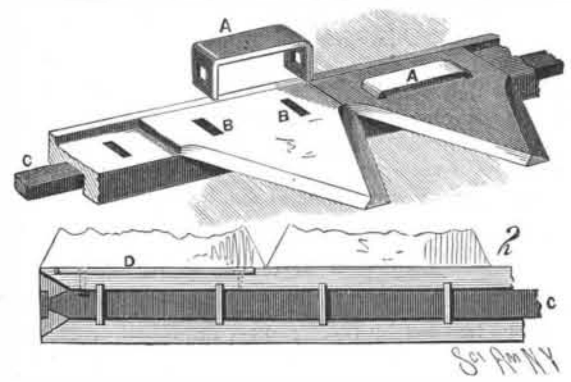
IMPROVED CUTTER BAR FOR MOWERS AND REAPERS.

A device for fastening the cutters on the cutter bars of mowers and reapers, so that the cutters may be quickly removed for grinding and other purposes, is shown in the accompanying illustration, and has been patented by Mr. Wallace B. Comstock, of Allendale Center, Mich. The under side of the cutter bar has a longitudinal groove, into which fits a key, C, and the bar also has vertical slots, corresponding with similar slots, B B, in each cutter, through which pass the side arms of a U-shaped staple, A. The outer end of the key, C, has a notch, into which fits a pin passing through an aperture in the bar, and secured to the free end of a spring, D, fastened to the front edge of the

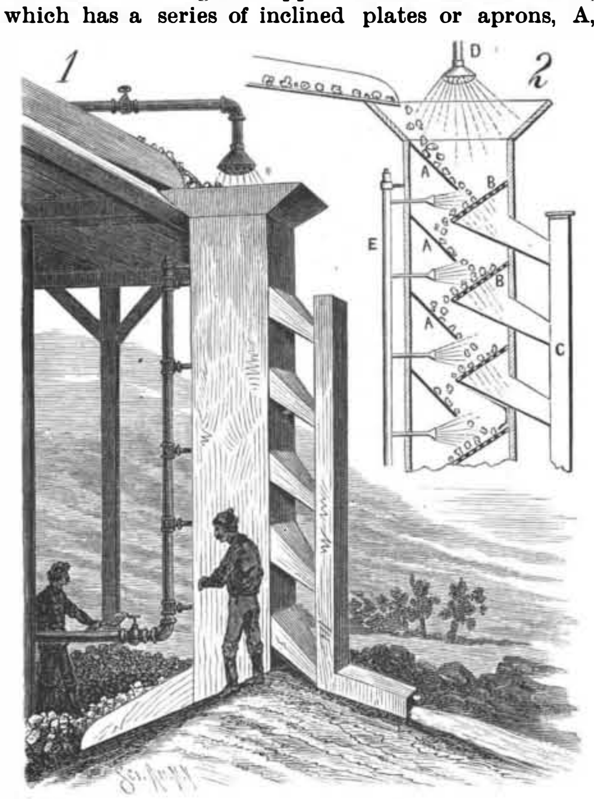


COMSTOCK'S CUTTER BAR.

bar, as shown in Fig. 2, whereby the key is locked in place. The eye, which connects in the usual manner with the devices for imparting motion to the bar, is also fastened to the bar by the key, C, and all the cutters can be readily removed when the key is withdrawn.

AN IMPROVED ROCK WASHING APPARATUS.

A method of cleansing rock from such impurities as sand or mud, previous to pulverizing, is shown in the accompanying illustration, and has been patented by Mr. Oscar W. Donner, of Coosaw, S. C. The rock is delivered through a hopper to a vertical conductor, which has a series of inclined plates or aprons, A,



DONNER'S APPARATUS FOR WASHING ROCK.

and opposite perforated plates, B, the rock falling first upon one and then another of these plates in its passage downward through the conductor. Over the conductor is a rose nozzle, D, which showers water upon the rock, and opposite each of the perforated plates are jets supplied from a stand pipe, E, the water thus sprinkled on the broken rock passing down the conveyer carrying off the refuse matter through the chute, C. The number of the plates, and their inclination and arrangement, may be varied according to the nature of the material to be treated.

Photographs of Lightning Flashes.

