of foreign matter into the apparatus becomes impossible. The force necessary for manufacturing 550 lbs. of ice per hour is at the outside 7 horse power. A temperature of 19·5° Fah. in the bath is more than sufficient for obtaining in the boxes a rapid and entirely economical freezing. The cost of making ice by this process is estimated at $2 per tun.

THE CENTENNIAL HORTICULTURAL BUILDING.

On the front page of this issue we publish an engraving of the interior of Horticultural Hall, a building which will be, to many visitors, the most attractive section of the Exhibition. The lightness and airiness of the structure and the beauty and variety of its contents, added to the fact that all their attractiveness is the work of Nature, will certainly secure a large share of the attention of many visitors. The noble palms shown in our engraving, are, many of them, new to this country; and there is, in nearly every department of floriculture and arboriculture, a good selection of native and foreign species. One hundred species are forwarded from Jamaica alone, all of them rare and interesting, many of which have never been in this country. The ferns indigenous to the United States also number one hundred varieties. Moreover, the following interesting and valuable plants will be shown, growing in the soil, and blossoming and bearing fruit: Ginger, pimento or allspice, nutmeg, alligator pear, bamboo, sarsaparilla, Liberian coffee, yam, cashew nut, *lignum vitæ*, teak, Indian or China grass, betel nut, tea. Also, specimens of the pawpaw, mammee apple, mango, black pepper, indigo, breadfruit, and noseberry. A few beautiful specimens of the orchid may also be found in the west wing of this building.

Illustrations of the Centennial.

We give on our front page an elegant illustration of the interior of Horticultural Hall, for which we are indebted to *Harper's Weekly*. We will take this occasion to say that the picture of the Woman's Pavilion and New Jersey building, given in our number for June 3, were also from that journal, credit for which was inadvertently omitted at the time of publication. The arrangements of the Messrs. Harper for the illustration of the Exhibition have been made on a most extensive scale, regardless of cost, and the numbers of their popular weekly teem with artistic productions of the highest merit.

Correspondence.

The Extraction of Gold.

To the Editor of the Scientific American:

The variety of the elementary bodies found in ores of the precious metals renders it extremely difficult to furnish any single formula that will in all cases meet the requirement of the metallurgist; but a large class of placer gold and auriferous ores will admit of treatment by the following process, which may, by slight alteration, be made to suit others.

Gold is generally found in Nature accompanied by other metals; and those are often in combination with other elementary bodies, such as sulphur and tellurium, in variable proportions. These are subject to decomposition by the action of oxygen, or water, or carbon; in the change, sulphuretted hydrogen is generated, and perhaps a union with sulphur and carbon is effected. The former is readily absorbed by gold, communicating to it a negative quality as regards mercury, forming what is called unamalgamable or rusty gold. The ordinary amalgamating process takes up a large part of the coarse gold. This favorable condition is due to its greater specific gravity, which favors superficial cleaning by the attrition received, while it presents less surface of the gold to chemical action. The finer particles escape amalgamation.

A quantitative analysis of the tailings at any of the quartz mills or placer washings will determine the difference of the assay value and the amount obtained by the mills; and the difference between the two estimates will excite some surprise. To obviate some of the inconveniences above mentioned has long been desirable, and resort has been had to other methods of treatment. Smelting, one of the most perfect processes for the reduction of metals, is unfortunately one of the most costly, and therefore cannot be employed in case of poor ores. The next in importance is the chlorination process, the invention of the celebrated metallurgist Plattner, of Freiburg, Germany. This process presents advantages of economy which have caused it to be adopted in California and elsewhere; yet unfortunately it entails certain conditions, difficult to comply with in many cases, which greatly impair its value. It is necessary that the ore should be free from most of the base metals and earthy bases. The weak attraction for oxygen and want of stability of the former, and the absorption of chlorine by the latter, will defeat the object in view. Under the most favorable conditions, very great skill and attention are necessary to insure success. To avoid the cost of smelting, and the restrictions narrowing the sphere of usefulness of the chlorination process, the following process has been devised:

The auriferous sulphides or fine sulphurets are roasted in the ordinary reverberatory or other furnaces, under the conditions commonly employed. The sulphurous vapors arising are passed through a broad-based chimney, partially filled with ore, rock, or coke, of egg size or thereabouts, resting upon a grating. A small stream of water is introduced and allowed to impinge on the top, and will percolate through the whole mass. The water arrives at the bottom highly charged with sulphurous acid from the ascending vapors; this acid may be converted into sulphuric by the use of hyponitric acid in a similar chimney arrangement. After roasting, the ore may consist of sulphate, sulphide, and oxide of iron, copper, etc. If the roasted ore is treated to a warm solution of dilute sulphuric acid, as above mentioned, there will result the following reaction: $FeS + HO, SO_3 = HS + FeO\ SO_3$. The sulphuretted hydrogen passes off as vapor; the iron sulphate and other soluble salts, if present, may be leached out. The insoluble salts remaining with the gold exert no action in separation by mercury. The addition of a little caustic lime at end of the process, excluding it as much as possible from atmospheric influence, will give rise to the formation of the hydrated protoxide of iron, a powerful deoxidizer, which acts by keeping both mercury and gold clean and active.

