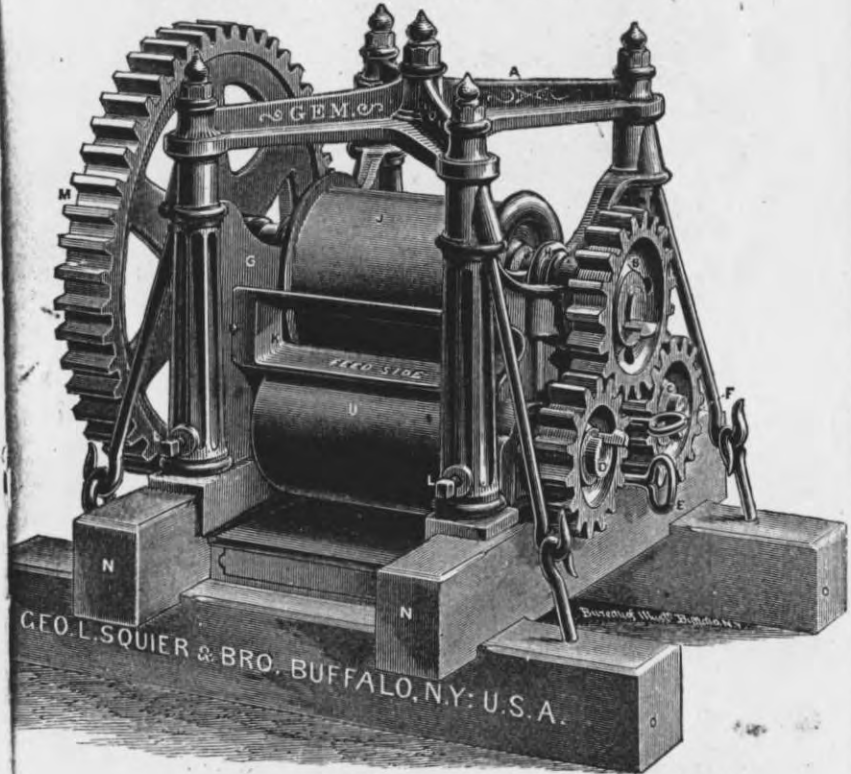


No. 6 Cuba Sugar Mill in operation. Rollers 28 x 72. Weight 100,000 lbs. Price \$10,000.

THE NORTHERN SUGAR CANE MANUAL

By Professors WEBER & SCOVELL.



WITH DESCRIPTION OF THE

AMERICAN SUGAR MACHINERY

MANUFACTURED BY

GEO. L. SQUIER,
BUFFALO, N. Y.

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GEO. L. SQUIER, BUFFALO, N. Y.

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UNITED STATES OF AMERICA.

List of Countries and Islands in which the Patent Plantation Machinery manufactured by GEO. L. SQUIER, of Buffalo, N. Y., is now in use.

INTRODUCTION

Three important questions seem to be fully settled in reference to the NORTHERN SUGAR CANE. 1st. That the plant will withstand the vicissitudes of our northern climate, and can be successfully grown wherever Indian corn can be grown, and is one of the surest crops that the farmer can raise. 2d. That from it can be raised not only a pure, healthy, finely-flavored CANE SYRUP, but that PURE CANE SUGAR, in paying quantities, can be manufactured from it with as absolute certainty as from the tropical cane. The results of last season's work at Champaign, Ill., and at Rio Grande, N. J., prove it, and verify the experiments and predictions made by Prof. Stewart, and the Commissioner of Agriculture long before. 3d. That it is one of the most profitable crops that the farmer can grow, as the experience of hundreds of farmers during the last three years has abundantly proved.

These vital questions having been settled favorably, it follows naturally and necessarily that it will be adopted as a staple crop by the intelligent farmers of the country, and within a few years be cultivated nearly or quite as extensively as Indian corn, or until the \$130,000,000 we now pay for foreign sweets is saved to the country.

In the infancy of an industry so important there will be thousands seeking information as to the best methods of culture and manipulation, and the best machinery for manufacturing the crop. For such inquirers this manual is prepared.

Professors WEBER and SCOVELL, late chemists of the Illinois State University, of Champaign, Ill., have, during the past three years, conducted a series of minute and exhaustive experiments in the culture and working of the NORTHERN SUGAR CANE, and their success in conducting the operations of the CHAMPAIGN SUGAR WORKS, during the past year, has become widely known, and has given a new impetus to this industry. We therefore deem ourselves fortunate in being able to present from their pens a condensed treatise, giving the results of their experiments and experience, in a shape to aid those who are seeking light on this subject. We feel confident that their treatise will be read with great pleasure and profit by all who are interested in this new industry, especially by those who contemplate the manufacture of sugar.

We have added a description of the machinery needed by those who desire only to make syrup, together with directions for setting up and working the machinery.

We have frequent inquiries for seed, but as we do not deal in seed, it may be of benefit to those seeking it to say that reliable seed can be procured of C. F. Miller, Dundas, Minn.; C. D. Roberts, Fairfield, Wayne County, Ill.; S. H. Kinsey, Rush, Monroe County, N. Y.; X. K. Stout, Troy, Kan., or James Lawson, Roxbury, Kan.

With greetings to our many friends throughout the country, we wish them a prosperous season, and commend to them a careful study of the following pages.

NORTHERN SUGAR-CANE MANUAL.

BY PROFESSORS WEBER AND SCOVELL.

THE NORTHERN SUGAR CANE INDUSTRY.

Through the results obtained at the sugar works at Champaign, Ill., and Rio Grande, N. J., in the production of sugar from Northern cane, on a commercial scale, during the season of 1882, a new impetus has been given to the Northern cane industry. The press of the country, as well as private individuals, have followed the development of these results with an unusual degree of interest. The cause of this general manifestation of sympathy with the efforts made in this direction will be found in the widespread conviction that, in a country like ours, so rich in agricultural resources, with such a variety of climate and soil, and with the proverbial enterprise of the American people, we should not be dependent upon foreign countries for nine-tenths of the sugar we consume. Sugar has long since ceased to be regarded as an article of luxury, but as one of the most important and necessary food products. From an agricultural and economic point of view, the benefits, which would be derived by the home production of the immense quantities of sugar and molasses annually imported into this country, is simply incalculable. We are now entering upon a new epoch in the history of Northern sugar cane. The production of sugar from several varieties of this plant has passed beyond the realm of experiment, and is now an assured success. The great expanse of territory in which Northern sugar cane can be grown profitably, its ready adaptability to all kinds of soil, its hardiness to withstand the vicissitudes of our climate, the easy and inexpensive methods of its cultivation, the certainty and ease with which the best of sugar and syrup can be made from it, when the proper machinery, in connection with the necessary skill and intelligence is applied, all these things taken together force us to look upon the Northern sugar cane as the source of our future supply of sugar.

SEED FOR PLANTING.

Great care should be exercised in the selection of seed for planting. Those heads which ripen first and at the same time should be selected for this purpose, as this will insure a more uniform development of the crop the next year. Three to four pounds of seed per acre is sufficient. Seed should be obtained from a different locality every two or three years. In procuring seed reliable dealers only should be consulted, and even then the germinating quality of the seed should be tested before planting.

VARIETIES OF CANE FOR SUGAR.

The early-maturing varieties of Northern cane present no great differences in their sugar-producing qualities. The Early Amber is, without doubt, the best variety

of this class to plant, because it has come into general use, so that good seed readily be obtained. The late-maturing varieties differ widely in their chemical composition, some being utterly unfit for the production of sugar, while others nearly approach the Early Amber in the per cent. of cane sugar they contain. The late-maturing varieties, as a class, are much larger and yield about one-half more per acre than the early varieties, and, where the climate permits, should always be planted for the latter part of the working season. Of the late varieties we would recommend the following in the order given: Link's Hybrid, Early Orange, Liberian.

SOIL, PLANTING AND CULTURE.

Northern sugar cane can be grown successfully on a great variety of soils, as the following analyses of Early Amber cane will show:

	Sp. Gr. of Juice.	Cane Sugar.	Grape Sugar.
1. Old prairie soil, average of 5 anal.....	1.070	11.28	2.94
2. Virgin prairie, " 2 "	1.071	12.77	3.46
3. Timber land, " 6 "	1.072	12.87	3.07
4. Sand land, " 2 "	1.060	12.80	2.39

From these analyses it will be seen that in the case of the sand land the specific gravity of the juice is much lower than that of the other varieties of soil, while the per cent. of saccharine matter is practically the same. This proves that the juice is more free from foreign matter, and hence this kind of soil is specially adapted to the raising of Northern cane. With the process for making sugar used at Champaign however, even the cane grown on the rich virgin prairie soil offers no impediment to thorough defecation and subsequent crystallization of the sugar.

Fresh barn-yard manure is very objectionable, and should never be employed the same year cane is grown. Mineral fertilizers, especially superphosphates, shorten the time for maturing the cane and increase the per cent. of sugar. The soil should be plowed deep and thoroughly pulverized, and the planting of the seed should follow the preparation of the soil immediately, so as to prevent the weeds getting a start.

Plant early. The first planting should not be more than one-half inch deep. Later in the season, when the soil is dry and warm, one inch is not too deep.

Plant in rows $3\frac{1}{2}$ feet apart, or in check rows about $3\frac{1}{2}$ feet each way.

Owing to the fact that the young cane plant is weak and slender and grows slowly in the start, it will be found necessary on all foul lands to give the crop one thorough hoeing to keep down the weeds, otherwise the cultivation does not differ from that of Indian corn.

STRIPPING.

In working up large crops of cane, the question of stripping becomes an important one, as it requires more help and costs more than all the rest of the harvest put together. It is a fact that the leaves increase the amount of feculent matter in the juice; but we have found that, with the new process of defecation (to be described further on), this difficulty can be readily overcome, and that grinding the cane with the leaves does not interfere with the quality of the products and the process of manufacture. Of course, if the stripping can be done cheaply by machinery, it would be best to strip; but, rather than do it by hand, we would prefer to grind the cane with the leaves, where large amounts of cane are to be handled. For small operations it is better to strip the cane.

HARVESTING.

In ordinary seasons, with the hot summer weather prevalent in the great corn belt of the Northwest, the development of the cane keeps pace with the formation of the seed, and the maximum of cane sugar is reached when the seed is in the "hardening dough." After this stage is reached the amount of cane sugar gradually diminishes as the cane is allowed to stand. The following table, which gives the average results of a large number of analyses, will illustrate this point:

Stage of Development.	Grape Sugar.	Cane Sugar.
Beginning to head.....	7.04	4.10
In blossom.....	5.76	7.77
Seed soft and milky.....	4.80	8.56
Seed in hardening dough.....	3.14	12.19
Seed quite ripe.....	2.85	11.18

In the season of 1882, with its cold, wet summer weather, the development of the cane sugar did not take place as rapidly as the formation of the seed, and the quality of the juice was found to change for the better, even for two or three weeks after the hardening dough stage was reached. The proper time for cutting the cane for making sugar should be determined by actual analysis made by the chemist in charge of the sugar works.

When cane is cut and allowed to remain in this condition before it is worked up, a gradual inversion of the cane sugar into grape sugar takes place, and in the course of time not a trace of cane sugar remains. This change takes place more rapidly in warm weather than in cold. Under no circumstances, when working for sugar, should the cane be cut more than twenty-four hours in advance of grinding. It should be taken to the mill and crushed as fast as it is cut.

MANUFACTURE OF SUGAR.

Northern cane juice is, with the single exception of the sugar beet, the most difficult to properly treat of any substance from which sugar is at present made. It is unnecessary to state that, in view of this fact, the production of sugar can be made largely profitable only by using the most approved machinery, including mills, defecators, evaporators, filters, vacuum pans, centrifugals, etc.; by adopting that process of manufacture which has been shown by actual results obtained to be reliable; and by employing a competent chemist who fully understands the process, as well as the manipulation of the machinery, and who is able to cope with the difficulties arising from the varying conditions of the juice, and from unforeseen irregularities in running the works.

The machinery necessary to fully equip a sugar plant, so as to insure satisfactory results, is, as a general thing, very expensive; and, for this reason, the manufacture of sugar cannot be conducted on a small scale. The capacity of a plant should be at least 500 or 600 acres of cane in a season of sixty days.

DEFECATION.

This is the first and most important step in the treatment of cane juice for sugar. The juice, in its normal condition, is acid, and it is well known that a solution of cane sugar heated in presence of an acid is changed into invert or uncrystallizable sugar. The amount of inversion which takes place depends upon the quality of the juice and the time required for evaporation. It is evident from this that the acid must be neutralized in the beginning of the process of defecation. Lime is the best and cheapest neutralizing agent. As the quality of the juice varies in different kinds of cane, and from time to time in the same variety, no definite proportion of juice and lime can be fixed upon. The point of exact neutralization should be determined by trial, using litmus paper as a test. Too much lime acts deleteriously in two ways: it causes undue discoloration of the syrup, and, by eliminating caustic potash, redissolves a portion of the coagulated nitrogenous matter, and thus prevents thorough defecation. In the open defecators, as ordinarily used, only that portion of the feculent matter is gotten rid of, which coagulates at the boiling point of the juice. On evaporating this defecated juice a continual rising of scum or separation of feculent matter ensues, as the boiling point of the liquor rises. This must either be removed by constant skimming or allowed to subside in settling tanks. To obviate this difficulty, we have employed a

NEW PROCESS OF DEFECATION,

Which, we hope, will be a great aid in establishing this new industry. The juice, after proper neutralization with lime, is run into cylindrical vessels, four feet in diameter and eight feet high, made of boiler iron and closed at both ends. When filled to within one foot of the top, the vessel is closed, and heat applied by means of a vertical copper coil on the inside. The liquor is thus heated in the start to the temperature of boiling syrup, 230 degrees Fahrenheit, and the feculent matter, which usually separates out on evaporation, is gotten rid of at once. The pressure upon the surface of the liquor prevents ebullition, consequently no scum rises to the surface; but all the feculent matter sinks to the bottom in a compact mass, above which the clear liquor can be drawn off. It is evident that if the vessel were opened or the liquor drawn off while the temperature remains above the boiling point, ebullition would take place and the sediment be agitated. The cooling of so large a body of liquor by radiation, would require several hours more time than necessary for the settling of the sediment. To save this time, as well as the heat required to raise the temperature of the liquor from 212 to 230 degrees, we connect the top of the defecator with the steam supply, and turn on steam as soon as the liquor is ready to be drawn off. By this means the pressure on the surface is kept constant and ebullition avoided. The excess of heat is employed for evaporation as soon as the liquor escapes into the air. When the clear liquor is all drawn off, the sediment is removed through an opening in the bottom of the defecator.

