stroke. The position of the engine after the accident is indicated by Fig. 2. The breakage of the strap was immediately followed by that of the cast iron skeleton frame and upper strap. The aftward half of the beam fell, carrying with it the connecting rod, which in its fall struck a wooden transverse beam, and broke off at a short distance from the forked end.

The detached half of the working beam with the forked end of the connecting rod fell directly on the center keelson, and fetched up against the mast, as represented in Fig. 2. Of course the fall of the beam with the heavy piece of connecting rod was somewhat broken by striking the partition, cabin stairs, and the transverse wooden beam, which were all shattered to pieces. The keelson and frames are strong, but had the beam fallen at either side of the keelson there might have been still more serious damage. The motion of the vessel caused the crank to make four or five revolutions after the beam broke, and the greater length of the connecting rod being attached to the crank pin, the broken end of the rod moved backwards and forwards on the top of the center keelson. The piston struck the cylinder head, forcing it off the cylinder flanges and causing other damage. The engine, like all others in the N. Y. & Fall River steamboats owned by the Old Colony Steamboat Company, is provided with an automatic arrangement that shuts off the steam instantaneously if the piston either in its ascent or descent should through any cause exceed the regular stroke. As the clearance between the piston and the cylinder head was about ⅜ or ½ inch in the Old Colony's engine, the advantage of this automatic mechanism was realized, for the steam valve closed just as soon as the piston exceeded the stroke, and prevented steam entering the saloons. Singular was it that no person was hurt or scalded, and still more remarkable that one of the oilers who was oiling the crosshead guides at the time of the break escaped unhurt. Fig. 3, p. 322, represents the flaw and break in the wrought iron strap as it appears when viewed endways, or as a transverse section. The flaw at the time of observation was black and smooth. Looking at it through a magnifying glass, very small bright spots were seen, indicating crystallization and attrition. The portion of the strap that broke at the time of the accident, and which is indicated in the lower part of Fig. 3, shows crystallization. The broken wrought iron connecting rod also exhibits crystallization. The breaks are short and indicate brittleness rather than fibrous toughness. Fig. 4 represents a side view of the wrought iron strap at the point of fracture, and Fig. 5 shows the strap with its connections. The figures indicate the exact dimensions of the flaw and iron.

The question naturally arises: Was this a flaw in the forging that was always there? or was it a flaw that had gradually increased in size as the iron gradually increased in crystallization? About this there are different opinions. Our own opinion coincides with that of the master mechanic of the company's extensive repair works at Newport. He says: "My theory regarding the breaking of the beam is, that the strap was fractured slightly while being forged, and that it gradually increased as the fibers of the iron became crystallized. Concussions, strains, friction, etc., will undoubtedly produce crystals in iron. After a critical examination of the working beam of the Old Colony, and a microscopic inspection of the fracture, I am convinced that it was absolutely impossible to have foreseen, by the closest scrutiny or observation, the fracture or defect in the wrought strap of the beam before the iron separated, which I believe in this case was instantaneous."



MACHINERY OF THE OLD COLONY—AFTER THE ACCIDENT.

PÉLIGOT has found in the skin of silk worms a substance, tunicin, which has the composition and properties of cellulose.

WHAT ARE THE CAUSES THAT AFFECT THE TASTE OF DRINKING WATERS?

An examination of the annual reports of the water boards of most of our larger cities, extending back over a period of some years, reveals the fact that water stored in reservoirs, both natural and artificial—no matter from whence the source of supply—is subject to an occasional phenomenal occurrence that manifests itself in the sudden appearance of an exceedingly unpalatable taste, accompanied quite often with a peculiar odor. The cause of this taste, which has everywhere been likened to that of cucumbers, has been for many years a prominent subject of inquiry among scientists; and, although some advances have been made towards a solution of the mystery, the ultimate "wherefore" remains nearly as deeply hidden as ever.

It is very clear that a complete and satisfactory answer as to the cause of the evil cannot be founded on chemical analysis alone. We can ascertain by this means the amount of inorganic matter very accurately; but it is rarely that the presence of these, in water, do any further harm than that of causing an unnecessary waste of soap—a matter of household economy not connected with our present inquiry. As to the organic constituents, to which we must look, as a source of anything that may render water disagreeable to the taste or smell, or deleterious to the health, chemistry can aid us but little. The best the chemist can do in the premises is to tell us (and that only approximately) the quantity of organic matter in a certain measure of the fluid; and, by a still further refinement of his analysis, the presence or absence of nitrogen, thus allowing us to judge of its animal or vegetable origin. Beyond this he cannot specify its nature, condition, or source.