JOHN TUNBRIDGE.

Newark, N. J.

Working Men's Reading Rooms.

To the Editor of the Scientific American:

I am happy to see that the working men have in you a true champion. They are to the country what his staples are to the farmer, to be relied on when other things fail; and it is in their behalf that I wish to speak.

Some time since I saw a reading room for working men suggested in your paper, and some of the towns in this vicinity have established such, to their benefit. Now there are many, perhaps hundreds, of working men, especially those employed in watch factories and the like, whose occupations during the day demand such a strain upon the eyesight that reading by lamplight is both difficult and injurious. There is also a classof working men whom my plan is more especially intended to help, namely, those whose limited education has not given them tastes which are calculated more to elevate character than to make money. A mechanic of the humbler class spends his life so much among the real, practical, and prosaic that, unless he has a very spiritual nature, he is apt to become coarse in his perceptions; and if he has no natural taste for instructive books, he will not be likely to acquire one in following his business. In almost every town, there are ladies and gentlemen who can spare at least one evening in the week, and who have enough literary talent to fill an interesting programme for an audience of working men, giving readings and addresses, which may be interspersed with music, thus making a pleasant and profitable evening for those who otherwise would find time hang heavily on their hands.

Many a workman who has yet to know what it is to receive wages that do not necessitate the strictest economy feels a pardonable hesitation in taking his family to any kind of meeting where broadcloth and velvet abound, and where people look askance at his worn clothes and hardened hands; but the entertainment I suggest would be his and his alone, and he and his fellow workers could meet thereat without restraint.

This suggestion is respectfully offered, not in opposition to that of the SCIENTIFIC AMERICAN, but to meet a want which that, in some instances, would not entirely cover. These ideas are, of course, subject to modifications; but I feel sure that such an institution, organized in any manufacturing town, would not be long in existence without a marked change for the better.

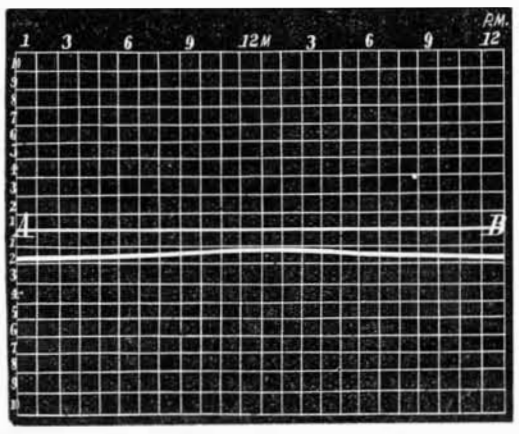
M. P. P.

Rockton, Ill.

HOME-MADE PROBABILITIES.

We are indebted to an old and valued subscriber, Dr. Levings, of this city, for a suggestion which we think will be of much use to farmers. It is a modification of the plan recently adopted by the New York *Tribune*, for exhibiting, graphically, barometric fluctuations over a given time; and its object is to enable every farmer, by the aid of barometer and thermometer, to cast up his own weather probabilities.

A blackboard, say two feet wide by three feet long, is preferable, but a barn door will answer. On this is ruled the horizontal center line, AB, in the engraving, say in red paint; above and below this are ten horizontal divisions, and



the board is also divided vertically into twenty hour sections, numbered to represent the hours as shown. The red line marks a barometric hight of 30 inches, and the other horizontal lines tenths of inches above and below. It is evident that on this the course of barometric variation can be indicated by an irregular line. For example, our engraving shows that at 12 P. M. the instrument registered 29·82, 12 hours later it had risen to 29·88, then it declined to 29·84. The board thus prepared is hung at any convenient place, near the barometer; and at noon or at any other time, whoever may pass it has only to glance at the clock or his watch, look at the barometer, and carry on the line to mark the indication with a bit of chalk. Then in the evening, say, if the farmer is desirous of knowing whether the weather will be fine on the morrow, he merely glances at the board, and the direction of the line tells the story. Being only a chalk mark, the line is rubbed out and made over every day. By observing the weather following changes of barometer, the farmer can soon learn to interpret the indications. As a general rule, however, says the *Tribune*, when the curved line is above the line of mean pressure and varies but little, fair weather may be relied upon; but if there are sudden and excessive fluctuations, a northeasterly storm is likely to follow. The time of its approach is indicated by the frequency of the fluctuations, its violence by the excess of the movement. When the curve is below the line of mean pressure, uncertain weather, mainly from the southward, with increased temperature, will follow. A descent of the curved line from above to below the line (30) evinces a tendency from good to bad weather; while an ascent, from below to above it, points as unmistakably to pleasant weather, which may, however, not be of long continuance. The diagram is the measure for all storms likely to occur. The proportional distance above and below the central line marks the excess of changes. As temperature corresponding to barometric indications is also an aid to predicting the weather, a second board might be constructed to mark changes in the thermometer, and hung beside the one already described.