In this process all skimming, both in defecating and evaporating, is dispensed with.

SEMI-SYRUP AND GRANULATION.

The semi-syrup obtained by evaporating the defecated juice, is still far from being pure enough for the successful production of sugar. It contains a part of the nitrogenous matter, the gum and all of the soluble starch and mineral matter originally

present in the juice. For further purification the semi-syrup is filtered through bone-coal, or its equivalent, and then it is ready for evaporation to mush sugar or melado in the vacuum pan. During the past season we made twenty-six strikes with our vacuum pan, and in every case granulation of the sugar was effected in the pan the crystals being started with part of a charge, and built up as is done in sugar-houses.

SEED.

The seed product is destined to play an important part in making the Northern cane industry a commercial success. The composition of seed, according to our analysis, is as follows:

Sugar	0.56
Starch.....	63.09
Fiber.....	6.35
Water.....	12.51
Ash	0.64
Albuminoids.....	7.35
Oil	3.08
Tannin	5.42
Total.....	99.00

The only marked difference between this seed and Indian corn is in the tannin which it contains. It is possible that this ingredient would interfere with its use as food for animals, on account of its costive properties, although this evil effect could be avoided to a great extent by grinding and boiling the seed. There is one use, however, to which it is eminently adapted, and that is the manufacture of glucose. In our process, the glucose is prepared directly from the seed, and all the work can be done with the same machinery used in making sugar, except that a mill for crushing the seed would have to be supplied.

Much has been said about the unhealthfulness of commercial glucose. When properly made it consists of grape sugar and dextrine, almost free from mineral salts and entirely free from acids. When sold as such, it is as legitimate, important and healthy an article of food as the syrups obtained from other sources. The public taste is in favor of a mild, light-colored table syrup, and this quality can be attained by the use of pure glucose better than in any other way.

SKILLED HELP.

It seems almost superfluous to state that a manufacturing establishment embodying so many intricate processes, can never be successfully carried on without a competent man at the head, who is familiar with operations and chemical changes taking place in all their details. In a plant, with a capacity of 500 to 1,000 acres, turning out a thousand dollars worth of goods per day, a few days' mismanagement in any one step of the process, would entail a loss much greater than the sum necessary to pay the salary of a skilled chemist for the whole working season. The manufacturers of glucose employ chemists, at a high salary, to superintend their work. Other branches of industry follow the same example. If in this new industry plants should be erected, and manufacturing attempted without the requisite knowledge and skill, failure will surely be the result.

RESULTS OBTAINED IN THE SEASON OF 1882 AT THE CHAMPAIGN SUGAR WORKS.

Thinking that it would not be uninteresting, we herewith give some statistics, with the consent of the Champaign Sugar Company, of results obtained at their works during the year 1882:

Total number of acres worked	244½
" " tons of stripped and topped cane.....	2,282¾
Average number of tons per acre	9½
Number of acres worked for syrup alone.....	59
" " " sugar and molasses.....	185½
" " " " " "	1,724
" pounds of sugar made	86,600
" gallons of molasses and syrup	25,650
" pounds of sugar per acre.....	465½
" acres of early amber.....	195½
" " " orange	49

Owing to the cold and wet season, the juice was much inferior to that of ordinary years, and then we only worked for firsts; did not make any seconds, as we would have done if the plant had been properly equipped.

We kept separate, and are able to give, the results obtained from a field of 12½ acres of early orange. The juice was good for the season, but not above the average of an ordinary season:

Tons of cane stripped and topped	151
Number of pounds of sugar	9,600
" gallons of molasses	1,450
" pounds of sugar per acre	768
" gallons of molasses "	116

The sugar and molasses produced by the process under which we work are entirely free from the sorghum taste.

In color and crystal, the sugar compares favorably with the best grades of New Orleans sugar, and has sold side by side with the Southern sugars, giving entire satisfaction.

The following analyses will show the comparative value of this sugar:

CHAMPAIGN SUGAR COMPANY:

Herewith you will please find statement of the relative value of the sugar made by your company and certain other designated kinds:

Kind.	Sugar Per Cent.	Molsture Per Cent.
Champaign sugar.....	97.40	1.50
Best refined.....	99.50	0.
Extra Yellow C.....	87.40	5.21
White Extra C.....	86.60	6.19

Yours truly, H. B. SLAUSON, Chemist."

From the results obtained during the past season, the profitable manufacture of sugar from Northern sugar cane can no longer be questioned. The establishment of a new industry, of the magnitude which this is destined to assume, based directly upon the agricultural interests of the country, and benefitting alike the farmer, laborer, manufacturer and the country in general, should excite the encouragement of all.

CHAMPAIGN, ILL., January 25, 1883.

H. A. WEBER.
M. A. SCOVELL.

The foregoing treatise by PROFESSORS WEBER AND SCOVELL is full of valuable information in reference to the cultivation of cane and will be read with profit by every cane grower. Their directions for working the cane into sugar are intended more particularly for large,

CENTRAL FACTORIES.

and will be found very useful to those who contemplate the erection of such Factories. The tendency of the industry now seems to be towards the establishment of such Factories and they have many advantages. The amount of work done by them warrants the necessary outlay for the most perfect and complete machinery, and the employment of the best skill. The Factory affords a good market for all the cane that is raised within a reasonable distance around it, and beyond that distance, the farmer with inexpensive machinery can work his cane into semi-syrup, and take it to the Factory to be worked into sugar. Many such Factories are being built in the West this season, and the day seems not far distant when Sugar Factories will be as plenty as Cheese Factories now are. But before and after the establishment of these Factories the great majority of farmers will need their own machinery for making syrup and semi-syrup, and we therefore proceed to describe such machinery, which may be divided into two general classes, viz.: STEAM MACHINERY and ANIMAL POWER MACHINERY.

STEAM MACHINERY.

There is no doubt but the best results may be obtained by the use of steam, as it gives a steady and untiring power to drive the mill, and in defecating and evaporating gives the operator absolute control of the heat so as to render every step certain. Yet steam machinery is so expensive that no farmer will desire to purchase it unless he can do so without running into debt, and has sufficient work to keep it busy during the grinding season. The machinery needed for a steam set is a strong horizontal mill, double back-gearred; a strong, simple engine; a boiler of four to five times the capacity needed to drive the mill, in order to furnish an abundance of steam for defecation and evaporation; two steam defecators to be worked alternately, a steam evaporator and a steam finisher. If it is intended to make sugar, a small vacuum pan should take the place of the steam finisher, and a centrifugal should be added. If the mill cannot be so located as to allow the juice to be spouted to the tanks, defecators and evaporators, a juice pump will also be required. Of course, the usual tanks, filters, coolers, etc., will be needed, but these are usually made on the farm, sets of steam machinery of this description can be procured of various sizes for from \$2,000, upwards.

ANIMAL POWER SETS.

Farmers who have no more than fifty acres of cane to work will generally be contented with animal power sets, and all those who have had no experience in working cane should begin with such sets, as their mistakes will be much less expensive than with steam sets. Animal power sets are comparatively cheap, and with them, any man of "gumption" can make an excellent article of syrup, and often sugar enough for his own use. A mill and fire evaporator, with the necessary tanks, filters, coolers, etc., are all that is needed, and with these every farmer can provide his own sweets, as well as manufacture for his neighbors and for the market. Such sets can be procured for \$100, up to \$1,000, according to size and style.

THE POINTS OF A GOOD MILL.

Whatever the size or style of mill, the first thing to be considered is STRENGTH. Few people realize the pressure required to grind cane as clean as it ought to be. An ordinary two-horse mill exerts a pressure of ten to twenty tons when fully fed, and if over-fed and clogged much more than that, and if the mill is not very strong something *must* break. Probably three-fourths of the mills in use last season broke down, entailing expense, delay and vexation upon their owners.

But breakage is not the only fault of a weak mill. It necessarily leaves a large per cent. of the juice in the bagasse. Growing cane, stripping, harvesting and milling, and still leaving one-half of the best juice in the bagasse pile is poor economy. Yet that is just what a large portion of the cane growers are doing. No man can afford to use a weak mill if it is given to him. Of course, a strong, well made mill, will cost more than a cheap made weak one, and those who look more at the price than at the quality of the mill will continue to buy the cheap affairs, and

break down and lose juice, time, and money enough to buy two good mills every year. But there are men who know that a good mill is cheapest in the end, and to aid such in their choice we will indicate the most important points for them to examine.

1st. The SHAFTS or journals should be wrought iron, and extra heavy in proportion to the size of the rollers, all the pressure of the rollers is carried by the shafts, and in addition, they have the twisting strain necessary to impart motion to the rollers. A cast iron shaft is worthless, and a small wrought iron shaft is a delusion. A large proportion of the mills in market have shafts so weak as to render them absolutely worthless. Other things being equal, select the mill that has the strongest shafts.

2d. The journals should run in BRASS OR GUN METAL BOXES. There is nothing else that will stand the pressure and wear so well.

3d. STRONG WROUGHT IRON STAY-BOLTS should brace the mill and hold every part firm, and should be so arranged as to take a large portion of the strain.

4th. VERY HEAVY GEARS with strong teeth should be used, and they should have extra heavy hubs. Farmers frequently trust the handling of the mill to hired help who know nothing of the proper handling of machinery, and are as likely to take a meat axe to drive a key with as anything else, and are thus very sure to split an ordinary hub and then lay the fault to the machine. Any gear that was ever made can be split by driving the key, and machinists understand this, and drive very carefully with a light hammer. An extra heavy hub reduces the danger of breakage by inexperienced persons.

5th. The HOUSINGS or side frames should be made very strong and heavy so as to withstand any strain that may be brought upon them.

6th. One of the most important features of a cane mill is the TURN-PLATE or scraper which guides the cane from the feed roll to the bagasse roll. Some manufacturers, who do not understand the proper construction of a cane mill, send out their mills without any turn-plate whatever, and the frequent choking and breakage of such mills proves conclusively that the triangular space between the three rollers will fill up with cane, and choke, unless proper provision is made for guiding the cane across this space. Others realizing the necessity for such provision, but having little knowledge or experience put in turn-plates that are entirely inadequate to the work, and break down and choke upon the slightest provocation. It requires long experience and much experiment and care to adapt a turn-plate to a mill so that it will do its work without choking and breaking. It should be very strong and easily adjustable to the movements of the rollers. This is an important point which should be thoroughly examined by every purchaser of a mill.

7th. SELF-ADJUSTING ROLLERS have so many important advantages over rigid rollers that they have come into general favor, and many of the most experienced operators cannot be induced to buy or use a rigid mill. The self-adjusting rollers compensate for the inequalities of feed and take out a larger per cent. of juice, do away with the jumping and jerking of rigid mills and make the mill run steady and smoothly, lessen the power necessary to drive the mill, and greatly lessen the liability of breakage.

8th. The GENERAL FORM, STYLE AND WORKMANSHIP of the mill should be looked after. By examining the form and workmanship of a piece of machinery it can be generally ascertained whether it was made as cheap as possible to sell to greenhorns or made for service; whether it was made by a mechanic or a bungler.

These are the most important points to be looked after in selecting a mill. Another point on which many purchasers make a grave mistake is in selecting TOO SMALL A MILL for the work they wish to do. Nine men out of ten who use a mill wish they had a larger one. A mill of larger capacity than is actually needed has many advantages and is cheaper in the end. It costs little if any more to run it, enables the operator to work without crowding and hurry, and in this way does away with much of the liability of breakage. It permits taking advantage of the weather, or hurrying up in case of threatening weather or frost, and enables him to increase his production if desired without buying a new mill. Therefore in selecting a mill care should be used not to choose too small a one. If a man has not the means to buy a good mill of ample size for his purposes, he had better hire his cane worked up until he acquires means sufficient to buy a rig that will not be a continual source of expense, trouble and vexation.

But when he has bought his mill he should remember that however much care and good judgment he has used in selecting it, it will all be nullified by neglecting to use the same care and good judgment in running it, or by trusting it to be run by incompetent persons. The best mill can be easily spoiled by carelessness or ignorance. No machine that was ever made is proof against bad management. The manufacturer cannot furnish brains to run his machines, nor make an educated engineer of every man who undertakes to run them, and when a man undertakes to run a machine that he knows nothing about he must get his education at his own risk and expense. If he undertakes to key on a gear with a meat axe or sledge hammer he will be very likely to spoil his gear. If he runs a stick of wood or a wrench, hammer or crowbar, through his mill the chances are that something will break. If he fails to keep the nuts tight and the journals well oiled he will be sure to meet with trouble sooner or later. If he fails to properly adjust his rollers and adjust his turn-plate, after he has adjusted his rollers, he will fail to get the proper per cent. of juice, and may clog his mill. Two mills as near alike as human ingenuity can make them may be put into the hands of two neighbors and one will run through the season without the least trouble or delay, while the other may have trouble all the time, simply because there is no "gumption" in the man running it. Yet this man thinks he has as much or a little more "gumption" than his neighbor. For evils of this nature there is no remedy. Such men are a damage to the business, to the machinery and to themselves, but the world is full of them and all kinds of business has to take its chances with them.

THE VARIOUS STYLES OF MILLS.