Neither can any help be expected from the zoölogist toward a solution of the question. Careful and accurate examinations of the affected waters, both by the naked eye and the microscope, made by specialists in this department of natural history, have failed to show in them any more than a normal quantity of animal life, and this not of a character nor in a condition to produce any effect whatever.

It is the botanist then, probably, to whom we shall have to look mainly for an elucidation of the matter, although it must be confessed that the results that we have received from this quarter so far are eminently unsatisfactory and inconclusive. The evil that we speak of is not confined to any one region or district, but extends pretty widely over the Eastern and Middle (and perhaps other) States. We have precisely the same reports from New York, Brooklyn, Albany, Troy, Poughkeepsie, Hartford, New Haven, Boston, Charlestown, Burlington, Lynn, and many other cities. Many of these cities have wisely taken measures to investigate the trouble, and in doing so have called to their aid the services of well known and able scientists. Let us examine the opinions of the latter.

When the Croton supply of the city of New York became offensive in 1859, Dr. John Torrey (who, with Dr. James R. Chilton, was commissioned to examine it) reported that, in his opinion, the peculiar condition of the water "was owing to a rapid and abundant growth of a microscopic, conferva-like plant, which abounds in a volatile, odorous principle soluble to some extent in water." He referred this plant to the genus *Nostoc*. He thought it probable, moreover, that it occurred more or less every summer, but only occasionally by excessive growth communicated an offensive odor and taste to water, and was thus brought into popular notice.

In Poughkeepsie, in 1875, during a like contamination of the water, Mr. C. Van Brunt, after a careful examination, ascribed the peculiar taste, not to the growing confervæ in the reservoir, but to the disintegrated plants diffused through the water, and undergoing decomposition in the service mains, especially near the hydrants, where the taste was observed to be most marked and unpleasant.

In 1871, Hartford suffering from the same evil, a committee, aided by Professor C. T. Jackson, made an investigation. Starting with the theory of an organic growth on the inner surface of the pipes, they ascribed the offensive taste of the water to the breaking up of the organisms and their subsequent decay in the "dead ends" of the service pipes.

On one of the occasions (1865) of an impurity of Rensselaer Lake, from whence Albany derives its supply, the board of health invited Professor Philip Ten Eyck, Drs. Hun, Vanderpoel, Mosher, and Boulware to carefully examine the lake and reservoir. Their report stated that they attributed the evil to vegetable matter, brought into the lake by the streams upon which it depends for its supply.

Finally, not to multiply cases, Boston having several times suffered from the same evil, occasion was taken on a recurrence of the trouble in 1875 to make a thorough investigation. At this time only one of the two storage basins was affected by the unpleasant cucumber taste. Dr. Farlow, on request, made a botanical examination of both basins. This gentleman stated in his report that the plants found in both basins were practically the same; and in neither one of them was there found any peculiar vegetable organism that might not be expected in any fresh water pond of that region. After a thorough examination, both of the living plants and those in a state of decay, he gave it as his opinion "that the cucumber taste is not caused by the presence of any living plant, nor by any plant undergoing any form of decomposition, which can be detected by the microscope," and "that there is no probability of obtaining any definite results from the botanical side of the question, unless many months, or even years, be devoted to the subject."

A great number of theories have been advanced in regard to the origin of these impurities, but unfortunately they have emanated from those who know little or nothing about the subject experimentally or otherwise, and are consequently of little importance. The few examples given may be said to comprise about all of the opinions of the different gentlemen who have investigated the subject in the interest of science, and whose names are a sufficient guarantee that their statements are worthy of consideration. How far these opinions are consistent with facts will be examined further on. The following data, gathered from the reports of various water boards, show all that is positively known on the subject up to the present time; and, while they may add nothing more than that already given towards a solution of the problem, they at least narrow the question down to limits within which future investigations may perhaps meet with success. We learn, then, that:

1. The appearance of these impurities is confined to no particular season. They have occurred in spring, summer, and autumn, and occasionally lasted through a whole winter. 2. As to duration, they have appeared suddenly, lasted a few days only, and then as suddenly disappeared; at other times they have continued a few months. 3. They have affected water supplies procured both by gravitation and pumping. They have appeared in reservoirs (both natural and artificial) fed by rivers and creeks, and by lakes, sometimes small and shallow and sometimes large and of great depth. In 1854, when the water in Cochituate Lake, Boston, became bad, *several wells* near the lake and in other places were similarly affected, as were the waters (usually remarkably pure) of

Jamaica Pond, and those of Round Pond (which supplies Haverhill) and the Chicopee river.

