

the communication with the furnace, from which the upward air current in the flue had drawn sparks. As water thrown in from below did not extinguish it, a hose was applied to the top; and at the moment of injecting a stream of water, a most violent explosion took place in the flue, blowing the wire grate, cupola, and belfry into fragments, and high into the air, and wounding 13 men. Then a fire broke out in the roof, but this was speedily under control after the firemen arrived.

The local papers, commenting on this event, say that the water was changed into steam, oxygen liberated, and the gas ignited; this of course is erroneous, and the cause of the explosion ought to be attributed, like all similar explosions, to a mixture of air with a combustible vapor or dust. Just as ordinary illuminating gas is liable to explode when mixed with air in the right proportion, so will the dust of inflammable material. There are already numerous examples on record of the same nature. Last August an explosion took place at the works of the Milburn Wagon Company at Toledo (see SCIENTIFIC AMERICAN, October 9, page 228, current volume), which was also caused by the fine wood dust in a shaft through which the shavings, etc., were conducted to the furnaces; it was so violent that the boiler room and magazine were completely wrecked, the roof blown off, the walls thrown down, etc.; and we then called attention to the dangerous nature of the dust of combustible materials.

In the *Science Record* for 1874, published at our office, it is stated (on page 395) that at the town hall at Friedek four persons were injured by such an explosion; and not wood dust only, but flour dust, will cause similar disasters. In the Ofen-Pesth steam mill, an explosion, which destroyed the windows and roof, was caused by a cloud of dust of some very fine varieties of flour being ignited by a candle. A great explosion also occurred at Glasgow, where the stones grinding the flour struck sparks during an accidental cessation of the feeding. Of the latter accident a detailed account was given in the SCIENTIFIC AMERICAN of October 5, 1872 (page 209, volume XXVII.), where it is also mentioned that Professors Rankine and MacAdam made experiments to ascertain the inflammability of such mixtures, and verified the result of the calculation of the right proportions to produce the accidents in question. It has been found that the rapid combustion of the finely divided flour, as well as the ignition of a mixture of air with the gases furnished by the decomposition of flour and of wood, may produce explosions. Flour and bran mixed gave off, at 450° Fah., a gas which, mixed with nine times its volume of air, ignites; and such a temperature is often obtained by the friction in the grinding process, and it has undoubtedly been a cause of many unexplained fires in flour mills.

Other materials than wood dust and flour have given rise to like accidents. About 10 years ago, a similar explosion took place in the Grahameite mines in Western Virginia, where the dry, resinous, and brittle material had filled the mining shaft in the form of an impalpable dust, which it was afterward found could not be entered with impunity without safety lamps.

It is therefore probable that the dry sawdust, with which the flues in the Detroit establishment were filled, required to be intermingled with air in the right proportion to form an explosive mixture, and that the intermingling was effected by the stream of water entering from above, while fire was set to the mixture from below; or inflammable gas may have been produced by the decomposition of the wood shavings at the bottom of the flue, or by imperfect combustion, evolving carbonic oxide gas, favored by insufficient access of air; this gas may also have entered from the furnace, by the acknowledged imperfection in the arrangements for closing the communication. This combustible gas may have mixed with the air and combustible dust, to such an extent as to form the explosive mixture. There is no doubt that the limits of such dangerous mixtures are often reached in many localities; and the actual explosion is only avoided by some disturbing influence, which prevents the attainment of the required proportions, persons of the vicinity remaining unaware of the dangerous crisis through which they have passed.

#### THE PRESERVATION OF HOPS.

As the brewing of beer is making such tremendous strides at the present day, owing to its enormously increasing consumption, the production of and trade in one of the most important ingredients, the hop, have become a correspondingly gigantic branch of commerce. The active constituent in the hop is volatile; but a worse feature is that it is powerfully acted upon by the atmospheric oxygen, which in time renders useless hops that have long been preserved. Hence attempts have been made to keep them in their normal condition, and the manufacture of an extract of hops has been attempted in this country with apparent success. The brewers, however, found that they could not use it, or rather that if they used it it made the beer less palatable, and therefore less salable; hence they have all adhered to the use of the original hops, and the great problem has been how to preserve the hops themselves. It is now announced in the German papers that C. B. Jung, a merchant in Fürth, has succeeded in doing this by removing the atmospheric air. As it was not practicable to do this by exhaustion by an air pump, he attempted to do it by displacing the air with a gas that did not contain any oxygen, or at least no free oxygen, and he tried nitrogen, hydrogen, carbonic oxide, carbonic acid, etc.; and he patented his process in several countries. At last he selected carbonic acid as the most effective and the cheapest gas, as it can be made by mixing limestone or chalk and sulphuric acid. He operated thus: He loosely filled a box (lined with tin) with hops: he brought a tube to the bot-

