Researches on Ethers.

I. Formation of the Compound Ethers by Means of Ether and Acids.—Can ether, formed at the expense of alcohol by elimination of water, reproduce the alcohol whence it has arisen, or at least the combinations of which this alcohol forms an integral part? This question has been proposed more than once; and in spite of certain facts repeatedly announced, it is not, I think, regarded as settled, nevertheless it is not perhaps without some importance. In fact, in a theory widely received, the compound ethers are represented by an anhydrous acid combined with oxyd of ethyle, a substance isomerous or identical with ether. The direct production of the compound ethers by means of ether and the acids, has a tendency to support this view, although it is also susceptible of other explanations.

This production is effected by heating the acid and ether, enclosed in very strong tubes, to about 680° to 752° F.

The author has procured benzoic ether in this manner from ether and benzoic acid. It possessed the odor and specific properties of of benzoic ether, boiled at 416° F., and gave on analysis— Formula.

Carbon	72·2	72·2
Hydrogen	6·7	6·7

Treated with potash and water, it produces the benzoic acid; and in place of the ether, a volatile inflammable liquid, soluble in water, which, when touched with a drop of a mixture of sulphuric and butyric acids, evolves the odor of butyric ether. These characters belong to alcohol.

The ether employed in the preceding experiment had been shaken five times with its volume of water, so as gradually to dissolve the half; it was then dried upon chloride of calcium, and rectified. After nine hours' contact with the benzoic acid at 680° F., it furnished 30 per cent. of benzoic ether (16 grms. produced 5 grms.). The formation of the benzoic ether commenced at 572° F.; but at this temperature, even after long contact, there was but little of it.

With the view of acquiring greater certainty with regard to the purity of the ether employed, the author rectified the ether purified by the above method, distilling only the half of it at a fixed temperature; the distillation was then repeated upon this portion, only collecting the half of the product. The ether thus obtained furnished 25 per cent. of benzoic ether after three hours' contact with the acid at 680°.

Ether and butyric acid, kept for six hours at 680 F., produced butyric ether. The liquid in the tubes, submitted to distillation, only furnished ether, water, butyric ether and butyric acid. No gas was evolved.

At the same temperature, ether and palmitic acid produced palmitic ether, fusible at 72°.

In these instances neither the acid nor the ether was entirely combined, whatever might be the excess of one or other of them.

Ether and water, heated to the limit of decomposition (842° F.?), do not combine.

II. Direct Fomation of the Ethers of Alcohol and Acids.—The union of acid and alcohol to form ether is effected either directly or by the intervention of a mineral acid. The direct combination is generally easy with the energetic acids; but with the organic acids, such as acetic acid, becomes very slow and incomplete. But with the aid of sulphuric acid, the combination is immediately and almost completely effected.

The author has arrived at the following results by employing close vessels, and the assistance of long exposure to heat, in the direct preparation of the ethers:—

At 392° to 482° F., the combination of the alcohols with the fatty acids is effected with rapidity. In this manner the author produced at 482° F. the following ethers:—

Methylopalmitic ether, a crystalline substance, fusible at 82° F., solidifying at 72° F.;

Ethylopalmitic ether, fusible at 70°·7 F., solidifying at 64°·4 F., and reproducing by the action of potash, palmitic acid, fusible at 142° F.; and.

Amylopalmitic ether, a waxy substance, fusible at 48° F.; with potash it reproduces palmitic acid, fusible at 142° F.

The combination of the alcohols with the fatty acids is never complete, either for the alcohol or the acid. But these three ethers are most abundantly formed in the presence of an excess of acid, which is afterwards separated by lime and ether. When heated afresh to 500°. for fourteen hours, with eight or ten times their weight of palmitic acid, they are found, after the operation, to have undergone no change whatever.

With thirty hours, contact at 212° F., benzoic, acetic, and butyric ethers were produced in great abundance, especially the latter.—Stearic ether even begins to be formed in 102 hours, but in very small quantity. The addition of acetic acid to the mixture, in the latter case, causes the stearic acid to become completely etherified in 102 hours. This corresponds with the known action of sulphuric and muriatic acids, only differing in the comparative weakness of the acetic acid. It appears especially in this case, that the combination of the stearic acid with the alcohol is induced by that which takes place between the acetic acid and the same alcohol. It is a pretty clear instance of the propagation of molecular movement.