Some very perfect photographs of the flashes of "forked lightning" have recently been secured by Mr. W. N. Jennings. Considerable difficulty is naturally experienced in securing exposures of so pre-eminently uncertain a subject. In two instances recently Mr. Jennings has achieved quite a notable success. One of the interesting features of the exposures is the undulatory or wave-like character of the tracing. The zigzag appearance so often shown in pictures is not present. The general appearance is that of the branch of a tree outlined by the flash. The lines are slightly sinuous, but nowhere of the conventional shape of "artistic lightning."

AN IMPROVED OX BOW.

The invention herewith illustrated provides an ox bow which will not bear upon the windpipe or upon the veins or arteries of the neck, and has been patented by Mr. Luman Rundell, of Grapeville, N. Y. The bow as represented is formed partly of wood and partly of metal, the metal portion being made tubular and forming an enlarged lower part of the bow, which is of sufficient size to relieve the lower part of the throat of the ox from any pressure of the bow. It may, however, be made entirely of wood bent into the form shown, or even of a piece of gas pipe bent into suitable form.

RIPENING OF LIQUORS BY OZONE.

The researches that have been made up to the present with a view of arriving at a process of removing the bad taste of alcoholic liquors and of artificially ageing them, prove how much interest a solution of the problem presents. We have already described the process of Mr. Naudin, which consists in converting into alcohol, through electrolytic hydrogen, the aldehydes that give distillers' wash its bad taste. Other processes consist in oxidizing the alcohol directly by passing through it a current of oxygen or ozonized air. It is on this principle that is based the process that we are about to describe and that is being worked by Messrs. Teillard and Tournous, purchasers of the Broyer and Petit patents.

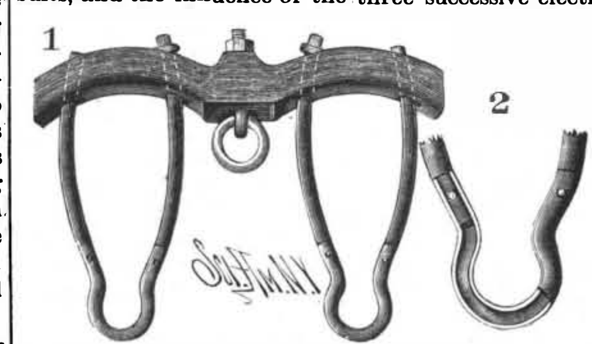
The process consists in the use of very pure and concentrated ozone under pressure, and making it serve several times in succession by regenerating it after each operation.

Ozone, the existence of which was recognized as long ago as 1785, was not really discovered till 1840, and although it has since been studied by eminent chemists, its use in the industries has not hitherto extended much. It is produced by causing an electric current to pass into oxygen, which, as a consequence of this operation, becomes reduced from three volumes to two. It is therefore a strengthened oxygen—an oxide of oxygen—and so has very strong oxidizing properties. All those who have handled plate electric machines or Ruhmkorff coils know its characteristic odor, whence, in fact, is derived it name (ὄζω, 'I smell ').

To make ozone, it suffices, then, to bring oxygen into contact with an electric current; but there are certain conditions to be fulfilled in order to obtain the best possible yield. One of the best known apparatus is Mr. Houzeau's, an example of which is shown at the bottom of Fig. 1. It consists of two spirals of aluminum wire isolated from each other by a glass tube, one being wound around the tube and the other being within it. The whole is inclosed in a larger glass tube, into which is passed the current of oxygen that is to be converted into ozone. Each spiral is connected by one of its extremities with a terminal affixed to the outer tube, and which serves to connect it with the source of electricity.

The ozone produced with this simple apparatus would not permit of deodorizing alcohol economically, and so Messrs. Broyer and Petit, in concert with the skillful glass blower Seguy, have arranged it in such a way as to obtain oxygen ozoned to the highest degree possible and to much increase the effect produced. The arrangement adopted is shown at the upper part of Fig. 1. It consists in the use of three tubes like the one just described placed alongside of each other and connected by elbows, and in electrifying each tube separately by means of an induction coil actuated by a pile of two elements. In this way, the oxygen already converted into ozone in the first tube passes into the second and then into the third, and is each time submitted to a new electrification. The induction coils and piles used up to the present are to be replaced by an alternating current dynamo. Each tube will be connected with the general circuit by a special derivation, in such a way that the conditions will be the same as they are at present.