tom of the box, and by it conveyed under the hops the carbonic acid, which, being heavier than air, remained below, and drove the air out upwards. He then compressed the hops, filled the box up again with more hops, and admitted more gas; and he continued in this way until the box was full, then put on the cover, and admitted more gas, to prevent the penetration of air by possible diffusion, and after a while he closed the box hermetically. For the performance of this generation on a large scale, he proposes to have the gas ready in a large gas holder, similar to those used for illuminating gas, and to introduce it by a moderate pressure. The hops prepared by him in this way have thus far been found by the brewers to have remained in perfect condition, and fully equal to the fresh article.

#### THE SCIENTIFIC AMERICAN SUPPLEMENT.

The first number of this new addition to our publications will be ready next week. We issue it considerably in advance of its actual date (January 1) for the convenience of those who desire to procure copies for examination prior to subscribing. Single copies 10 cents. For sale at all the principal news stores throughout the country. Single copies also sent from this office to any address on receipt of the price. The first number of the SCIENTIFIC AMERICAN SUPPLEMENT will contain a large amount of interesting matter.

Among other things it will contain a paper relating to the Construction of Ice Boats, illustrated with working drawings and specifications for the making of the best and fastest boats now used on the Hudson River. These articles will be of great utility to young mechanics in all parts of the country, furnishing them the measurements, proportions, and all the details of construction. The ice boat is a simple machine, but its use involves some skill and is productive of great enjoyment.

For a more detailed statement of what the subscriber to our SUPPLEMENT may expect during the year we refer to the prospectus in another column.

#### A HINT FOR THE HOLIDAYS.

As the season for gift-giving draws nigh, the annually recurring problem, what to give, presents itself. What will afford the most pleasure or yield the largest benefit for the money to be expended?

We do not propose to answer or attempt to answer a question so delicate and important; but would merely suggest a few instances in which a very useful, pleasure-giving, and appropriate gift would be a year's subscription to the SCIENTIFIC AMERICAN.

Employers often find it advantageous to manifest their appreciation of the fidelity and painstaking care of the better sort of workmen by a holiday gift; and for such a gift, a year's subscription to the SCIENTIFIC AMERICAN is sometimes chosen. In some cases as many as fifty workmen in a single establishment are reminded, in this way, that their personal character and skillful services are favorably regarded by the proprietors. And we have been assured, by those who have tried the experiment, that gifts of this kind are as profitable to the giver as acceptable to the receiver. By its timely suggestions, hints, items of information, and general influence, the SCIENTIFIC AMERICAN makes the recipient more careful and intelligent as a workman, more fertile in resources, less likely to waste his time in idleness or unprofitable associations; and the giver reaps a benefit perhaps many times above the cost of the gift. This, leaving out of sight the pleasant effect which such attentions from employers have upon the employed.

Equally happy will be the effect of such a gift upon any young mechanic from any interested friend. It cannot but be instructive and improving; and many successful machinists, artisans, and others have gratified us with the voluntary assurance that their progress in their chosen trade or profession has been very largely owing to the habitual study of the SCIENTIFIC AMERICAN.

But it is not to the mechanic only that a subscription to the SCIENTIFIC AMERICAN will be acceptable and useful. To the farmer—young or old—its pages are full of suggestions and instruction; and no better or more pleasing present for its cost could be made to a wide-awake son of the soil. This not only for the wide range of entertaining and instructive scientific matter it presents, but also for the information it furnishes in regard to improvements in farming machines and implements, and still more in regard to the handling and care of them. To be a successful farmer to-day, a man needs almost to be a machinist as well.

Not less appropriate is the SCIENTIFIC AMERICAN as a holiday gift to the doctor, lawyer, minister, or other professional man. Each and all of these have to do mainly with the great army of producers, of whose thoughts, labors, interests, etc., this paper is an exponent; and their success in their profession cannot but be furthered by such a knowledge of the world their clients live in, as our paper is calculated to furnish.

Do you contemplate a holiday gift to your pastor? Consider whether a present which will break the routine of his professional reading, which will show him, from week to week, what the men who deal with the physical are attempting and achieving, how they regard the great question of force and life, and what is doing in the world of Science and scientific speculation: whether such a gift will not prove at once useful and suggestive to him, a help in social intercourse, a means of diversion and of instructive recreation.