For ANIMAL POWER there are two distinct classes of mills, viz., VERTICAL and HORIZONTAL. Both kinds have three rollers arranged triangularly, with turn-plates to conduct the cane through the triangular space between the three rollers, and the cane gets two pressures.

VERTICAL MILLS can be afforded cheaper than Horizontal Mills of the same weight and strength, and if they are made very strong answer a good purpose for small operators. They are not as convenient to feed as Horizontal Mills and work slow, as they have only one revolution of the rollers to one of the team.

But for rapid, efficient and economical work and the best results HORIZONTAL MILLS are far better than any Vertical Mills that can be made and are generally used by all experienced operators. Having two revolutions of the rollers to one of the team they work much more rapidly, are fed more naturally and easily to the full capacity of the rollers, and deliver the juice more readily and savingly from the crushed stalks. If they are made to run with sweeps attached directly to the mill (and this saves purchasing a separate Horse Power) they need to be made very stout to withstand the twist and strain upon them. Such mills cannot be made *cheap* and be good for anything; but a good, stout, heavy, well-made Horizontal Mill is worth any four Vertical Mills that can be made, as every man will testify who has used both kinds.

HORIZONTAL ANIMAL POWER MILLS are of three kinds, viz.: those with SWEEP ABOVE, those with SWEEP BELOW, and those arranged to be driven by SEPARATE HORSE-POWER. Each kind has its special advantages and each man must determine for himself which is best for the particular circumstances under which he desires to use it.

The SWEEP-ABOVE MILL is best when it is desired to set the mill on the ground or in the lower story of a building, or when it is desired to move the mill from place to place.

The SWEEP-BELOW MILL is arranged to run in the second story of a building while the team works on the floor below. This is a very convenient arrangement. The team and sweeps being out of the way, the cane can be piled conveniently near the mill, feed table and baggage carriers can be used, and the elevation permits the juice to be carried in pipes to the tanks, defecators and evaporators.

The SEPARATE-POWER MILL has all the advantages of the sweep-below mill with the additional advantages that it can be set either on a level with the Horse Power or in the story above as desired, that any desired speed can be given to the rollers and that it is adapted to run by steam power if at any future time steam is used.

The separate HORSE-POWERS to drive such mills should have a slow motion and be made very strong. The ordinary Horse-Powers in market are too flimsy for such work. If a Thrashing Machine Power is used a double back-gear will be required to get the motion of the rollers slow enough.

STEAM MILLS are always horizontal. They should be made of extra strength in proportion to the work they have to do, so as to be able to stall the engine without breaking. If a quick stroke engine is used they should have a double back-gear in order to get the speed of the rollers slow enough. The best speed for the rollers is from 18 to 22 feet surface speed per minute.

SETTING UP AND WORKING THE MILL.

The main thing in setting up and working a Vertical Mill is to have a FIRM FOUNDATION. The posts should be attached by plank cross-pieces spiked on in bracing form, and this "crib" should be set at least five feet in the ground and the earth well packed down. The *sweep* should be very strong, and the lever end should be from ten to twelve feet long and the other end long and heavy enough to balance like an old-fashioned well sweep.

HORIZONTAL MILLS should be firmly fastened, if upon a floor, by means of cleats and bolts; if upon the ground, by means of timbers bedded in the ground and stakes. Oil thoroughly and often, using none but the *best lard oil*. Never bring kerosene oil near a cane mill.

Start up carefully, at first without any cane, to see if everything is right, and get the horses used to the work. Then try a few stalks and adjust the rollers, then increase the feed slowly, until the gearing is worn a little smooth, and then if everything is right,—go ahead.

Always feed the cane butt ends foremost. Clean the mill thoroughly and often, as fragments of cane left to sour and ferment about the mill may injure your whole batch of syrup, especially if intended for sugar.

FILTERING.

The necessity of thoroughly filtering the juice to remove all extraneous matter that can be removed by mechanical means is too often overlooked. The juice, as it comes from the mill, should run through a wire strainer and then through a filter. The filter is usually constructed on the farm, and the filtering material most commonly used is straw or hay. This should be frequently renewed. As the juice comes from the filter it is well to strain it through a filtering cloth. The filters, as well as all tanks, and the mill, should be frequently washed with lime water to prevent souring. Bone coal filters are used in sugar factories for filtering the syrup after it is boiled down to 25 deg. B. and before it goes to the vacuum pan, to take out whatever impurities remain after ordinary defecation. But these filters are too expensive for small operators.

DEFECATION.

Thorough defecation is one of the most important and difficult points in making syrup or sugar, and yet it is the point most often neglected by ordinary operators. The juice is acid and filled with impurities, and the acid must be neutralized, and the impurities removed, at the *earliest possible moment* after the juice leaves the mill. Three or four hours' standing without defecation will spoil any juice, and one hour's standing will materially damage it. Lime is the best and cheapest agent for neutralizing the acid. It is usually prepared like whitewash made about as thin as milk, and is used at about the rate of one pint to a barrel of juice. But many think the best results are obtained by preparing it by simply sprinkling enough water on the lime to slack it, and using a small measure, say, four inches square and one inch deep, to apply it with. The lime should be thoroughly stirred into the juice when cold or as it is being heated. As every batch of juice differs in acidity, no definite rule can be given as to the quantity of lime that should be used. Care should be taken not to use too much. Experience, guided by the use of litmus paper, must determine in each case just when the neutral point is reached. It is a trade that must be learned. A prejudice exists among inexperienced operators against the use of lime because it darkens the syrup. An excess of lime does darken the syrup too much, but just enough to neutralize the acid brings the syrup to the best merchantable color. Experienced buyers will not touch light colored syrup because they know that it has not been limed and is acid.

Steam defecators are best because the heat can be controlled and boiling prevented. But small operators generally defecate over a fire and use either separate defecators or defecate in one compartment of the evaporator. In defecating the juice is gradually brought up just to the boiling point, but never allowed to boil. As it comes up to the boiling point the feculent matter coagulates and rises and forms a thick blanket on top. If a separate defecator is used this operation may be

repeated two or three times and then the heat withdrawn and the juice allowed to settle. The blanket of course should be skimmed off each time. If the defecation is done in a portion of the evaporator, after the defecation is done as thoroughly as possible, the juice should pass on to be evaporated, and the boiling will throw up more of this feculent matter in the shape of scum, which should be removed as fast as a blanket is formed. Be careful in skimming not to stir the scum into the juice.

EVAPORATORS.

Heat is an active agent in inverting sugar, yet heat must be used for evaporation. Too high a degree of heat will burn the syrup, so evaporation is surrounded by limitations. The less time the juice is exposed to the heat, or the lower the degree of heat used, the less the inversion. For this reason the best evaporator yet devised is the vacuum pan, because the removal of the pressure of the atmosphere enables the evaporation to be done rapidly with a low heat; but vacuum pans are too expensive for small operations. Next to vacuum pans in point of merit are steam evaporators, because with these the heat is under absolute control; but steam evaporators are beyond the reach of a majority of farmers, who use animal power mills and must use open fire evaporators. A good fire evaporator can be made to do good work economically, but the trouble is that a large portion of the evaporators in use are made by Tom, Dick and Harry, who know nothing of the actual requirements of the case, and as a natural consequence very few of the evaporators in use can do good work. In small operations a large portion of the defecation is done in the evaporator, so that a properly constructed evaporator must provide for the three distinct operations of Defecating, Evaporating and Finishing.

The first of these processes is *defecation* or the removal of the foreign and deleterious particles from the juices. This should be done over a slow fire that raises the juice gradually to the boiling point, giving ample time for the extraneous matter to be thrown up in the form of scum and removed. Intense heat and violent boiling in this part of the process is fatal, as it boils the deleterious substances into the syrup so that it cannot afterwards be removed by any ordinary process.

The second process is *desiccation* or the evaporation of the watery portion of the juice. This process should be accomplished with all possible speed, for the longer the syrup is subjected to high heat the darker will be its color and the poorer its quality. Therefore this process should be conducted over the hottest part of the fire, and the juice should be spread out over a greater surface so as to have a thinner body, and thereby increase the rapidity of evaporation. Care should also be taken not to burn the syrup in this process.

When the juice is evaporated down to about 25 deg Baume, the last or *finishing* process commences. And in this process the heat must be absolutely under the control of the operator, for in this process is the great liability and danger of *scorching*. Here a low heat is required, and the syrup gradually cooked down to about 33 deg Baume, when it is drawn off into the coolers. In both the evaporating and finishing processes some skimming will be necessary, unless the defecating process has been very thorough.

Good, thick, heavy sheet iron is the best material for evaporators on account of its cheapness, durability and efficiency. Many beginners have the fallacious idea that iron discolors the syrup. An old sugar maker would laugh at such an idea. In tropical countries the juice is defecated in iron defecators, evaporated in iron kettles and finished in iron vacuum pans, with never a thought of discoloration. If the evaporator is kept clean there is not the remotest danger of discoloration from using iron pans, and if it is not kept clean the syrup will be discolored in any kind of metal.

Galvanized pans are always made too thin for durability; the zinc with which they are covered wears off soon, but while it remains it is one of the poorest conductors of heat known. Copper pans have the advantages that they are easier kept clean and that copper is a better conductor of heat than iron, but they are too expensive for ordinary operators and are not enough better than iron to pay the difference in cost.

Some manufacturers, to save a little in the cost of pans, make the sides and ends of wood, which is a constant source of trouble to the operator. For if the joints do not leak from the first, the wood soon chars next to the iron, and the nails burn out, and there is constant leakage and constant tinkering. Besides the impurities work into the cracks, where it is impossible to clean them out, and there ferment, and sour, and taint, and injure the whole syrup. Evaporators should be thoroughly cleaned every night, and kept as sweet and clean as a good dairy woman keeps her milk-pans.

THE AMERICAN SUGAR CANE MACHINERY.

The rapid growth of the NORTHERN SUGAR CANE industry has brought into market mills, evaporators, etc., made by parties having no experience nor knowledge of the proper construction of such machinery. Manufacturers of the old sorghum machinery of twenty years ago, in ignorance of the progress that has been made since, are also bringing out their old sorghum mills and evaporators and trying to work them off. As a result the market is flooded with mills that break down and evaporators that fail to give satisfaction, and hundreds of farmers are victimized.

No man is capable of constructing good sugar machinery unless he has full and accurate knowledge of the best machinery in use in sugar producing countries where the art of sugar making has been made a study for many years, and has had long experience in manufacturing this class of machinery, and intelligence enough to keep up with the improvements that are made every year, and enterprise enough to make and adopt improvements, and opportunity to test his machinery by the side of the best machinery in the world.

The manufacturer of the American Cane Machinery has been engaged for over thirty years in manufacturing agricultural implements, and for the past fifteen years has made a specialty of sugar machinery for tropical countries, where the best sugar machinery in the world is used. His machinery has come into general use throughout the tropical world, and has been tested by years of use in many countries, by all kinds of people, with every variety of cane, and has had the advantages of the experience and suggestions of experts, engineers and planters of all sugar producing countries and has become the standard machinery of the world. In Appleton's New Encyclopedia of Mechanics his sugar mills are illustrated and described as the most perfect and approved sugar mills known to the mechanical world. He has introduced many important improvements in sugar machinery which he has patented in this and other countries, and his machinery is secured by over twenty patents. He manufactures over seventy sizes and styles of sugar mills, every one constructed especially for grinding the hard tropical cane and used in tropical countries. He does not manufacture sorghum mills, and does not wish nor profess to compete with the weak cheap sorghum mills in market. He desires to work only for those who can appreciate good machinery and know the difference between a strong, well finished machine and a weak botch—who understand that a good machine costs more to make than a poor one, but is cheapest in the end. He has found that there are enough such men to give him all he can do, and he is proud to point to his machines in the hands of nearly all the leaders in the industry, and proud of their encomiums upon it.

The sizes of his mills and other machinery best adapted to the present condition of the Northern cane industry are illustrated in the following pages, where each man can find the size best adapted to his own particular wants. Every one of the mills illustrated is a STRONG TROPICAL CANE SUGAR MILL, and is in use in tropical countries, and is worth a cart load of the ordinary sorghum mills in market, for practical use.

He manufactures Evaporators of the most approved form, of various sizes to match his different sized mills. These Evaporators can be run with bagasse, straw or hay, if desired. He also manufactures Defecators, Steam Clarifiers, Centrifugals, Kettles, Juice Pumps, Saccharometers, and everything that is needed for a sugar plant. For driving his larger Sugar Mills he manufactures Horse-powers, Steam Engines and Water-wheels of any sizes wanted.

His foreign trade absorbs nearly the whole capacity of his factory, so that he will be able to make but a limited amount of machinery for the home trade this season, and those who want this class of machinery should get their orders in early or they may not be able to obtain it. Farmers can order direct of him, or through his agents, as they prefer. Price Lists will be furnished upon application to

GEORGE L. SQUIER,

Buffalo, N. Y.

DISTINCTIVE FEATURES OF THE AMERICAN SUGAR CANE MILLS.

Among the new principles and improvements which are embodied in the series of Sugar Cane Mills manufactured by GEO. L. SQUIER & BRO., and which in so short a time have made them famous throughout all the sugar producing countries of the globe, the most prominent and important are the

PATENT RUBBER SPRINGS,

by means of which the rollers are made SELF-ADJUSTING. Rubber springs, or cushions, similar to those used under cars, are applied to all our mills in such a manner that the amount of pressure can be easily and accurately adjusted to the work to be done. By means of nuts and screws, these springs can be tightened so as to give any degree of elasticity, and, at the same time the greater the amount of cane passing through the rollers the greater will be the pressure. The rollers are thus made to *adapt themselves perfectly to the amount of work to be done*, and grind the cane thoroughly, whether the cane be fed light or heavy; with heavy feeding there is no clogging, with light feeding the rollers close up and press the cane thoroughly. An experience of several years in the use of these self-adjusting mills has abundantly proved that the rubber springs give them the following important advantages:

1st. The rubber springs insure the perfect and even grinding of all the cane, whether fed light or heavy, and remedy the evils of careless feeding.