Now, in the light of such facts, let us examine the opinions that scientists have given us. In the first place, we may exclude from any consideration whatever the theory that the contamination is due to the decomposition of leaves, twigs, or other parts of the higher plants that have fallen or been swept into reservoirs. Careful examination and experiment have demonstrated that such an opinion is untenable.

Now we know that the minute plants known as fresh water algæ begin their growth only when the warmth of spring awakens their spores to life, and that they reach their greatest development in midsummer, and then, fruiting, decay and disappear till another spring. Dr. Torrey gave it as his opinion that the offensive taste was due to such plants in a *vigorous state of growth*. Now if this be so why should the same offensive taste arise in late autumn and continue all winter, when all plants of this kind have disappeared? Besides, we should state here, that during an excessive mortality among the fish in the Passaic river last June, the water was filled with unusual amounts of aquatic plants of a low order of vegetable life, yet no complaint was made either of the appearance, odor, or taste of the water. It is evident, therefore, that we shall have to look further for a cause.

In examining the second opinion that has been advanced, we are again met by difficulties. Dr. Farlow failed to detect any difference between the cryptogamic flora of the infected waters of the Bradlee basin and that of the sweet waters of the Brookline reservoir. Moreover, his experiments proved that none of the algæ found in either reservoir would produce the cucumber taste during decomposition. If, then, as it seems generally admitted, this peculiar impurity be due to some vegetable organism, it must be (reasoning from analogy) some particular species, since in every case it is accompanied by so distinctive a taste. Dr. Farlow remarks: "Undoubtedly the most disagreeable odor ever found in fresh water may be produced by nostocs, using that word to designate the order *Nostochineæ*," but "the important point is that it is during their decay that the odor is found. A genus, *Coccochloris*, belonging to an order allied to the nostocs, consists of an effused mass of transparent mucus, in which are imbedded green globules, often not more than three ten-thousandths of an inch in diameter. The latter, in the process of decay, might readily become diffused through water, and elude anything but a high power of the microscope to detect them."

But whence come the germs from which these plants are developed simultaneously in such exceedingly diverse habitats as still waters exposed to heat and light in open ponds, pure waters lying in the obscurity of wells, and occasionally, though rarely, the flowing waters of rivers?

The superintendent of the Albany Water Works, Mr. Geo. W. Carpenter, without announcing it as a theory, has asked whether "we may not conclude, from all the evidence advanced, that the impurities are 'climatic;' that the atmosphere is the great reservoir containing the spores, and that large bodies of water, stored as city supplies, frequently are liable to be affected when the temperature and other conditions of the air and water are favorable to the development of these germs?"

As having a bearing on this view of the matter, we may mention some observations that have been made at Paris during the present spring. An epidemic of typhoid fever having arisen in Paris, it was determined to examine the dust from the atmosphere of Prince Eugene barracks, where several deaths had occurred. After the evacuation of the barracks some of the dust, which must have been constantly in suspension in the air during the presence of the soldiers, was scraped from a window-sill in one of the rooms and moistened with water. It *evolved during this operation a most disagreeable odor*. Under the microscope it was found to contain several algæ, more especially that species known to botanists as *Coccochloris Brebissonii*. There were also numerous *vibrions*, some *bacteria*, and some *monads*.

Such, then, are the facts, as we find them, regarding this peculiar phase of the contamination of water when stored in reservoirs, a phenomenon for which, notwithstanding the most searching examinations and chemical analyses, science has thus far failed to find a satisfactory reason.

Communications.

The Patent Law Discussion.

To the Editor of the Scientific American :

Your issue of April 13 contains an article upon Section 11 of the bill now before Congress for the amendment of the patent law. I had considerable share in the preparation of the bill, and have advocated it before the committees both of the Senate and House of Representatives.

Mr. J. J. Storrow, of Boston, has also participated in the preparation of the bill and advocated it before the committees. I think you will see from our arguments before the committees, which were reported and printed, that we fully believe the patent law to be of the greatest value to the country, and that we would not willingly do anything to impair its efficiency or impose any unnecessary burden upon inventors. Mr. Storrow in connection with Mr. Coffin, who was employed by us to collect information in relation to our industries, presented to the House Committee a most remarkable collection of facts bearing upon the influence of the patent law upon the progress of inventions and the growth of our agricultural and mechanical industries. In my argument before the same committee, I called attention especially to the advantage which this country had derived from its patent law, by placing the advantages of the law within the reach of the poorest inventors, and bringing its stimulus to bear directly upon large numbers who are not reached practically by the laws of other countries. Section 11, to which you object, which provides for the payment of fees at two periods during the term of a patent, to preserve it in force, was the subject of a careful consideration. The arguments against the section did not escape our attention. They are certainly entitled to much consideration. Whatever else may be said about the section in question, it certainly was not brought forward and supported by us "in obedience to the wishes of wealthy corporations," or in the belief that it would operate especially for the interests of such corporations.