This mode of producing ozone gives remarkable results, and the influence of the three successive electri-



RUNDELL'S OX BOW.

fications may be easily seen by means of the reagent usually employed (terebinthine and tincture of guaiac), which ozone turns blue. If we take the gas coming from the first tube, we obtain a certain coloration that will serve as a starting point. Making the same test with the gas as it comes from the second tube, we find that the color is tenfold deeper; and, finally, on making its exit from the last tube, the color is fifteen times deeper than at first. If the tests be extended still further, we observe hardly any increase in the depth of the color, and it is hence concluded that three tubes are sufficient to allow the gas to give its maximum effect.

The essential oils that give alcohol its bad taste do not resist the action of ozone thus prepared; but in order to obtain a good result it is necessary to pass into the alcoholic liquid at least ten times its bulk of ozone. This represents considerable of an expense, especially when we consider that the oxygen to be converted into ozone must be very pure. In order to obviate this inconvenience and render the method really practical, recourse is had to an ingenious process that consists in the use of the same oxygen several times in succession. In fact, the oxygen is not destroyed by its conversion into ozone, but undergoes a simple transformation—a concentration that gives it new qualities. But it resumes its first form, either after being heated to about 75° or after being utilized in chemical reactions like those under consideration.

Fig. 2, which gives a general view of the Teillard plant, shows how this property has been put to profit. The oxygen is produced in cast iron retorts (not figured) by means of a mixture of chlorate of potash and binoxide of manganese, and is purified by passing it

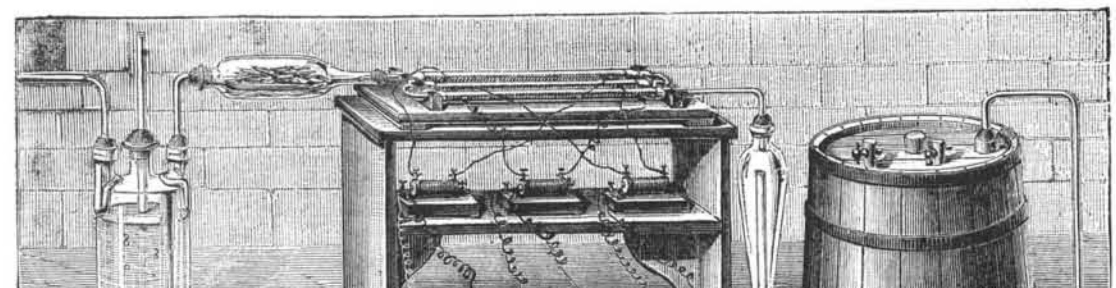


Fig. 2.—*t*, tube for leading the oxygen from the retorts; *u*, its cock; *n*, tube for leading oxygen from the gas holder, L; *u*, its cock; *m*, pump; *g*, piles; *f*, induction coils; *a*, ozone tubes; *o*, wash bottles; C, C_2, C_3, I, I_1, I_2, alcohol vats; D, safety tube.

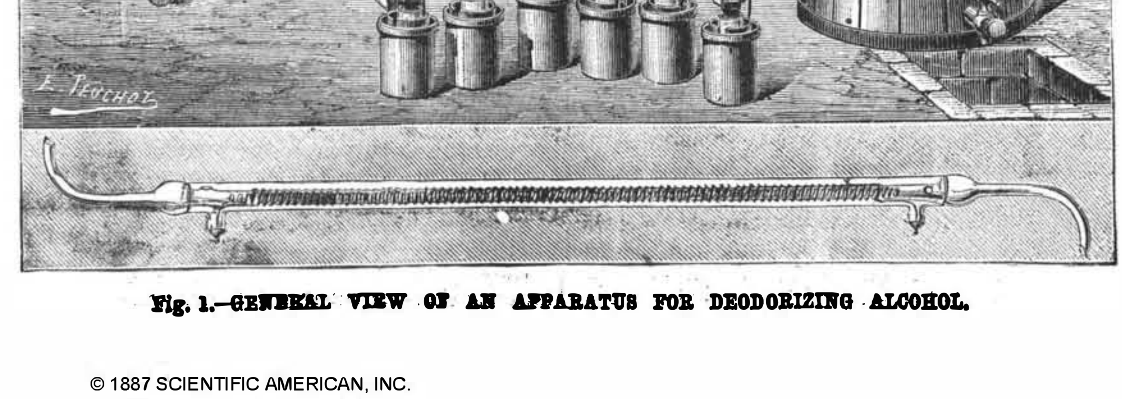


Fig. 1.—GENERAL VIEW OF AN APPARATUS FOR DEODORIZING ALCOHOL.