2d. The rubber springs prevent clogging and breaking from over-feeding. A large proportion of the breakages that occur in sugar mills are caused by over-feeding, and the rubber springs are exactly what is needed to save the mill in such a crisis.

3d. The rubber springs facilitate the feeding, make it easier to feed large and small canes together, and, in a great measure, compensate for the carelessness of the feeder.

4th. The rubber springs make the mill run steadier and easier. The springs bear the strain of unequal feeding instead of the power, and, by equalizing the pressure, remedy the jerking and unsteady motion common to the rigid mills. Hence the self-adjusting mills require much less power to drive them than the rigid mills of equal capacity.

THE HEAVY WROUGHT IRON STAY BOLTS,

in connection with the rubber springs, reduce the liability of breakage to the minimum point. By the peculiar arrangement of the stay bolts and springs, the straining pressure of the rollers is thrown upon wrought iron and rubber, while in most of the old style rigid mills it is thrown upon treacherous cast iron. Hence, breakage is almost impossible under any ordinary usage of these mills, and their freedom from breakage is a matter of comment and wonder with all who have had anything to do with them. This point will be thoroughly appreciated by all who have been annoyed by the breaking of a rigid mill in the midst of the grinding season.

HEAVY WROUGHT IRON SHAFTS

are used in all our mills. For the small mills the shafts are made of rolled iron; for the large mills, of steam forged car-axle iron. The shafts run in

BRASS, STEEL, AND BABBITTED BOXES,

which are very durable, and easily renewed when necessary.

STRONG, HEAVY GEARING

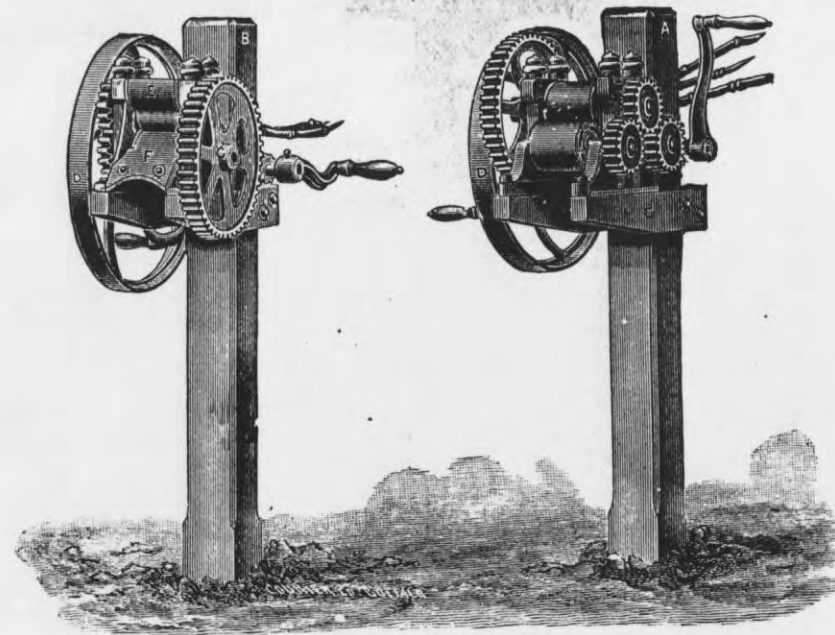
is used in all our mills proportionate to the capacity of the mills: and while in

SHAPE, STYLE, AND FINISH

our mills are unequalled by anything to be found in the market, the

AT VERY LOW PRICES

at which we offer them place them beyond competition.



THE PIONEER.

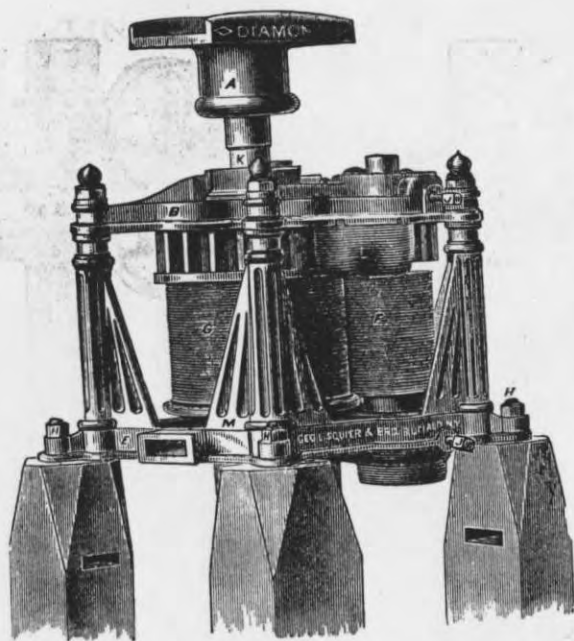
Horizontal Hand-Power Mills.

PIONEER No. 1.	Two Rollers, 4x4.	Weight, about 170 Lbs.
PIONEER No. 2.	Three Rollers, 5x5.	Weight, about 270 Lbs.

With the advent of central factories the need of a good hand-mill to test the different lots of cane as they come in, and for other experimental purposes, is imperative. There is also need of such mills for parties experimenting with different varieties of cane or originating new varieties, and also for those who raise small patches of cane for family use. To supply this want we have constructed two sizes of hand-mills, illustrated above. They have ample strength for the capacity of the rollers and are constructed in every respect as perfectly and thoroughly as the large mills, and will extract about as large a per cent. of juice.

An engineer in Trinidad, who has a No. 2 Pioneer, writes that he extracted 69 per cent. of the weight of the cane in juice with it, and is greatly pleased with it. Professors Weber and Scovell used a No. 2 Pioneer at Champaign last season, and write: "Your little mill is a perfect gem. It is just what we have been in need of ever since we commenced our investigation. The percentage of juice obtained from a certain variety of cane is of as great importance as the composition of the juice, and this we are now able to determine with accuracy by means of this mill."

By putting a pulley on the No. 2 Pioneer it can be run by power and made to do a sufficient amount of work for small operators



DIAMOND No. 1.

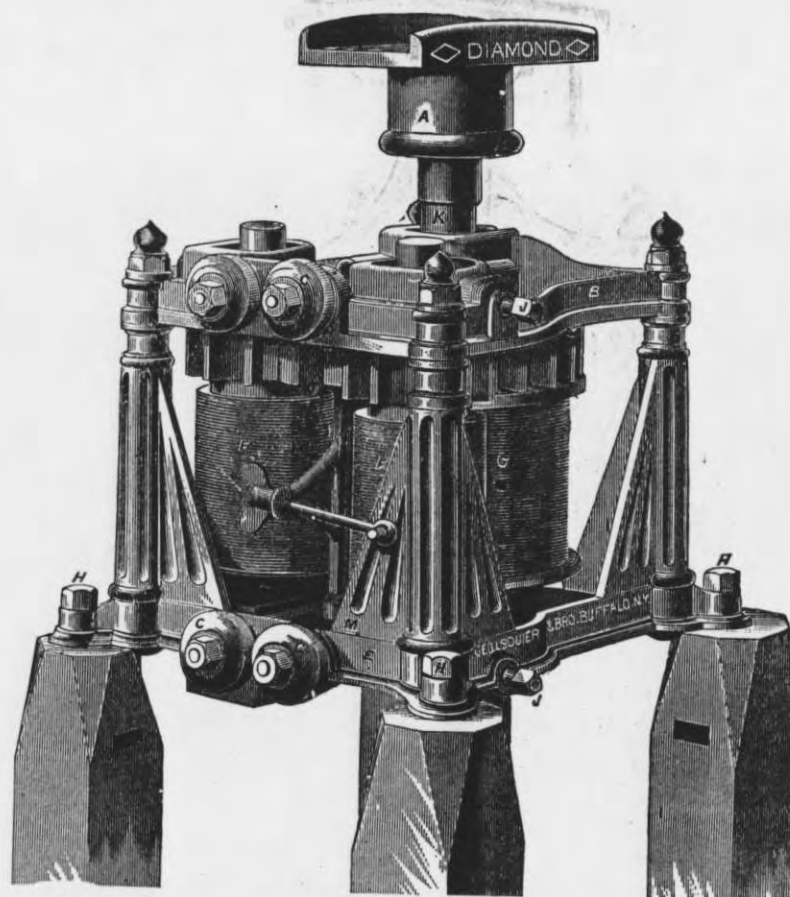
Three-Roller, Self-Adjusting Vertical Mill.

Main Roller, 10 x 7.

Weight, 500 Lbs.

There has always been a demand for a very cheap vertical, three-roller mill, and we have been often requested to construct such a mill embodying our patented improvements, but we have always refused to do so because the price of iron has ruled so high for many years past that we knew a thoroughly reliable and efficient mill could not be afforded for the low price at which some manufacturers were selling small mills. We were unwilling to damage our reputation for first-class machinery by making small mills with cast iron rollers, taken out of the sand and thrown together, or by making them so small and weak that they could have no adequate strength nor capacity. But now the price of iron having fallen sufficiently to permit making a small and cheap three-roller mill, with strength sufficient to be reliable and capacity enough to be useful, we have constructed the No. 1 DIAMOND Mill represented by the above engraving.

This mill has nearly twice the strength and capacity of any other mill of the same price in market. We have endeavored to make the mill just as perfect in every respect as human ingenuity could make it. Heavy wrought iron shafts and bolts are used of the same size as those used in our Samson mill. The small rolls are cast solid, heavy wrought iron stay-bolts take the strain, and the patent rubber cushions render the rollers self-adjusting. Set screws are provided for adjusting the feed roller. We estimate this mill to be one-half stronger than the Samson in proportion to its capacity, and, as the Samson is the strongest mill of its size heretofore put into the market, this is saying much for it. In style and beauty this mill is unsurpassed, and in workmanship and material it is equal to the most expensive mill we make. We take great pride in being able to offer to our friends so good a mill at so low a price.



DIAMOND MILLS.

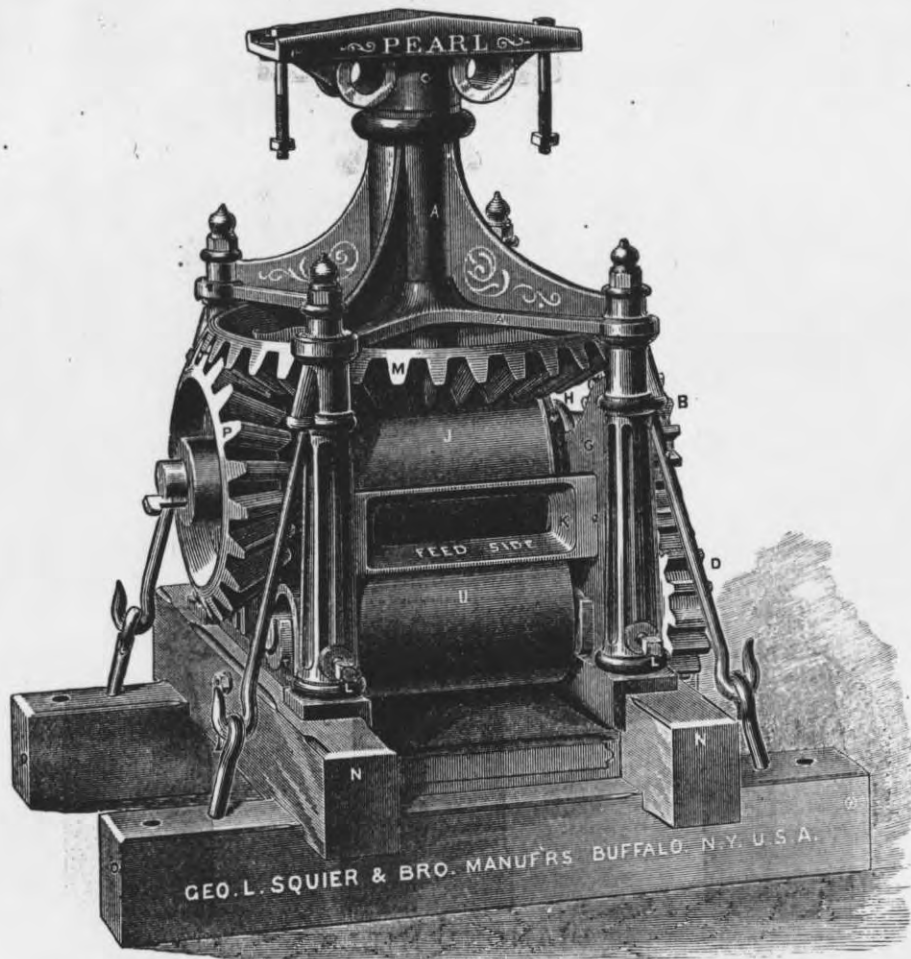
Three-Roller, Self-Adjusting, Vertical, Animal Power Mills. Two Sizes.

DIAMOND No. 2.	Main Roller, 12 x 8.	Weight, 700 Lbs.
DIAMOND No. 3.	Main Roller, 14 x 10.	Weight, 1,000 Lbs.

In many countries where the cane grows very luxuriantly and large, there is a growing demand for extra heavy and strong vertical mills for horse power, embodying the latest improvements. To meet this demand we have constructed the DIAMOND Mills represented by the above engraving.

The mills are made stronger and heavier in proportion to the capacity of the rollers than any mills that have heretofore been put into the market. They embody all of our patented improvements, and combine all the best results of our long experience in manufacturing sugar mills for all the sugar-growing countries of the world.

The forged wrought iron shafts are much larger and stronger than are ordinarily used in mills of this size and run in brass boxes. Very heavy wrought iron stay-bolts take the strain, and our patent rubber springs render the rollers self-adjusting. Set screws are provided for the feed rollers to adjust them to any size of cane. In style and workmanship these mills are superior to any vertical mills that we have ever put into market, and there is nothing else in market that can compare with them. We offer these mills to our friends with full confidence that they will give perfect satisfaction to all who want extra heavy and stout vertical mills, embodying all modern improvements, for grinding the largest tropical cane.