We certainly did not intend to "discriminate against inventors of limited means" or to subject them "to the mercy of grasping corporations." On the contrary, we came to the conclusion that the interests of poor inventors, as a class, would be promoted by the provision. We found a widespread complaint that many patents for inventions of little or no value in themselves, and which never brought any profits to the inventors, were often bought up for trifling sums by speculators, to embarrass subsequent meritorious inventors whose inventions had gone into actual use. We had ourselves known of aggravated cases of this abuse of patents, not for the interests of the poor inventors, but for the interests of some speculator who had discovered an opportunity, not to use the invention, but to use the patent to compel, either by threats of litigation or by actual litigation, the owners of subsequent inventions in actual use to purchase the prior invention at a price not measured by its actual value, but by the value of the inventions which were in actual use. We had seen a "grasping corporation" formed for the actual purpose of purchasing a worthless patent, and levying under it a contribution upon one of the most important industries of the country, to the advancement of which no person interested in the corporation had ever contributed a cent. We had seen the property of large numbers of manufacturers placed under attachment at the suits of this corporation. We had good reason to believe that this illegitimate use of old unused patents was a frequent one, and that by it many poor inventors, whose inventions had gone into actual use, were robbed of the fruits of their inventions. We were forced to believe that the interests of poor inventors as a class demanded that the evil should be removed, or at least mitigated as far as possible. If we could have devised a remedy which would not impose any additional tax upon inventors, we should have been glad to do so. None occurred to us; none has been suggested which seemed deserving of much consideration. It has been thought by some that the Patent Office should be required to investigate the practical value of inventions, upon the application for patents, and to issue patents only to those which could be proved to be of very considerable value. This idea was much discussed in England a few years ago. I suppose I need not enter into an argument to show that such a plan for eliminating patents for trifling or worthless inventions would be utterly impracticable; that while it would impose additional expense upon the inventor, its results would be unsatisfactory both to the public and the inventor. The plan proposed in Section 11 allows the inventor to obtain his patent upon the present terms, and leaves it for him or his assignee to decide, after trial, whether it is worth while to keep it in force by the payment of $50 or $100 at the ends of the prescribed periods.

It is often necessary to make a choice of burdens, and it seemed to us that the burden of the tax upon inventors imposed by Section 11 is small in comparison to the extortionate demands to which they are liable under the color of State patents, in the hands of speculators and "grasping corporations," and to which they are compelled to submit. The danger that such claims may spring up after an invention has gone into use is so great that it seriously affects the value of all patents, and thus frequently prevents inventors from selling their inventions at their full value. If you add to this the consideration that the evil to which I refer had become so serious that it was creating a hostility to patents which threatened to sweep away the patent law altogether, I think you can hardly fail to agree that it was high time, in the interests of inventors, to bring forward some remedy. The operation of the law will be to greatly reduce the number of patents which are never used to protect an industry, but only to levy contributions on subsequent inventors and the users of their inventions.

In conclusion I wish to add that I am glad you have called attention to the subject, not because it has given me an opportunity to present my own views, but because we have felt that the amendment of so important a law as the patent law is a delicate matter, and we have been desirous that all objections to which the proposed amendments are liable, should be brought forward and fully considered by the public and by Congress. I should be glad to have the attention of inventors and manufacturers especially invited to the various provisions of the proposed amendments.

Boston, April 8, 1878.

CHAUNCEY SMITH.

THE companion of Sirius can be seen with telescopes of 6 inches aperture and larger sizes; but not with smaller instruments.

Thymol, the New Rival to Carbolic Acid.