through solutions of sulphate of iron and caustic potash. It enters a washer, *o*, under a pressure of three atmospheres, through the tube, *t*, whose cock, *u*, is open, and here becomes cool. It then traverses a pipe filled with caustic potash and enters the tubes, *a*, described above, and therein becomes converted into supersaturated ozone. This latter flows into the first vat, C, filled with alcohol, to be rectified, traverses all the liquid that it contains, and then escapes through a pipe and traverses the vats of alcohol, C and C_1. At this point it has lost the greater part of its properties. On making its exit from vat, C_2, it is no longer supersaturated ozone that escapes from the pipe, but oxygen charged with vapors of alcohol.

This oxygen is freed from the latter in a washbottle containing cold water, is dried in contact with caustic potash, and afterward passes through a second series of apparatus like the others, first being converted into ozone, and then passing into the vats of alcohol. Finally, after meeting with a third series of apparatus, the gas, which has for a third time become oxygen, enters a gasometer, L. When the latter is full, the production of oxygen in the retorts is stopped, the cock of the tube, *t*, is closed, and that of the tube, *n*, is opened. Through a suction and force pump, the gas in the gasometer is sent through the tube, *n*, to the first washing vat, placed in front of the first series, and traverses all the apparatus again.

The operation is thus carried on until the gas is exhausted, this fact being shown by the level of the gasometer, L, which is then filled again by means of the retorts. We have, then, a closed cycle that permits of operating continuously and under economical conditions.

Fig. 1 gives a perspective view and the details of all the apparatus. The gas is supposed to be coming from the left. Between the first vat and the ozone apparatus there is a safety tube for preventing the liquid from entering the latter and breaking it in case a diminution in pressure should occur. The room containing the apparatus is kept at a temperature of less than 15°.

The alcohol treated by this process is perfectly deodorized, whatever be its source, and, on coming from the apparatus, is comparable to spirits that are several years old, thus rendering it fit for the manufacture of cognac.—*La Nature.*

MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, NEW YORK, 1887.

(*Continued from first page.*)

nomic science and statistics, Henry E. Alvord, of Amherst, Mass.; permanent secretary, Frederick W. Putnam, of Cambridge (office, Salem, Mass.); general secretary, William H. Pettee, of Ann Arbor, Mich.; assistant general secretary, J. C. Arthur, of Geneva, N. Y.; treasurer, William Lilly, of Mauch Chunk.

The following are some points of the programme: On Wednesday morning, at 10 o'clock, a general session for organization in the library hall of the college, and in the afternoon addresses by the vice-presidents of the several sections. The retiring president, Professor E. S. Morse, will make an address in the evening. There will be daily meetings of the sections, both morning and afternoon. A general reception will be given in the Metropolitan Opera House, Thursday, at 9 P. M., by the ladies' committee, to members of the association and their families. On Friday afternoon a water party will be given by Mrs. J. S. T. Stranahan, of Brooklyn, including a visit to Governor's Island and other places of interest. In the evening of that day, the Torrey Botanical Club will give a reception. It is proposed to visit West Point on Saturday. There will be a botanical excursion, Monday afternoon, to Sandy Hook; and an evening reception by Mrs. A. B. Stone, at Valentia flats, from 5 to 7; after which the New York Academy of Sciences will welcome the A. A. A. S. at Columbia College, followed by various receptions at private residences. The closing exercises will be on Tuesday evening. An excursion to Long Branch, by ocean steamer, is arranged for the Wednesday after adjournment. Other entertainments have been suggested, viz., a visit to the benevolent institutions on Blackwell's Island; to the American Museum of Natural History; to some of the leading manufacturing establishments of the city, etc. The geological section will visit the trap rocks of Bergen Ridge and inspect the glaciation of the rocks at Central Park. The Entomological Club will meet here on the day prior to the general meeting of the A. A. A. S., and the Agricultural Society will meet Monday and Tuesday.