THE PEARL.

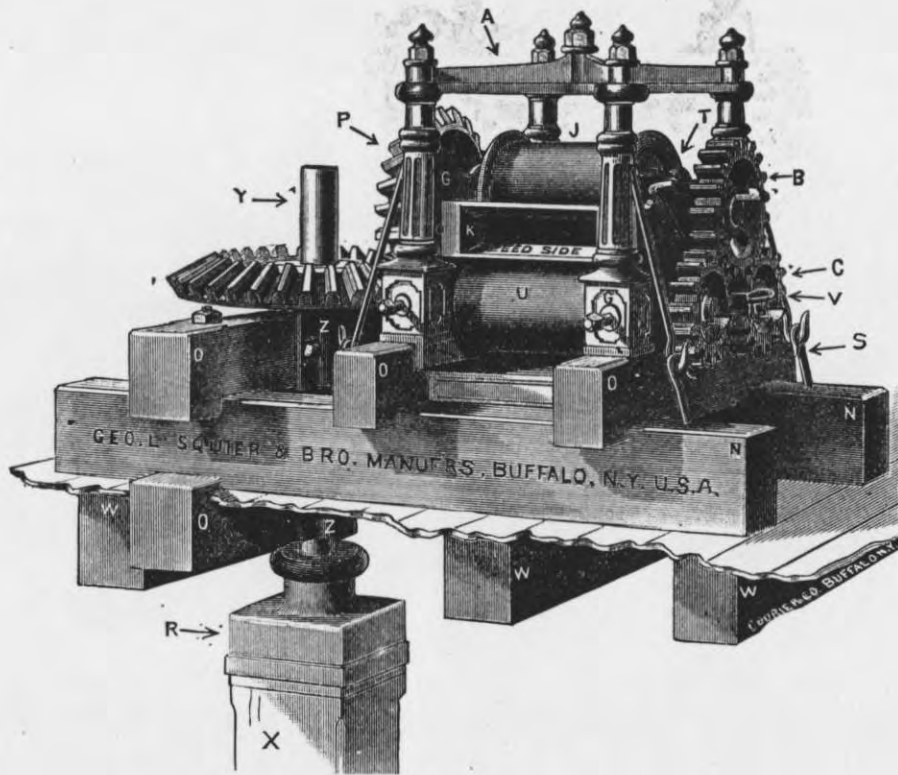
Horizontal, Self-adjusting Animal-power Mills. Four Sizes.

PEARL No. 1.	Main Roller, 8 x 8.	Weight, about 800 Lbs.
PEARL No. 2.	Main Roller, 10 x 10.	Weight, about 1,200 Lbs.
PEARL No. 3.	Main Roller, 10 x 12.	Weight, about 1,400 Lbs.
PEARL No. 4.	Main Roller, 12 x 16.	Weight, about 3,000 Lbs.

Our "CRONCHER" Mills have met with such great favor as Animal-power Mills, that we have been induced to construct some new sizes embodying the patented principles that have proved so successful in the CRONCHERS, with additional improvements that experience and the suggestions of our patrons have shown to be desirable.

These new sizes we have named "PEARL," and they are represented by the above engraving. The horse-power and the mill are combined in the most compact, symmetrical and durable form possible. The crown wheel, through which motion is given to the rollers, is held firmly in place under the bridge-tree by a stout wheel, running through a long box in the bridge-tree, and connecting with the sweep-cap to which wrought iron shafts are attached. Extra heavy and strong gears are used, and the wrought iron shafts are of extra size, and run in brass boxes. Heavy wrought iron stay bolts hold all parts firmly in place. Our patent Rubber Springs render the rollers self-adjusting, and the wrought iron strap bolts take the strain of the rollers. Set screws are provided to adjust the rollers to any size of cane. Extra strength in proportion to their capacity is given to these mills, to enable them to grind the largest and hardest tropical cane.

These mills can be changed to steam or water-power mills, like the "GEM," by removing the crown wheel and pinion, and substituting a back-gear and pinion, so that the purchaser can commence with animal-power and afterwards change to steam or water-power, or by buying a back-gear and pinion with the mill, he can alternate from animal to water or steam-power at pleasure. In workmanship, style, symmetry and beauty, these mills are unequalled, and we take great pleasure in being able to offer to our friends such beautiful and



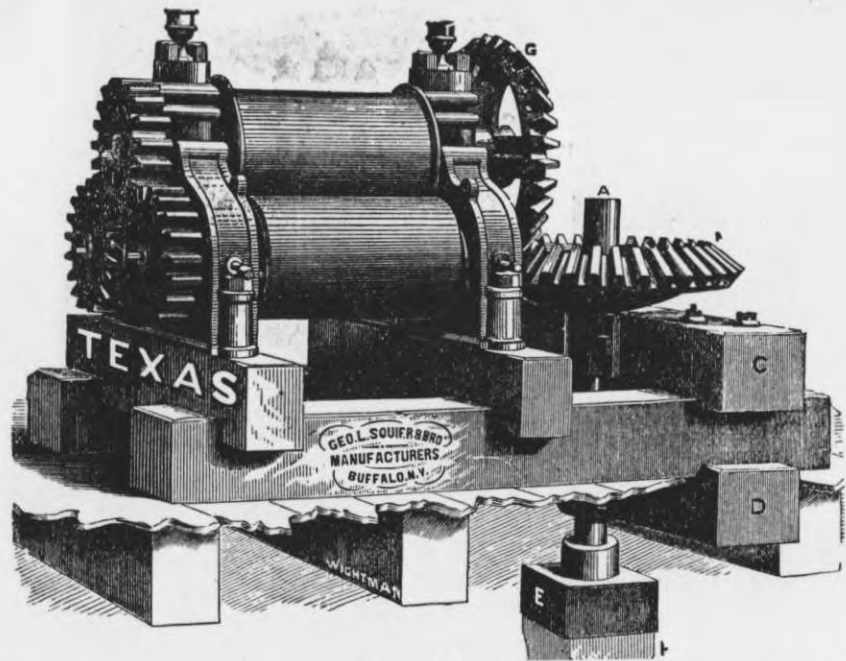
THE RUBY.

Horizontal, Self-adjusting, Sweep-below Animal-power Mills. Four Sizes.

RUBY No. 1.	Main Roller, 8 x 8.	Weight, about 900 Lbs.
RUBY No. 2.	Main Roller, 10 x 10.	Weight, about 1,300 Lbs.
RUBY No. 3.	Main Roller, 10 x 12.	Weight, about 1,500 Lbs.
RUBY No. 4.	Main Roller, 12 x 16.	Weight, about 3,200 Lbs.

The frequent calls for sweep-below mills smaller than our "TEXAS" mills have induced us to construct the above series of "RUBY" mills. They correspond in sizes and style with our "PEARL" and "GEM" mills which have met with such great favor since we introduced them. They embody all our latest improvements, and are very heavy and strong in proportion to the capacity of the rollers. Like all our mills, they have our self-adjusting springs, wrought iron stay bolts, heavy wrought shafts, and brass boxes, and are strong enough in every part to grind tropical cane. The advantages of sweep-below mills will be found stated in our description of our "TEXAS" mills, and need not be repeated here.

We send with each mill a sweep-socket and step for the sweep post. The post should be made of a seasoned stick of timber twelve to fifteen inches diameter. If at any future time the purchaser wishes to use steam instead of animal-power, these mills can be converted into steam mills like the "GEM" at a small expense.



THE TEXAS.

Heavy Horizontal Horse Power Mills, with Sweep Below or Sweep Above, as desired. Five Sizes.

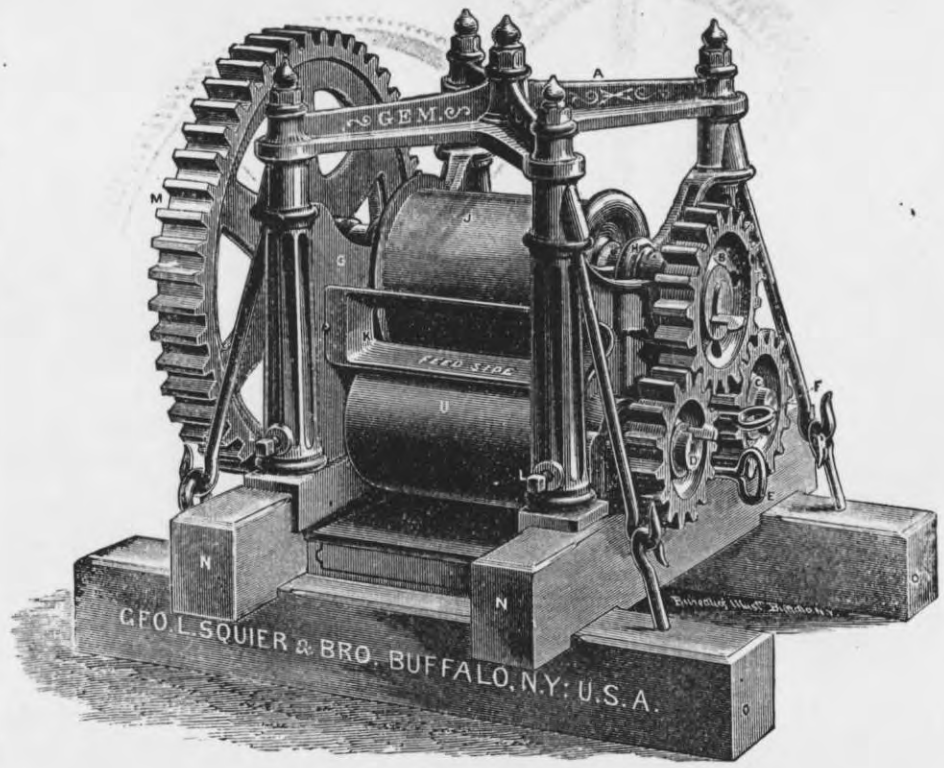
TEXAS No. 0.	Main Roller, 12 x 15.	Weight, 2,000 Lbs.
TEXAS No. 1.	Rollers, 12 x 20.	Weight, 3,500 Lbs.
TEXAS No. 2.	Rollers, 12 x 20.	Weight, 4,100 Lbs.
TEXAS No. 3.	Rollers, 16 x 24.	Weight, 6,600 Lbs.
TEXAS No. 4.	Rollers, 20 x 30.	Weight, 13,150 Lbs.

Our Texas Mills have now been in use many years in many different countries and give great satisfaction. They are by far the largest, heaviest and strongest animal power mills in market, and possess all the advantages of the best steam power mills; indeed, they can be easily converted into steam or water power mills, and we recommend them to all planters who desire to commence with animal power, expecting to change to steam or water power at some future time.

There are many advantages in a Sweep Below Mill, when the planter has a proper building in which to run it. The mill is placed in the second story of the building, and a shaft extends from thence to the ground, to which the team working on the ground floor is attached. The team and sweeps are entirely out of the way of the mill; the cane can be unloaded from the cart directly into the second story of the building, and piled near the mill under cover; the bagasse can be carried by a chute into the cart and carted off, and the juice spouted to the defecator or evaporator, without lifting or pumping. A Feed Table or Cane Carrier can be used with the mill as desired.

The general style of the mill and its housings is similar to our celebrated "Louisiana" Mills, which have met with so great success. The housings are arched and stay-bolted; the rollers are adjustable by set screws; the main rollers are flanged and the gearing very heavy. Rubber springs, wrought iron stay-bolts and heavy wrought shafts are used as in all our mills. The mill is very stout and heavy in all its parts, and we believe it to be the only Sweep Below Mill in the market fitted to grind the Southern cane. We send with each mill a sweep-socket and step for the sweep-post, but do not send the post, as that can be better and cheaper made on the plantation from a seasoned stick of timber, 12 to 15 inches in diameter.

The mill is so constructed that if the planter has no suitable building in which to run it as a Sweep Below Mill, it can be set on the ground, and the sweep-post extended upwards, so as to use as a Sweep Above Mill. And if at any future time he wishes to use steam, instead of animal power, it can be converted into a steam mill at a small expense by removing the bevel gears and substituting the ordinary back gear.



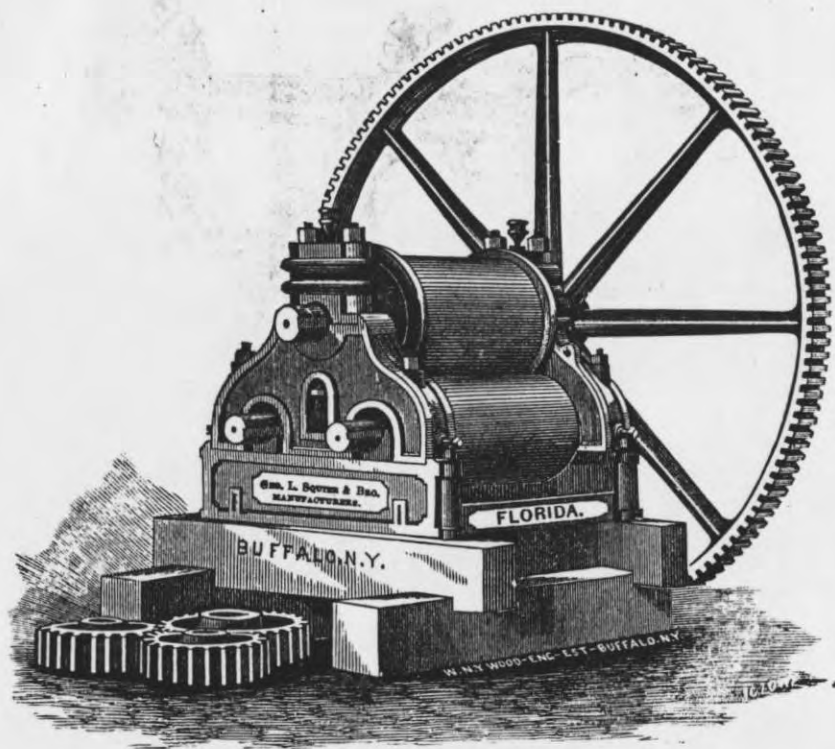
THE GEM.