The ready etherification of the fatty acids in an alcoholic liquid, rendered acid even by acetic acid, appears to the author often to render the purification of these bodies very delicate.

III. On the Decomposition of the Ethers.—The ethers are split by the same agents which cause their formation. Thus—

Water heated to 212° F., for 102 hours, with stearic and oleic ethers, begins to split them, with regeneration of stearic and oleic acids.—Under these conditions it does not act at all upon benzoic ethers.

Acetic acid, diluted with 2 or 3 vols. of water, when in contact with stearic ether for 1060 hours at 212°, distinctly acidifies the stearic ether without producing acetic ether; it partially decomposes butyric and benzoic ethers, with formation of butyric and benzoic acids.

Fuming muriatic acid, in 106 hours, at 212°, produces double decomposition with acetic, butyric, benzoic and stearic ethers. The acids are set free, and muriatic ether is formed. The decomposition is never complete, unless in the case of stearic ether.

Thus a weak acid may be etherified or its ether decomposed at will under the influence of muriatic, or even of acetic acid. This difference in the action of the same substance results from the presence of excess of water in the one case, of alcohol in the other. The mass and relative energy of the acids are also to be taken into account.—M. Berthelet, "Comptes Rendus."

[For the Scientific American.]

Wind Mills in the South.

It having been necessary for some time for me to use wind mills for different purposes, I have been struck with the fact that while every other motive power has received great attention from our most skillful machinists, to simplify and make them useful to man, the application of wind as a motor (except to sail vessels) remains in the same bungling condition now as it was centuries ago in the fens of Holland. It is yet more singular that, in this country, with such an extended sea-coast, and such wide-spread prairies, where the wind blows with force three-fourths of the year, that the subject should not receive more attention. I do not wish to advance the idea, by any means, that wind can in any way compete with water or steam power where uniform and steady results are to be obtained, yet there are hundreds of minor but useful purposes that wind power could be put to by the planter, farmer, and mechanic, especially on our prairies and seaboard, to great advantage; provided our mechanics will hit upon some cheap, simple, and efficient method of constructing the windmill, and communicating its power.

I take it for granted that the common vertical wind mill, with inclined sails, is much more powerful than any horizontal mill yet invented, with like spread of sails. In fact, horizontal wind mills are powerless things unless of very large diameter, from the fact that in one of small diameter the wind acts at and near a tangent, a shorter space of time than in case of one of large diameter.

But the difficulty with a vertical wind millis to gear off with simplicity and effect, from the necessity of always keeping the sails to the wind. This is perhaps the greatest difficulty for constructors and machinists to overcome; another thing they should do is to construct the different parts ready to put on, and in the tower, something after the manner of the different kinds of horse-powers now in use, so that they can be taken apart, and snugly packed for transport to any part of the country.

They should be built of different sizes and for different purposes, such as turning the smaller kinds of grinding mills, sawing wood or lumber with either a circular or reciprocating saw, pumping water, &c. That wind mills are now applied to many of those purposes is certain, for I have seen in Texas a little vertical mill not more than six or seven feet in diameter, busily at work grinding hominy, in a common hand steel mill. And I have seen a larger one of about twenty feet in diameter, with six sails, doing a very fair business in sawing lumber, the power being conveyed to the saw by a crank in the center of the wind sail shaft. I have no doubt but that an enterprising man who would make the improvements I have suggested, and show to the world that his wind mills were efficient and durable, could sell thousands of them in Texas and on the western prairies, not to mention the seaboard, especially if he so built them that the purchaser had little else to do than to put up the tower, to set them into operation. They should be relatively as cheap as the different kinds of horse powers that are now made so compact and useful.

As I have given some thought to the method of simplifying the construction of the smaller kinds of wind mills above suggested, perhaps some constructor in that line may gather useful ideas by reading what I have to say, but I fear it will not be easily understood.

I think that, for the purposes named, wind sails from fifteen to twenty-five feet in diameter would be amply large, especially if six instead of four sails are put on them, and in order to get strength, compactness, and lightness, the different parts should be made of iron.