For the last ten or twelve years, the industrial and medicinal applications of carbolic acid, or phenol, have become so manifold, and its utility so generally known, that its use has gradually extended itself and made it even a common antidote in the household. There always has been, however, and always will be a prejudice against employing it when something else can be substituted for the same purposes, with less objectionable odor. It would seem, from all accounts, that such an article has been found in thymol, a chemical to which we briefly referred in a recent number of the SCIENTIFIC AMERICAN. We are made the less suspicious of this new antiseptic, for the reason that it is not put forth in the interest of any manufacturer, but is brought into notice by medical journals as an article that has stood a successful test, in the practice of some of the most noted German surgeons, for the last two years. Thymol is a homologue of phenol, or carbolic acid, and exists in the oils of thyme, American horsemint, and a few other plants. It is a crystalline, nearly colorless body, with a pleasant odor and an aromatic, burning taste. Its specific gravity is 1·028, and it melts at 44° C. It dissolves in 1,200 parts of cold water, 1 part rectified spirit, 120 parts glycerin, and ½ part caustic alkalies. It was discovered in 1719 by Caspar Neumann, examined chemically by Lallemand and Leonard Doveri, and first used to deodorize unhealthy wounds by Bouillon and Paquet, of Lille, in 1868. In 1875 several German surgeons published investigations of its antiseptic properties, which are estimated to be from 4 to 25 times as powerful as those of carbolic acid. It is prepared from either of the oils above mentioned by treating them with an equal volume of a 20 per cent solution of caustic soda, separating the alkaline liquid, and neutralizing it with hydrochloric acid, when thymol will float upon the surface. It may also be obtained by submitting the oils to a low temperature for a few days, when the thymol crystallizes out. Its powerful antiseptic action, exceeding, under some conditions, that of carbolic acid, its small activity as a poison (about one tenth that of carbolic acid), and the absence of irritating effect when applied to the skin, all point to its use as a substitute for carbolic acid in the now well known antiseptic treatment of surgical cases elaborated by Professor Lister. This substitution has been made with great success by Professor Volkmann, of Halle, who has achieved such brilliant results in surgery by Lister's method. His assistant, Dr. Ranke, reports fifty-nine operations in which thymol was used with strikingly good results. For the spray solution, this gentleman used a mixture of 1 part thymol, 10 of alcohol, 20 of glycerin, and 1,000 of water. For the gauze dressings used by Professor Lister, others were substituted, made by saturating 1,000 parts of bleached gauze, with a mixture of 500 parts spermaceti, 50 of resin, and 16 of thymol. The present cost of thymol is about five times that of the best carbolic acid, but as one part of the former seems to do as much work as 25 parts of the latter, the advantage of price is on the side of thymol.

The Great Cincinnati Organ.

Up to the present, the Boston Music Hall organ has ranked as the largest instrument of the kind in America. It was built by E. F. Walcker & Son, of Ludwigsburg, Würtemberg; begun in 1857 and finished in 1863. The cost of the instrument proper was about $50,000, and $20,000 additional were expended on the case. It is about 47 feet in width, and the two projecting central towers are 60 feet high. There are 89 stops, 5,474 pipes, 13 combination pedals, and 12 couplers. The motor for operating the six large bellows is a 10 horse power steam engine. The organ just erected in the Cincinnati Music Hall was built by Messrs. E. & G. G. Hook & Hastings, of Boston, Mass., and is the largest one ever built in this country, and ranks about the fourth or fifth in size in the world. It is 50 feet wide, 30 feet deep, and 60 feet high. There are 6,237 pipes, and 96 stops. We are informed that the design of the case was drawn by some of the most talented pupils of the Art School. To give an idea by comparison of the size of this instrument, we append the number of pipes and stops in some of the very largest European organs. That in the Albert Hall, London, is the largest in the world. Albert Hall organ, 111 stops, 7,879 pipes; St. Sulpice, Paris, 100 stops, 6,706 pipes; Cathedral at Ulm, 100 stops, 6,564 pipes; St. George's Hall, Liverpool, 100 stops.

The interior of the Cincinnati Music Hall is of tulip wood finished in oil. It is 192 feet long, 112 feet wide, and 70 feet high. The stage is 112 feet wide by 56 feet deep.

Formula for Copying Ink.

Professor Gintl proposes the following: A concentrated solution of logwood is treated, first, with 1 per cent of alum, and then with the same proportion of lime water until a permanent precipitate is formed. A few drops of a weak solution of chloride of calcium are added, until a bluish black color is obtained; then hydrochloric acid is added drop by drop until the liquid turns red. A little gum and about 1 per cent of glycerin are then added, and the ink is ready for use.

WALKING UPON THE WATER.—It is stated that H. Dusseault lately accomplished the feat of walking upon water at Taunton, Mass. He walked a quarter of a mile on Taunton river in six minutes. He wears a pair of patent shoes made of tin, about one foot wide and three feet long, in which air is confined, and he makes his way in a kind of skating gait.