Separate Horse-power or Small Steam or Water-power Mills. Three Sizes.

GEM No. 2.	Main Roller, 10 x 10.	Weight, about 1,100 Lbs.
GEM No. 3.	Main Roller, 10 x 12.	Weight, about 1,300 Lbs.
GEM No. 4.	Main Roller, 12 x 16.	Weight, about 2,500 Lbs.

The above engraving represents our "GEM" Mills, which are small steam and water-power mills, or separate horse-power mills, made strong enough to grind the tropical cane. They are the smallest steam and water-power mills we manufacture, and we have taken especial pains to make them very strong in proportion to their capacity, to enable them to sustain the great strain to which they are liable to be subjected in grinding the hard tropical cane by such power. Our patent Rubber Springs also offer an additional safeguard against breakage, and the wrought iron stay bolts take the strain of the rollers when working. The gearing is very strong, and the wrought iron shafts are of extra size, and run in brass boxes.

In driving all small sugar mills by steam or water-power, care should be used not to crowd the mill beyond its capacity. There is always a temptation to make a small machine do as much work as a large one, and as the power in such cases usually over-sizes the mill, there is always danger of breakage by attempting to make the machine do more work than the capacity of its rollers will permit. No machine can be made so strong that a greater power cannot break it, and so long as the power is stronger than the machine, breakage must occur, if the machine is fed according to the capacity of the power, instead of according to the capacity of the machine. The "GEM" Mills are made amply strong in proportion to the capacity of their rollers to do all the work that the rollers can do with proper feeding. They are nearly or quite twice as strong as any other mills in market, with the same capacity of rollers. In style and workmanship, they are unique and unequalled.



THE FLORIDA NO. 1.
Weight 1400 lbs. Main Roller 12 x 15.

THE FLORIDA NO. 2.
Weight 3000 lbs. Rollers 12 x 20.

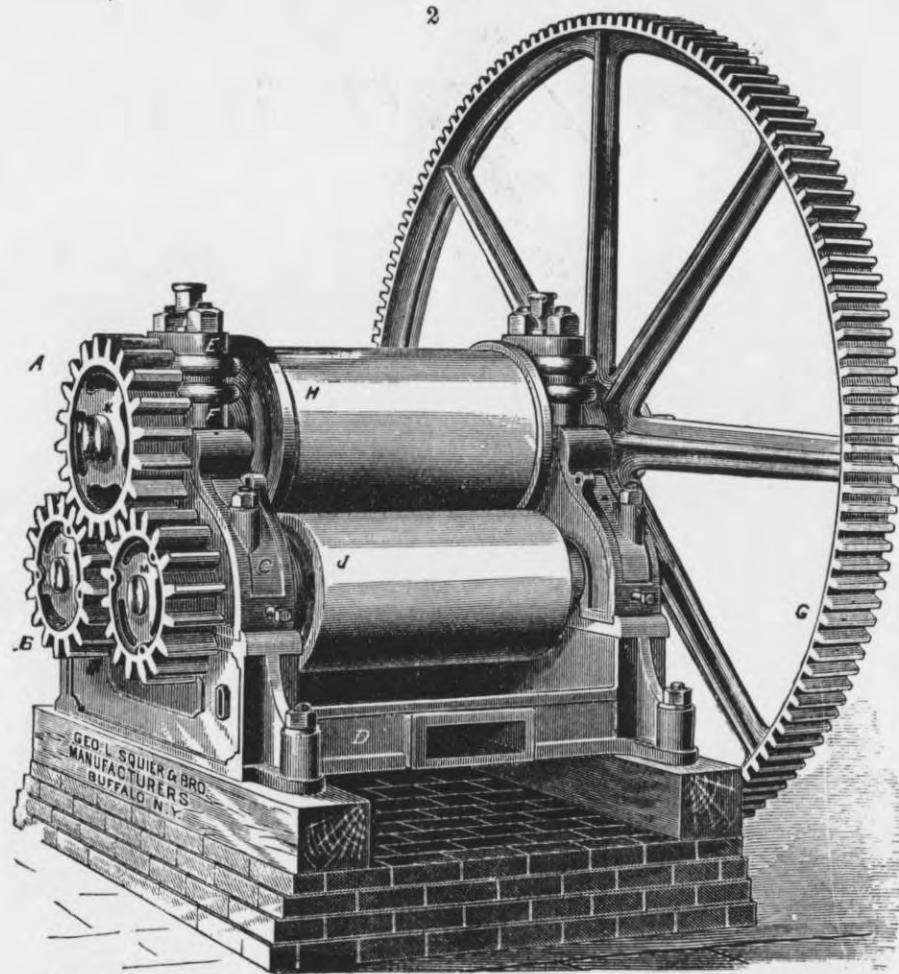
For Separate Horse Power, or Small Steam, or Water Power.

The above cut represents our "Florida" Mills, constructed expressly for grinding the Southern or tropical cane. They are constructed with our new style of HEAVY ARCHED HOUSINGS, similar to our "Louisiana" Mills, with heavy wrought iron stay-bolts to take the strain. Rubber springs, heavy wrought iron shafts, very strong, heavy gearing and flanged rollers are used as in all our mills. The rollers are adjustable by set screws, as in the larger mills. We have taken great pains to make them abundantly stout for their capacity, and we believe them to be fully as strong in proportion to their size and capacity as our celebrated "Louisiana" Mills.

FLORIDA No. 1 can be driven by our No. 4 Samson Horse Power, and makes a very perfect separate Horse Power Mill. It can also be driven by small steam or water power, though we would always recommend a larger mill for steam or water power. The Florida No 1 can be taken in pieces and transported on mules.

FLORIDA, No. 2 is, in our opinion, as small a mill as should ever be driven by steam or water power. It can be driven by our No. 5 Samson Horse Power, so that if the purchaser of the mill does not desire to purchase an engine for the present, he can drive the mill by horse power for one or more seasons until his crop will warrant him in buying an engine. This renders "FLORIDA" No. 2 an exceedingly desirable mill, as it enables the small planter to buy his machinery by degrees, as his crops increase and his means accumulate, and he is not forced to incur a heavy debt to procure his machinery to start with.

We can furnish Feed Tables and Bagasse Carriers for our Florida Mills when specially ordered, also Counter Shafts and Pulleys.



THE LOUISIANA MILLS, WITH IRON BED-PLATE.

Two Sizes.

LOUISIANA No. 1.	Weight, 4,600 Lbs.	Main Roller, 16 x 24.
LOUISIANA No. 2.	Weight, 10,500 Lbs.	Main Roller, 20 x 30.

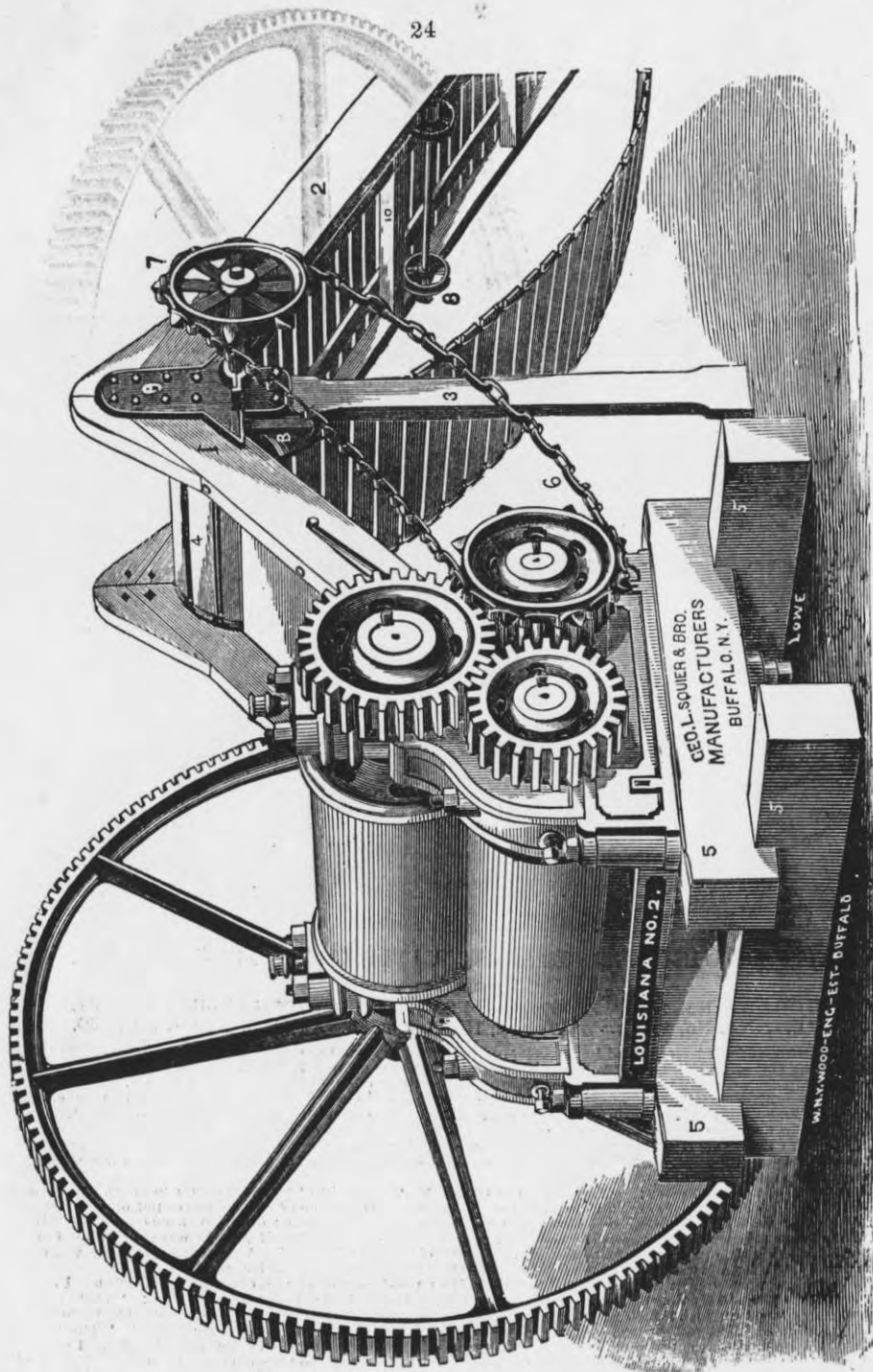
Our LOUISIANA MILLS have proved to be very popular, since they are the cheapest mills in the market in proportion to the size and capacity of the rollers, and are just what is wanted for medium steam and water power mills. In tropical countries where wood decays rapidly, or where it is liable to the attacks of ants, many prefer to have these mills with iron bed-plates, for, although it increases their first cost, it proves cheaper in the end.

The above engraving represents our LOUISIANA MILLS with an IRON BED-PLATE. The bed-plate is made very strong and the mills are first-class in every respect. Though not as heavy as our NIAGARA MILLS, the great strength of the Lake Superior iron of which they are made, while it permits us to furnish them at a lower price than the very heavy mills, gives them *all needed strength*, as has been proved by the long-continued use of many of these mills in different parts of the world.

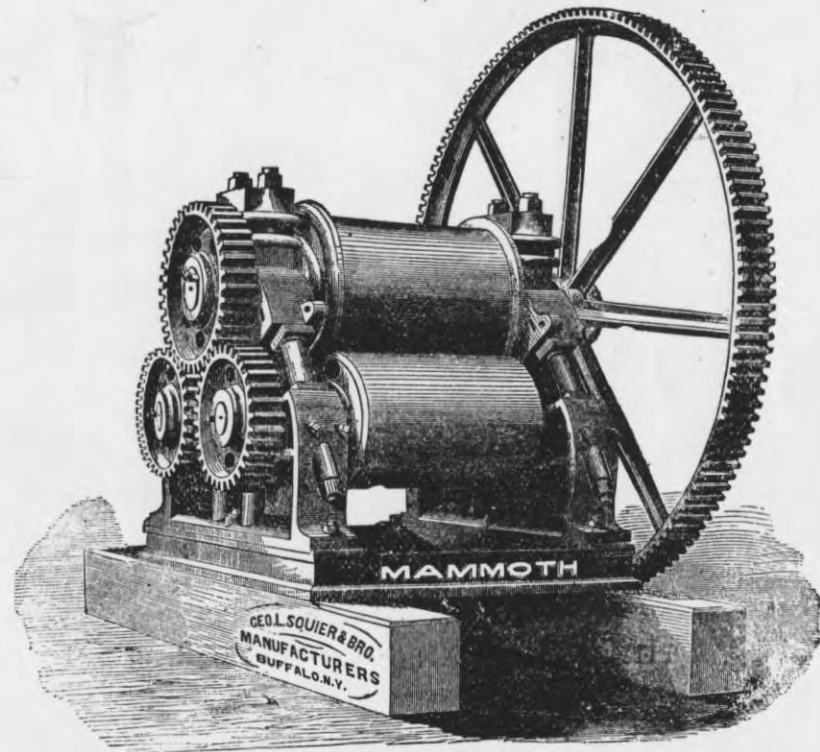
A Louisiana planter writes us: "The No. 2 LOUISIANA MILL bought of you is superior to anything of the kind I have ever seen. It squeezes all the juice out of the cane. My engineer said he never put up a mill that went together so well and fitted so exact, and he had put up a great many different kinds of mills. He said the mechanical work was the best he had ever seen in any mill." A Brazil planter writes: "The LOUISIANA No. 2 MILL I bought of you works well and gives entire satisfaction." A Guatemala planter writes: "The No. 2 LOUISIANA MILL and engine please me very much and are just what I wanted."

