Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *nine dollars a year*.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, $5.00 a year; combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign countries, $11.50 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, NOVEMBER 28, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 830.

For the Week Ending November 28, 1891.

Price 10 cents. For sale by all newsdealers.

PLATES FOR SECONDARY BATTERIES.

A solution is made by boiling litharge in a very concentrated solution of caustic soda and potash. A lead plate boiled in this solution will receive a coating of spongy lead ½ inch in thickness. This can be pressed down so as to occupy only one one-hundredth of an inch. A plate thus prepared yields readily to the forming process. This method is due to Edison.

IMPORTANT IMPROVEMENTS IN SORGHUM SUGAR MANUFACTURE.

By the recent introduction of the alcohol process in the manufacture of sugar from sorghum, the industry takes on a new aspect and promises soon to rival if it does not surpass in value the cane and the beet root products. H. W. Wiley, director of the government surghum sugar station at Medicine Lodge, Kansas, reports the yield of first sugar to be 150 pounds per ton of the plant, which latter costs $2 to $2.50 per ton, against $4 to $5 per ton for beets or cane, yielding the same amount of first sugar.

The Louisiana *Planter* says: The process, until the semi-sirup is ready for the strike pan, is the same as in the ordinary sorghum mill. After the juice has been evaporated to a semi-sirup, ready for graining in the strike pan, it is drawn off into large tanks and mixed with an equal volume of alcohol, a pipe at the bottom of the tank conveys a current of air through the mixture, and the sirup and alcohol are thoroughly mixed. It is then allowed to stand about twelve hours.

The alcohol combines with the impurities in the sirup and a mass of gummy substances is precipitated to the bottom. The clear mixture of sirup and alcohol is then drawn into the distilling column and the alcohol recovered. The sirup, being freed from impurities and alcohol, is then conveyed to the strike pan.

The residue left in the bottom of the tanks is run through filter presses, and after the sirup is obtained from it a thick, gummy mass is left which somewhat resembles rubber in appearance, but lacks its consistency, and readily breaks apart.

The loss of alcohol is less than one per cent.

The masse cuite contains no gums and is swung through the centrifugals in a remarkably short time, a charge being run through in less than two minutes, while masse cuite from sorghum sirup by the ordinary process requires from seven to ten minutes.

By the alcohol process actual sugar to the amount of from 148 to 160 pounds per ton of cane has been obtained.

In all the industrial arts there is perhaps nowhere a more striking illustration of the ability of science to remove difficulties than in this case of sorghum sugar manufacture. Chemicals failed to remove the gummy substances from the juice, mechanical means failed. Mark how simple the remedy—convert the gummy substances into alcohol, and use the alcohol to separate the gummy substances. It is simply to make the gummy substances remove the gummy substances. It is simply to cause the juice to clarify the juice, the impurities to remove the impurities. There is nothing simpler, except the wand of a magician.

And now sorghum sugar manufacture, having the diffusion process and the alcohol process, enters a new era, an era of success. It has now a business basis, instead of a theoretical basis.

There are many millions of acres of land in the Southwest whose soil and climate are admirably fitted to produce sorghum cane containing 246 pounds of sugar in a ton of trimmed cane, that is cane cleaned of leaves and of seed, and of this 246 pounds of sugar, 150 pounds is known to be easily obtainable; so that with the second sugar the total yield will not fall much short of 200 pounds of sugar per ton of clean cane. The cultivation of sorghum is much easier and less expensive, in the Southwest, than the cultivation of sugar cane or of sugar beets.

POOR ENGINEERS AND GOOD BOILERS.

Boiler explosions are constantly taking place which ordinary precautions would have served to prevent. If any one doubts this let him investigate the causes of such disasters. On an average, the serious ones occur about twenty times a month, at least this has been the rate for the past two years, during which time the writer has carefully noted them. One potent cause is undoubtedly to be attributed to the employment of ignorant or careless men in the engine room, and another to the parsimony of some steam users, who "cannot afford" to get new boilers, though the old ones have been rendered dangerous by ill usage; perhaps they were only cheap tank iron affairs when first set in.

A few, happily the minimum, come from causes which the most painstaking manufacture and the most skillful handling would not always avail to prevent, for there are conditions of generation and expansion of gases within boiler shells which even at this late day are not thoroughly understood.