The shaft of the wind-wheel proper should be made of wought iron, with collars or flanches at each end of the bearings or journals for reasons that will be obvious hereafter, and the bearings for the journals of the above shaft should be made in iron chucks connected with an iron circle, say of from five to eight feet in diameter, which is made to revolve on a fixed iron railway circle, which railway should have projecting flanches on each side to grasp corresponding flanches on the chucks of the revolving circle, to keep said circle from lifting. There should be four of these chucks to the revolving circle, and in the case of a wind mill for pumping, &c., which requires a crank on the shaft in the center between the bearings, the bearing of the wind-wheel shaft should be made on two opposite chucks of the revolving circle. But in case of one required to communicate a revolving motion, by banding off from a perpendicular shaft, the outer bearing of the wind wheel shaft should be on one of the chucks and the other in the center of the circle—where it can be made by connecting the opposite chucks of the revolving circle by an iron bar at right angles to the wind-wheel shaft, to which bar the bearing of the inner end of the wind-wheel shaft can be attached near the center of the revolving circle, and by the same arrangement, a bearing can be formed in the precise center of the said circle, for the journal of the upright shaft, to the upper end of which, and to the inner end of the wind wheel shaft, there can be fitted either bevel or miter wheels, as the case may require. The chucks to the revolving circle I have named should have rollers in them. These can be arranged by an obvious method, so that the revolving circle shall move easily over the fixed railway circle; there should likewise be stops to the chucks, so that the wind wheel can be fixed firm to its place when brought to the wind. To a mechanic the further arrangement of these parts will be obvious without further waste of words. Flanches should be fitted to the outer end of the wind wheelshaft, to fasten on the wind sail frame with bands and screws, which frame should be made of sheet iron, bent and molded to the right form for strength with wire. This frame can either be covered with canvas or boards.

As far as my experience goes the wind sails should incline with the plane of motion about 18° or 20°, or in other words should incline with the axis of motion 70° and 110° respectively.

It has been my intention in the above only to furnish hints, and it is for the mechanic and constructor to arrange and complete the details, but I will further add, that if the parts of wind mills above named, and likewise such as are there shadowed forth—strong, simple, compact, and cheap—could be got up by an enterprising man, who would persevere in introducing them, hundreds, yes thousands of them could be sold on our western prairies and in Texas, to say nothing of the sea-board. W. C. D.

Key West, Fla.

(For the Scientific American.)

Light and the Eyes.

As several articles have been published in the Scientific American, in relation to the care of the eyes, I have a word to say on the subject, which may be useful. My eyes are weak, and though they see far and distinctly when not fatigued, they become dim, blood-shot, and painful whenever made to undergo exertion during candle light, even for half an hour. For years this infirmity prevented me from reading and writing after sun-down, until I happened one night, while traveling on a steamboat, to have in my hand a book which greatly interested me, and which I continued to read by the light of a chandelier which hung from the roof of the cabin, and which threw its light upon a table, beside which I was sitting. I expected that, as usual, I would soon be obliged to close the book; but to my surprise no dimness or pain occurred to my eyes, and I continued to read without the least pain or inconvenience till past one in the morning. The next day my eyes were as well as usual. I attributed this to the fact that the light was above my head, and fell upon the paper in the same manner as the light of day—from on high. Was I right in this? I leave you to answer. Certain it is, I have had a large lamp, with three branches, hung up in my office, several feet over my desk, and find that I can now read and write for hours by its light, without difficulty or suffering.

Yankee Creole.

The Darien Ship Canal Expeditions.

Reports from both the Atlantic and Pacific expeditions across the Isthmus of Darien, to explore the country for a ship canal, have been received. The result of these observations is, that the proposed route is a continuous chain of mountains, with summits of four thousand feet. One portion of the Atlantic party is still on the way to the Pacific. The construction of the canal, according to these reports, is utterly impracticable; but whether the explorations were as thorough as they might have been, does not yet appear. Mr. Kennish, one of the canal engineers on the Pacific side of the expedition, says:

"I refrain from expressing my opinion as to the practicability of this route for a canal, because I do not consider our data sufficient to allow me to arrive at any conlcusion worthy of public confidence, even though I believe that the expedition I had the honor to accompany explored further and with more detail than any other individual or party before the present time."

The expedition was composed of a detachment of engineers sent out by the governments, of the United States, France, and England.—The construction of a ship canal, through the Isthmus, seems to be impracticable; the expedition has been successful in settling this point—a very important one.

The next meeting of the American Association for the Advancement of Science, will be held in Washington City, commencing on the 30th of April.