The fact that the association meets this year in the halls of the Columbia College gives additional interest to engravings showing the exterior of the building on Madison Avenue, "Hamilton Hall;" and the interior of the library, where the general sessions will be held.

Originally chartered, in 1754, as "King's College," this was at first distinctively an Anglican institution. George III. and other noble patrons enabled the governors of the college to "extend their plan of education almost as diffusely as any college in Europe." The first president was Rev. Samuel Johnson, D.D., of Connecticut. For several years the recitations were heard in the vestry room of Trinity Church. The corporation of that church granted land to the institution between Broadway and the Hudson River, a portion of which was immediately, and for a hundred years, used for college buildings, while the remainder was leased, the rentals yielding a large income. During the revolutionary war the property was used as barracks for soldiers, the library was scattered, and the affairs of the college broken up. The legislature of New York, recreating the institution in 1784, perfected its charter in 1787, under the present title of "Columbia College." Thus this is its centennial year—an event enthusiastically celebrated last April, and of which this scientific assembly will be also a fitting commemoration. In 1814 the legislature granted the college a tract of twenty acres, then valued at $5,000, and located, on the present map of the city, between Fifth and Sixth Avenues and from 47th to 51st Street. It was not, however, until 1857 that the requirements of commerce made it necessary for the college to be removed from College Place to its present location, where it occupies the block bounded by 49th and 50th Streets and Fourth and Madison Avenues.

The range of academic instruction has been greatly enlarged, until now what is called the School of Arts includes, besides the usual curriculum, numerous optional studies. There are also several associated schools clustered around this as a nucleus, some of which are famous, while all are useful. These are a School of Mines, a School of Law, a School of Political Science, a School of Library Economy, and a School of Medicine. The School of Mines was established in 1864, prior to which there was no college in the country where mining was taught as a science. It grew from its original design until now it includes seven parallel courses of study, each occupying four years, and no two of which a student is allowed to pursue at once. These courses are mining engineering, civil engineering, metallurgy, geology and paleontology, analytical and applied chemistry, architecture, and sanitary engineering. Thus it might more appropriately be styled "The School of Applied Sciences." A highly interesting portion of its work is done by means of "summer classes," which meet in widely different localities. *E. g.*, in 1886, one class met in Northern Michigan, to study practical methods of mining; another for practical surveying, near Litchfield, Conn.; another for studying geodesy, near Otsego Lake; another had its headquarters at the Delamater Iron Works, on the North River; while the class in chemistry stays in the laboratories of the university. The School of Library Economy is an original feature, introduced this year, expressly to meet the wants of young persons of literary tastes wishing to study bibliography and the best methods of selecting, buying, arranging and caring for libraries, and making their contents useful and available for readers.

The Columbia College Library itself has been recently reorganized, and with the most modern appliances. The building in which it is contained, with its equipment, cost over $400,000; and such is the rapid accumulation of literary treasures that the trustees suggest an enlargement involving an expenditure of about a quarter of a million of dollars. The School of Law and astronomical observatory are also accommodated in this building. The building for the School of Mines was erected in 1874, at a cost of $150,000. Hamilton Hall, built in 1879, with a frontage of 200 feet on Madison Avenue, and a depth of 60 feet, shown in our engraving, was completed at a cost of about $200,000, for the School of Arts. The School of Medicine had this year 606 students, and moves this summer into its new building on 59th and 60th Streets, the munificent gift of the late Wm. H. Vanderbilt.

The chemical museum is rich in several thousand specimens to illustrate that department. The lithological cabinet contains about 5,000 rocks and minerals. The collection illustrating historical geology includes 75,000 specimens. The paleontological series includes thousands of recent and fossil animals and plants. The botanical collection has 60,000 species represented, and is peculiarly rich in "type specimens." There are also models, casts, specimens of building materials, ores, clays, coals, etc.

The faculty of this great university includes a president and one hundred and eighty professors, instructors, and assistants, and it has, according to President Barnard's statement, 1,602 students in all its departments. Such an array may well command the public attention, even amid the noise and rush of a commercial metropolis, that is by many supposed to be unfavorable to the calm pursuits of an intellectual life. The wealthy men of New York City would do wisely to increase the already large resources of Columbia College, so as to enable its managers to carry out fully and in the most attractive manner possible all their praiseworthy projects.