A Louisiana planter writes: "The No. 1 LOUISIANA MILL purchased of you gives entire satisfaction. I consider it good for five to six hogheads of sugar in twenty-four hours." Another planter writes: "Last year I successfully worked up with the No. 1 LOUISIANA MILL a crop of eighty-four acres of cane without any breakage or loss of time. The mill proved in every way strong and reliable." Another planter writes: "The LOUISIANA No. 1 MILL I bought of you is strong in all its parts, runs easily and never gets out of order. I could grind my cane almost to saw-dust. I consider it impossible to make any improvement on this mill."

We have many more such testimonials in reference to these mills that we could give if space permitted, but these are enough to prove that they are all we claim for them.



LOUISIANA No. 2 WITH CANE CARRIER.



THE AMERICAN MAMMOTH NO. 1

Weight, 16,000 Lbs. Main Roller, 24 x 30. Minor Rollers, 20 x 30.

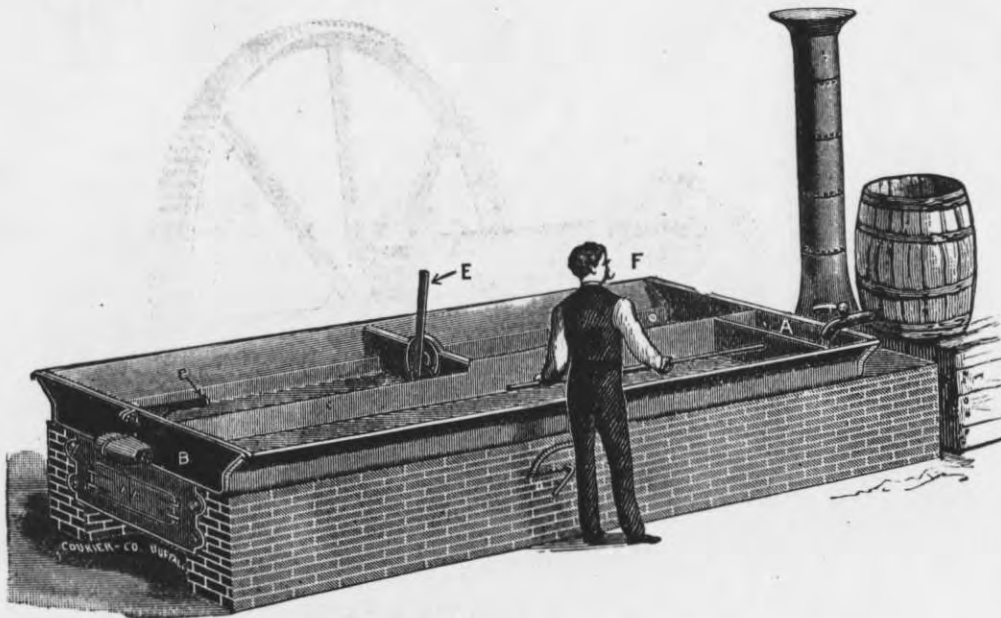
THE AMERICAN MAMMOTH NO. 2.

Weight, 18,000 Lbs. Main Roller, 24 x 36. Minor Rollers, 20 x 36.

The above cut represents our "MAMMOTH" Mills, which have been in use for nearly ten years, giving great satisfaction to their purchasers. One planter in Louisiana, who has used a Mammoth for eight years, writes: "In strength, durability, workmanship and capacity, it is unsurpassed by any Mill in market of its size. I can readily make 300 hogsheads of sugar with it in one and a half month's grinding." Another Louisiana planter writes: "It has made good your representations in every particular and we are more than satisfied with our purchase." Another planter writes: "We regard it as absolutely perfect." Such testimonials from experienced sugar-planters in reference to these Mills are better proofs of their merits than anything we could say.

These Mills have our PATENT RUBBER SPRINGS, which have proved, if possible, more useful and desirable in the larger Mills than in the small ones, for with the large Mills the cane often accumulates on the carrier and gets tangled, so that sometimes a large amount is forced into the rollers at once, while at other times very little goes in, and the rubber springs are just what is needed to adapt the rollers to this inequality of feeding.

These Mills are well proportioned, the weight and strength being placed just where it is needed, as is proved by the fact that though they are not heavy Mills for the size of their rollers, there has been hardly any breakage of any of them in ten years' use. We believe them to have a larger capacity and strength than any Mills of their price in market, and we recommend them with full confidence that they will give good satisfaction to the purchaser.



THE AMERICAN EVAPORATOR.

The above cut represents our shallow "AMERICAN EVAPORATOR," which is commonly used with our smaller sized horse-power mills. We manufacture five different sizes, from 6 feet to 14 feet in length, to adapt them to the different sized mills. It is made of extra heavy rolled iron of an extra quality rolled expressly for it, and has iron side-ends and partitions, with no joint or seam between the bottom and sides. Unlike the ordinary evaporators, it has no wood about it to burn out and make leaky joints. On this account, as well as on account of the thickness of the iron, it is very durable and will last for years with proper care, which makes it in reality the cheapest Evaporator in the market.

It is constructed with the special object of reducing to practice the true theory of Evaporation, having separate compartments and different degrees of heat for each of the distinct operations of defecating, evaporating and finishing. It consists of two long parallel pans, firmly united side by side, and used upon a furnace with a single arch or fire-place in front, and with separate flues under each pan, from about the middle backward, and a register damper at the mouth of each flue, to absolutely control the heat under that part of the pan.

Tight iron gates, with joints planed and ground to a perfect fit, are provided between the compartments to permit the juice to be drawn from one compartment to the other. The central division is lower in the front half of the pan than in the rear to permit the scum to boil over that part of the partition and float to the rear end of the pan, at A, where nearly all the skimming is done. This makes the operation of it very easy and simple, and one operator can easily attend to a large pan. A skimmer, scoop, strainer and two dampers are sent with each Evaporator. These Evaporators are made of galvanized iron or copper when so desired.

To operate the Evaporator shut the gates E and C tight and fill that side of the pan with one or two inc' s of water to prevent its burning; then let in the juice at A to the depth of two or three inches and start the fire. As the juice becomes heated the scum will rise and float back to A, where it should be removed. When the juice is sufficiently defecated pass the water from the compartment C into the finishing compartment F and let the defecated juice into the compartment C at the same time letting fresh juice into the pan at A. When the juice at C is boiled down to the finishing point, say 25 to 30 degrees, let the water out of the finishing compartment and let in the juice from C. At the same time let the defecated juice follow from B and let in fresh juice at A. Now the Evaporator is ready for regular operation and the work will go forward systematically, the juice following from one compartment into the next as it is wanted. Each operation of defecating, evaporating and finishing being done by itself can be perfectly done, and the juice in every stage is just where it is wanted. The heat under the defecating and finishing compartments is under full control by means of the dampers. The danger of burning occurs mostly in the finishing compartment when the syrup is thick, and here the heat should be very carefully regulated to the condition of the syrup. In emptying the pan at night, the syrup should be followed by water to prevent the pan from burning. The syrup is easiest run from one compartment to another by means of a sweep or a corn-husk brush of the width of the compartment. Set the sweep behind the syrup and shove it forward through the gate, at the same time opening the gate behind to let the syrup from the next compartment follow the sweep.

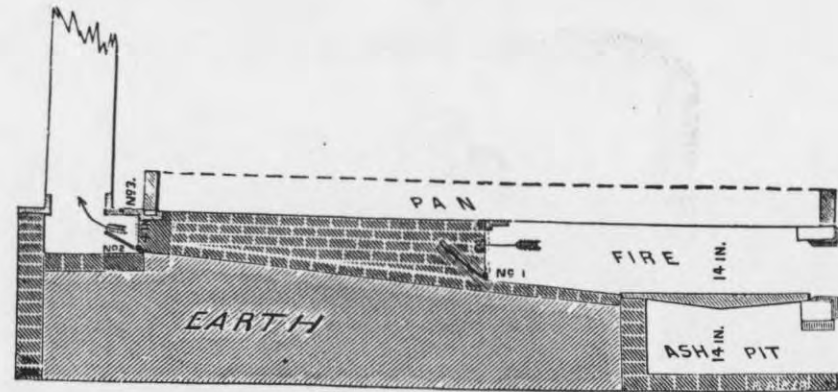


DIAGRAM OF BRICK ARCH FOR THE AMERICAN EVAPORATOR.

The above diagram represents the method of constructing the arch for our AMERICAN EVAPORATORS. The arch may be built of brick or stone, or any other substance that will stand fire, and, where the ground permits, it is well to locate it on a hill-side, sufficiently below the mill to allow the juice to run from the mill-tank into the evaporator.

Before building the arch, the surface soil should be removed down to the hard earth, to prevent the walls from cracking. The side walls should be from eight to twelve inches thick, and thirty inches high above the ground, and long enough to receive the pan and flue-cap with iron chimney on top. A brick chimney can be built if desired. A division wall four inches thick should extend from the chimney forward, far enough for the damper to be located at the front end of it to shut the heat off from the finishing compartment when desirable. The grates should be set fourteen to sixteen inches below the bottom of the pan, with their rear ends resting upon a cross wall which forms the rear of the ash-pit. The side walls should be built so far apart that the pan will lap on them only two or three inches, so as to leave nearly the whole bottom of the pan available for heating surface. This arch is very cheaply and easily constructed. We send with each evaporator full directions for building the arch and working the pan.

These evaporators have been in use for many years, and we have a great many testimonials from men who have used them who have formerly used many other kinds, and who say that the AMERICAN EVAPORATORS are very much superior to any that they have ever seen. We manufacture eight sizes of these evaporators, of iron or copper, as desired, as follows, viz.:

No. 1.	6 feet long,	3 1/2 feet wide,	6 inches deep.
No. 2.	8 "	3 1/2 "	6 "
No. 3.	10 "	3 1/2 "	6 "
No. 4.	12 "	3 1/2 "	6 "
No. 5.	14 "	3 1/2 "	6 "
No. 5 1/2.	14 "	3 1/2 "	10 "
No. 6.	15 "	4 1/2 "	17 "
No. 8.	20 "	4 1/2 "	17 "



THE AMERICAN EVAPORATOR.
With Portable Furnace.

For small operations a PORTABLE FURNACE AND EVAPORATOR is often more convenient than a stationary one, and we have therefore constructed a portable furnace for the American Evaporator, in which we have endeavored to combine all desirable features. The furnace has the same arrangement of flues and dampers as the brick arch, and operates in the same manner. It is made of heavy sheet iron, thoroughly riveted, and stayed and strengthened by angle iron, and has a heavy cast iron door frame and door and flue cap, and heavy cast iron grates. It has wrought iron legs, peculiarly arranged, and braced so as to stand very firmly, while for transportation or storage they can be folded up so as to occupy little space. It is also provided with a large and stout sheet iron chimney, and is all ready to run except the brick lining. Before putting in the fire it should be lined throughout the bottom and sides with bricks laid flatwise, to prevent its burning out. Fire bricks are the best, but ordinary bricks will answer.

THE EVAPORATOR is constructed precisely like the stationary one, described on the preceding page, and is operated in the same manner. It will be noticed that the "AMERICAN" EVAPORATORS provide fully for the three distinct processes of evaporation. The first compartment, or "Grande," is used for defecation. It is situated at the rear end of the evaporator, where the heat is moderate. Here the raw juice is let in and gradually brought up to the boiling point, allowing time for the albumen to coagulate, and the feculent matter to be thrown up where it can be easily skimmed off. There is no violent ebullition here to interfere with the skimming. When sufficiently defecated it flows forward to the next compartment, or "Flambeau," directly over the fire, where it is rapidly desiccated, or the watery portion evaporated. From the "Flambeau" it flows into the "Cero," on the other side of the pan, but still over the hottest part of the fire where the rapid evaporation continues, until it is ready for the "Battery." It will be noticed that the greatest part of the evaporation is carried on in the "Flambeau" and "Cero," over the hottest part of the fire, and where the evaporating surface is larger, consequently the evaporation is exceedingly rapid.

In the "Battery" the finishing process is carried on and the "strike" made. This is the process in which there is the greatest danger of burning, and consequently the heat should here be under absolute control. This is accomplished by means of the register damper, located directly under the commencement of this compartment, by means of which the heat can be kept under perfect control, or entirely cut off and thrown up the opposite flue and utilized under the "Grande."

Thus the three distinct processes of defecation, desiccation and finishing, are fully and



THE AMERICAN DEEP EVAPORATOR.

The above cut represents our Deep Evaporator intended for Sugar making, and adapted in size to our smaller Horizontal Mills. They are constructed and operated upon precisely the same principle as our smaller Evaporator described and illustrated on the preceding pages, having compartments corresponding with the "Grande," "Flambeau," "Cero," and "Battery," of the Kettle Range.

The shallow Evaporators can be made into deep Evaporators when desired, simply by building the walls of the brick arch thicker and extending them above the sides and ends of the shallow Evaporator, flaring or tiling them out, after reaching the height of the iron sides of the Evaporator, and lining the flaring portion with cement or mortar, as is commonly practiced with kettles.

There is a "Grande," or defecating compartment in our Deep Evaporator, so that there is no necessity for a separate Defecator to work the Evaporator to the best advantage. Yet when it is desirable to increase the capacity of the Evaporator it can be easily done by adding a Defecator, placing it upon the same arch in the rear of the Evaporator. The defecating can then be performed in the separate Defecator and the whole capacity of the Evaporator be used for evaporating. We manufacture Defecators to go with our Deep Evaporators, when wanted. We send with each Evaporator plans and instructions for setting up and working them. All our Evaporators, large and small, shallow and deep, work on precisely the same principle, the only difference in them being in their capacity. We make all our Evaporators of heavy rolled iron, with iron sides and ends, and the heaviest of them are stayed with iron rods.

These Evaporators have been in use for a number of years and have given better satisfaction than any open pans that have yet been introduced, and they are so cheap and so economical of labor and fuel that they are far preferable to kettles for small operations. For very large operations where a large crop is to be worked off, planters generally prefer kettles.

STEAM EVAPORATORS.