Solvay's Ammonia Soda Process.

This new method of making soda ash from common salt seems likely to prove as great a success in practice as it is remarkable in theory. In technology revolutions take place slowly. Although this process was exhibited at the Vienna Exhibition and attracted a great deal of attention there, it has been slow in coming into practical use. Professor A. W Hofmann did not hesitate then to prophesy for it a brilliant future, but some details of the operation were not yet perfect, and, while capitalists hesitated to risk on a thing so new, old manufacturers fought it as their direst foe. The operation depends on a principle discovered a long time previous, namely: that bicarbonate of ammonia is able, under certain circumstances, to decompose the much more permanent compound, chloride of sodium, the result being chloride of ammonium and bicarbonate of soda. A patent was taken out in 1838, in England, for making soda ash in this way, but it seems not to have come into practical use.

E. Solvay took out several patents abroad, the first being in 1863. His method, we understand, as now employed, is nearly as follows: In one tank a saturated solution of common salt is first prepared, and then slightly diluted with water until it stands at 67° or 70°. This solution is then filtered and run into a second tank, and ammonia gas forced up through the brine in small bubbles, which are rapidly absorbed. When the brine has become saturated with ammonia gas and its density falls to 16°, it flows automatically into the third tank, first, however, passing through a worm placed in cold water to cool it. This third vessel, called the absorber, is the most important part of the apparatus, for it is here that the carbonic acid is admitted, which seems at first to combine with the ammonia to form a bicarbonate of ammonia, then, gaining fresh power, it attacks the chloride of sodium, driving out the acid and combining with the base. The operation may be represented thus; $(NH_4)HCO_3 + Na\ Cl = NH_4\ Cl + Na\ HCO_3$. The absorber is a cylinder 37 to 53 feet high, provided with numerous perforated, convexed, horizontal partitions, or false bottoms, with teeth-like openings around the edge. The absorber is filled with liquid and carbonic acid forced in at the bottom under 1½ to 2 atmospheres of pressure; and ascending, it comes into intimate contact with the liquid. The bicarbonate of soda collects as a crust on the false bottom. The liquor is frequently drawn off, and the absorber filled with water to dissolve the soda salt, which can then be evaporated in vacuo and the excess of carbonic acid driven off and caught in receivers for use a second time. The carbonate of soda resulting from calcining this bicarbonate is quite pure if the salt employed be pure, and is at all events free from sulphur, an ever-present and inavoidable contamination of crude soda ash made by the Leblanc process.

What becomes of the waste products? The chief by-product is, of course, chloride of ammonia, which by treatment with an alkali is decomposed, and the ammonia gas liberated for use over and over again. If quicklime be employed to decompose the sal ammoniac, the operation is as follows: $2NH_4Cl + Ca\ O, H_2O = Ca\ Cl_2 + 2NH_3 + 2H_2O$. The chloride of calcium thus obtained being an article of very little value, it is preferable to decompose the sal ammoniac by means of caustic magnesia, thus obtaining a chloride of magnesia, which can in turn be decomposed very readily by the action of steam into caustic magnesia and hydrochloric acid, the latter a valuable commercial article, the former for use again.

It will be seen that there is no waste, every product being utilized; and the question of practicability rests chiefly on the one question: Is bicarbonate of ammonia able to decompose all, or very nearly all, the chloride of sodium in the brine? Ordinarily, no; but under pressure and by a proper adjustment of conditions it seems to have become possible, else the success of the process reported abroad could not have been attained.

Moths.

This is the period when moths begin to fly, and those who have not packed away winter garments and furs should lose no time in doing so. Beat the articles thoroughly, and expose them to bright sunlight and air for several hours. Seal them up in tight paper cases, or put them away in close trunks, with plenty of gum camphor, pepper, tobacco, chips of Russia leather, or cedar dust.

A GOOD cheap paint for rough woodwork is made of melted pitch 6 lbs., linseed oil 1 pint, brick dust 1 lb,