Is it a gift for the village schoolmaster that you are seeking? A copy of the SCIENTIFIC AMERICAN will give him a weekly respite from the domination of text books, tell him much that the intelligent patrons of the school are interested

in, and furnish an abundant store of information with regard to the world's activities, the discoveries of Science, the masterpieces of inventive genius, and a thousand things, not only available for breaking the monotony of school studies and brightening the wits of the children, but directly useful to him in increasing his range of knowledge and widening his views of man and nature.

Is it a bright student you think of favoring? The annual volumes of the SCIENTIFIC AMERICAN furnish instructive matter equal to several books of corresponding cost, besides a multitude of engravings, illustrating not only the best inventions, but the more important feats of engineering and construction, new discoveries in chemistry, electricity, and physical science, figures of many new and remarkable plants and animals, portraits of eminent men, views of the world's great workshops, and scores of other interesting scenes and objects. The subjects discussed and described, unlike those of his text book, are subjects of current interest and significance. They open to him an inviting entrance to the living world of human thought and action, enliven his interest in what is useful and instructive, and tend to create in him a becoming respect for the dignity and honor of labor. And its influence is cumulative. The pleasure and profit of the gift do not pass with the holiday season, but abide throughout the year, bringing, at the least, fifty-two reminders of the giver's thoughtfulness and kindly consideration.

What is true in regard to the fitness of the SCIENTIFIC AMERICAN (and of the SCIENTIFIC AMERICAN SUPPLEMENT as well) as a cheap, appropriate, and useful holiday gift to the classes we have named, is equally true with respect to many others. Is there no Association, Society, Reading Room, Library, Lyceum, Lodge, Club, or Institution, in your vicinity, whose prosperity you desire to promote? Probably nothing that you could do would be so highly appreciated by the members as the gift of a year's numbers of THE SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT. These two publications, costing only \$7.00, will furnish fresh and useful reading matter throughout the year, equal in amount to eight thousand ordinary book pages.

#### SCIENTIFIC AND PRACTICAL INFORMATION.

##### RUSSIA AND THE CENTENNIAL.

A curious misunderstanding, it now appears, has existed throughout the country relative to the attitude of Russia regarding the Centennial. Her neglect to apply for space, and to accept the official invitation of our government to contribute to the Exposition, has been a matter both of surprise and regret, since the friendship existing between the two countries has never been impaired, and the non-participation of the empire has been construed in the light of an intended slight. The news, therefore, that Russia has not only recently officially applied for space through her representative in Washington, but has asked for double the area allowed her, will be received with general satisfaction. The Russian journals promise a magnificent display of national productions, which will far exceed anything hitherto contributed by Russia to any of the great expositions heretofore held in Europe.

##### REMARKABLE FEAT IN SAW MAKING.

At the works of Messrs. Emerson, Ford & Co., Beaver Falls, Pa., on November 11, a solid toothed circular saw, with 40 teeth, of No. 5 gage at the center, and No. 6 at the rim, was finished complete, ready for market, in the short period of 7 hours and 45 minutes. The saw was on the anvil (being flattened, smithed, hammered, and blocked) 4 hours and 55 minutes. The hammer strokes were counted, and aggregated 12,764. The balance of the time, 2 hours and 50 minutes, was occupied in drilling, toothing, grinding, hardening, tempering, and cooling, after it was tempered. The teeth were ground into shape after they were cut, and the saw was ground after smithing, then again after being hammered and before it was polished and stamped. Total amount of labor expended, including that of helpers, was 12 hours and 40 minutes. The saw was of high temper, and required rather more than an average amount of smithing, as 8,523 blows were expended in this laborious operation alone.

##### AN IMPROVED METHOD OF ETCHING COPPER AND STEEL.

In overlooking the recent handbooks, encyclopedias, technological dictionaries, and journals, many directions for etching metals, especially steel and copper, are found. It is a pity, however, that most of these prescriptions only very imperfectly fulfil the purpose intended, while some of them are even utterly impracticable. Some modern industrial establishments in Germany, especially the Metallurgical Museum of Nuremberg, have undertaken the task of submitting the processes proposed by the books to practical tests, in order to abolish many of them, which, like a chronic disease, are carried from generation to generation, by being copied in good faith in the handbooks and encyclopedias; and it is expected that only very few of them will stand this severe ordeal.

Rudolf Wagner, editor of the "Annual Chemical Technological Report" (*Jahrbuch des chemischer Technologie*), mentions in a recent German industrial journal that he found that solutions of bromine and bromine compounds were most excellent for the etching of steel. He uses 1 part of bromine to 100 of water; and in case he wished to avoid the vapor of this volatile material, which may injure delicate objects around, he prefers a solution of 1 part of bromide of mercury in 30 parts of water. For etching copper, he recommended a solution of bromine in hydrochloric acid, as preferable above all other agents known.