Let us inquire into the causes of some of the recent explosions. There were twenty-five serious ones between October 15 and November 15. In the case of the disaster in the boiler house of the Louisville (Ky.) Electric Power Co., the exploding boiler was connected with another by a large steam drum, so that when one had a certain pressure, the other had the same. Each had an independent feed pipe entering at the top, and also separate gauge cocks and glass water gauges. They were connected at the bottom with a two inch equalizing pipe. It was shown conclusively that there was plenty of water in one, and none in the exploded boiler. Close inspection of the inner sides of the plates showed this. The feed valve had become closed and the equalizing pipe stopped up by scale and sediment. The indications of the back head and the flue, which showed the blue line, indicated low water, and even the engineer admitted that that was the cause. The result of this explosion was the death of one man, the wounding of several others, and a disastrous fire.

The engineer trusted to the equalizing pipe, and did not even trouble himself to keep his boilers free of scale and to watch his gauges. Even his brother engineers in Louisville condemned him in a special meeting.

A somewhat similar case occurred at the Enterprise Mills, St. Jacob, Ill. The boiler that exploded let go along the horizontal seam of the first sheet, just below the water line, one flue was collapsed its full length. There were two boilers set in battery, connected at bottom with mud drum with seven inch legs, and on top with four inch pipe only. The boiler that did not explode showed no signs of low water, while in the other they were unmistakable. This seems to have been a clear case of driving the water from one boiler into the other. There had been a big fire under the one that exploded, and but little under the other. That and the small steam connection is thought to be sufficient to account for it.

Here is a fairly representative list of explosions for thirty days, with the causes given where known:

Bessemer, Ala.: Electric Light Works. Cause: low water.

Anderson, Ind.: Am. Straw Board Co. Engineer went out for his lunch. He "thought it would be all right."

Tifton, Ind.: Coleman's Mill. Cause: not known.

Medina, N. Y.: Sanderson's Mill. Cause: boiler scaled an inch thick.

St. Paul, Minn.: Kansas City Lime Shops, locomotive boiler. Cause: unknown.

Manchester, N. H.: Amoskeag Mill. Fly wheel exploded. Cause: imperfect casting.

Chicago: Tug boat Parker. Foaming, caused by using Chicago River (sewage) water.

Whitcomb, Wash.: Str. Evangel. Engineer forcing boiler beyond safety limit.

Pottsville, Pa.: New locomotive, cause unknown.

Brookhaven, Miss.: Brookhaven Machine Company. Boiler hadn't been cleaned and examined in three months.

Highland Park, N. J.: Raritan Brewery. Gauges stopped up and safety valve out of order.

South Stillwater, Minn.: Stillwater Lumber Co.'s Mill. Improperly constructed boiler.

Marion, O.: Schaffner's furniture factory. Low water.

Philadelphia, Pa.: Conroy Boiler Co. Boiler thick and cumbered with incrustation.

Sanborn, N. D.: Thrashing machine. Low water.

Tokio, O.: Portable engine. Engineer "didn't know it made any difference how much steam he got up."

McDonald, Pa.: Drilling engine. Engineer playing cards with a friend.

Eckelson's, N. D.: Thrashing engine. The water was low, and engineer couldn't remember just how much steam he was carrying.

Kildare, Tex.: Steward's Saw Mill. Scale and lack of water.

Van Wert, O.: Steam picket saw. Engineer had to go out for his lunch.

Sundridge, Ont.; Tookey's Planing Mill. Boiler worn out.

Venedocia, O.: Saw mill. Low water.

In most of the cases where there were deaths, the coroner's inquiry brought out the fact of gross incompetence. Indeed, the evidence in many of these cases is calculated to amaze the reader. It seems to be a fact that there are those who employ steam in their business without the smallest idea of its dangers. They hire an engineer as they hire a wagon driver, and trust to luck for the rest.

In some sections the laws bar out incompetence from the engine room, and such laws should be in force everywhere.

The Stationary Engineers, of Louisville, Ky., who met recently to consider the cause of the explosion in that city, declared it as their belief that "engineers as well as boilers should be inspected." A sentiment, it may be said, which does credit to their intelligence.

To prepare transfer paper, take some thin post or tissue paper, rub the surface well with black lead, vermilion, red chalk or any coloring matter. Wipe the preparation well off with a piece of clean rag and the paper will be ready for use.