ELECTRICITY under favorable circumstances has been found to travel at the rate of 288,000 miles per second.

Northern Pacific Railway.

This company has now a continuous line from St. Paul and Duluth to Tacoma, on Puget Sound, the switchback over the Cascade Mountains having just been completed. The distance from St. Paul to Tacoma is 1,937 miles, which is a saving of 124 miles over the present route by way of Portland, Ore. As the Northern Pacific owns the line from Tacoma south to Portland—145 miles—it also has its own track from St. Paul to the latter city, and the distance by this route to Portland—2,082 miles—is only 25 miles longer than the present route, using the tracks of the Oregon Railway and Navigation Co. from Wallula Junction to Portland, a distance of 222 miles. The Northern Pacific Company, therefore, has completed its long entertained hope of owning a continuous line from Lake Superior and the Mississippi to the waters of the Pacific. The great Stampede tunnel through the Cascade range, which will take the place of the switchback, is to be completed in May, 1888, and will considerably shorten the present line. Its length will be 9,880 feet, while the overhead line of switchback requires a length of about four miles to cross the mountains.

Imitation Meteoric Iron.

It appeared to me that some interesting information might be learned by trying to reproduce meteoric iron artificially. I therefore melted together in proper proportions the iron, nickel, and other constituents of the Toluca iron. The furnace was left to go out very gradually, to insure, if possible, slow crystallization. The product is about as unlike meteoric iron as it is unlike ordinary cast metal. It is easy to see that the iron crystallized on solidification in feathery crystals, somewhat like those in some kinds of cast iron, but beyond that similarity ceases. In thus crystallizing, a harder substance was thrown off to the bounding surfaces, but it is impossible to say that it is true schreibersite. On examining the detail, the crystals constituting the chief bulk are seen to have a structure which may be called Widmanstätten figuring on a very small scale, when magnified about 60 linear looking like some etched meteoric iron unmagnified. Taking, however, all into consideration, the structure is very unlike the Toluca or any other meteoric iron which I have examined. It is, however, very interesting to find that apparently no recrystallization took place on cooling, since, unlike what is seen in cast steel, the structure on a small scale seems to be the true structure of the larger crystals. Possibly this relative permanence may depend on the difference in chemical composition. It seemed desirable to try the effect of long continued heat, but at a temperature much below the fusing point of this alloy. In making such experiments, even in well-covered crucibles, one cannot but suspect the influence of carbon introduced from the fuel, even if there is no decided proof of its action. The change produced by keeping a portion of the alloy for some hours at a high temperature was very great. I must say I expected that the effect would have been to have made the structure more like that of normal meteoric iron, but, to my surprise, I found it more unlike than before, and nearly all trace of the minute Widmanstätten figuring lost. If there is any analogy between its structure and that of any meteoric irons, it is with those which have undergone recrystallization, since the whole mass consists of interposing granular crystals of two different characters, whose size varies in relation to the original feathery crystals, the former existence of which is thus well shown, though their structure is entirely changed.

I do not think this single series of experiments sufficiently conclusive to enable us to build on them any important deductions; but, at all events, they serve to show that much might be learned by further experiment with such alloys, of equally great interest in connection with meteoric and artificial irons, since the presence of foreign constituents manifestly alters the mechanical construction very materially. It may perhaps, however, be allowable to draw one provisional conclusion. When solidifying from a state of fusion, the constituents of the complex alloy appear not to have had sufficient time to separate completely, but were able to separate when the product was kept a long time at a high temperature, crystallizing as small grains of at least two different kinds, with no special orientation. There is no evidence of such a separation in the case of meteoric irons, like that from Ruff's Mountain, the original large crystals having merely broken up into a mass of small. Though fully conscious how much more experiment is necessary, I must say that the general tendency of what is now known is to lead us to believe that the present crystalline structure of normal meteoric iron was developed at a temperature much below that of fusion, even though the material may have been previously melted. That very profound changes can quickly take place in iron, merely somewhat softened by heat, admits of no sort of doubt, and further research may prove that similar great changes may take place at no very high temperature, when the time of action is indefinitely long.—*Dr. H. C. Sorby.*