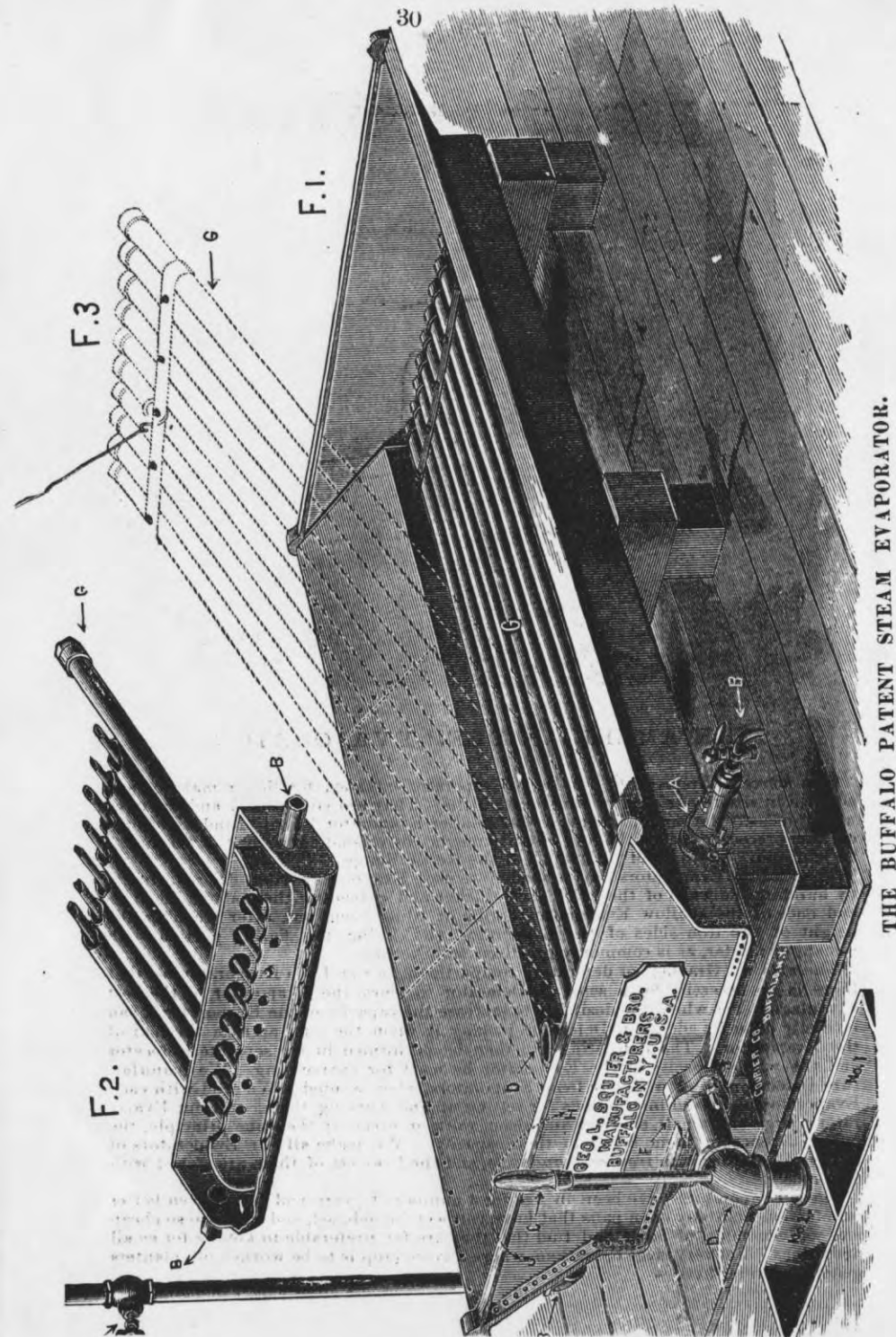
The attention of cane growers is being turned towards steam evaporation, and the subject suggests several important questions. Direct fire evaporation is unquestionably more economical of fuel than steam evaporation, for there is necessarily a loss in all secondary applications of heat or power. But as the bagasse will furnish nearly, or quite, all the fuel needed in either case, this question is not very important. Undoubtedly much surer and better results can be obtained by steam evaporation than by direct fire. The danger of burning is almost entirely obviated, and every stage of the processes of defecating, evaporating and finishing can be kept under absolute control.

But steam apparatus is expensive, and it becomes a question, in each case, whether the amount of work to be done will warrant the outlay. Many farmers have farm-engines, which they can use to drive the mills, but the boilers usually connected with these engines are totally inadequate to furnish the steam for evaporating with apparatus of any considerable dimensions. Those who have had no experience in evaporating with steam are very apt to provide too little boiler-power to do the work properly. The amount of steam required for evaporation will, of course, depend very largely upon the mode of applying it and the kind of apparatus used. But, as a general rule, it may be stated that it will require at least twice as much steam to evaporate the juice as it will to grind the cane, and it would be better to have three times as much. That is, if the mill requires ten horse-power, the boiler for both grinding and evaporating ought to be from thirty to forty horse-power. In using steam for any purpose it is always economical to have a surplus of boiler capacity, which saves burning and straining the boiler, and also saves fuel.

As a general rule we should say that, unless a farmer has more cane to work than he can grind with a four horse-mill, he would not be warranted in going to the expense of putting in steam apparatus for evaporating.

In response to the call for steam evaporators, we have spent much time and money in experimenting to devise an evaporator which should come up to the motto which governs us in constructing all our machinery, viz.: "The best in the market or nothing." We first tried the ordinary coil running back and forth in the bottom of the pan, taking in the steam on one side and letting it run through the whole length of the coil and discharge on the other side. We found that there were many serious objections to this style of coil. The steam would become condensed and lose its heating power when about half-way through the coil, and, as a consequence, the pan would boil violently on one side and not at all on the other side. We then tried letting the steam into the center of the coil, and dividing it and letting it run each way and exhaust at each side. The pan would then boil violently in the middle and not any at the sides. Besides we found that these continuous coils with many elbows were liable to get clogged with the condensed water, that they would warp out of shape, that they were very inconvenient to clean and rendered the cleaning of the pan very difficult, and that they would be very difficult for a farmer to repair when out of order. We concluded that something better must be devised which would do away with the many objections which we found inherent in the common coil.

Without detailing our experiments further we will simply say that we finally constructed the evaporator represented on the preceding page, as embodying the best results of all our efforts and we offer it to the public believing it to be the best steam evaporator yet devised.

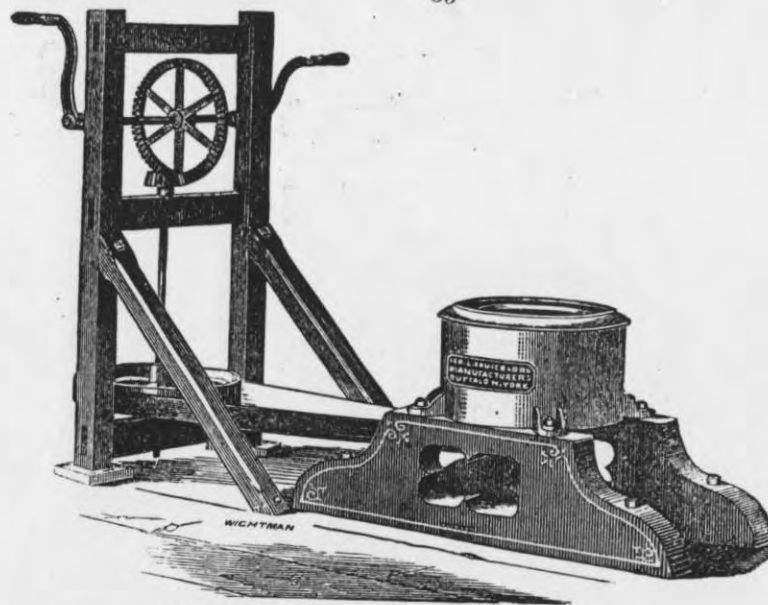


THE BUFFALO PATENT STEAM EVAPORATOR.

The pan is made of heavy galvanized iron with flaring sides to facilitate skimming, angle iron along the edges to stiffen it and heavy cast-iron ends. A hollow manifold steam head runs crosswise of one end of the pan, with hollow trunnions projecting through the sides of the pan with water-tight joints. The steam pipes are each screwed into this head and caps are screwed on the other end of each pipe. Inside of each steam pipe is a small exhaust pipe which is screwed into a diaphragm which runs longitudinally through the manifold head. The steam enters through the hollow trunnion on one side of the pan and passes into all the steam pipes alike, and is exhausted through the small internal pipes which carry it to the other side of the diaphragm and it is discharged through the hollow trunnion at the other side of the pan. By this arrangement fresh, live steam is furnished to each pipe alike and the pan boils all over and the evaporation is very rapid. We found that we could evaporate water twice as rapidly with this coil as we could with the same number of feet of the old style continuous coil. As rapidity of evaporation is an essential feature in reducing saccharine juices this is a very important point gained. By means of cocks the amount of steam can be perfectly controlled and any desired heat for defecating and finishing obtained. Being hinged on the trunnions, the whole coil can be turned up out of the pan for cleaning both coil and pan. Each steam pipe being independent can be unscrewed and taken out for repairs when necessary, without sending for a plumber. By means of a swing-pipe at one end of the pan the liquid can be drawn off to any desired depth or the whole can be drawn out.

For steam pipes, common iron or galvanized, or copper pipes can be used. When the evaporator is to be used for concentrating cider, copper pipes are necessary, but for saccharine juices we regard iron or galvanized pipes as about as good practically as copper. The idea that iron pipes discolor the syrup is a delusion, provided they are kept clean. In the tropics the juice is defecated in iron defecators, evaporated in iron kettles and finished in iron vacuum pans and no discoloration of the syrup is discovered. Copper pipes are so expensive that they almost double the cost of steam apparatus, and, unless a man has plenty of money to invest in such an apparatus we would not recommend them.

All the processes of defecating, evaporating and finishing can be carried on in one of these evaporators, but it will be necessarily slow, as each process must wait for the other. For rapid work we would recommend a full steam train of four evaporators, viz.: Two defecators to be used alternately, one evaporator and one finisher. Then all the processes can be carried on at once and the work pushed. For the defecators, exhaust steam can be used if desired. The different pans can be arranged so as to draw directly from one to the other. In large establishments working for sugar the finishing can be done in vacuum pans if desired.



SUGAR CENTRIFUGAL NO. 2.

For Hand or Horse Power. Basket 15 Inches Diameter, 8 Inches Deep

Hand Centrifugals, cheaply constructed, have occasionally been offered in the market, but have proved so worthless, that their manufacture has been abandoned. A machine requiring so nice an adjustment and so high a speed, cannot be cheaply constructed without being worthless.

If made very small, they are inefficient. If made of cheap materials, they become dangerous from their liability to burst. If cheap workmanship is employed, their nice adjustment is lost, and they soon wear out.

In view of these facts, to answer the demand for hand and small power centrifugals, we have constructed the machine represented by the above cut, with a sole view to its efficiency, durability and safety, sparing no expense to make it a perfect machine of its kind. Of course such a machine cannot be made or afforded at any thing like the cost of the worthless machines heretofore put upon the market, but our motto is and always has been "the best thing of its kind or none," and we only make machinery for those who want the best article in the market.

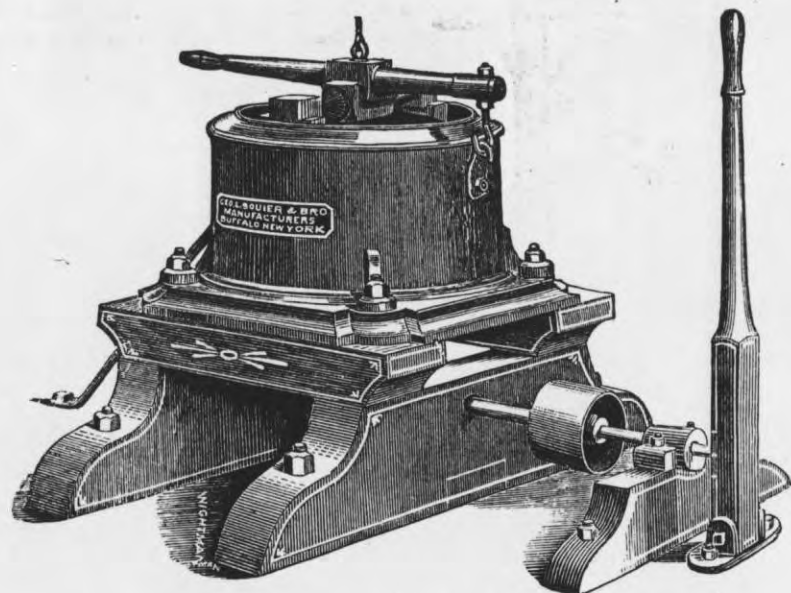
The Case is made of solid iron, cast in one piece, and about twice as heavy as is usually made. The Basket is made entirely of brass and gun metal of the very best quality, and much heavier than usual, to avoid the possibility of bursting. The Basket is lined with the heaviest and best German wire-cloth made expressly for this purpose.

The Spindle is made of cast steel. The upper Journal is provided with three brass boxes, adjusted with set screws and jam nuts, arranged so as to balance themselves equally in the direction of their length upon the points of the set screws, thus insuring equal bearing their full length. The oiling arrangements are usually very defective in such machines; to obviate the usual defects in this respect we make the hub of the basket hollow, and fill the cavity with wool or cotton, into which nearly one-half pint of oil is poured. The oil then feeds itself very gradually through a groove, down the shaft to the lower journals, insuring perfect lubrication with little attention.

We furnish all the wood work with the machine when desired. When the wood work is not desired on account of the expense of transportation, we furnish the necessary bolts and drawings, showing the dimensions and construction of the wood work. An extra basket is very convenient, so that one basket can be emptied and changed while the other is in motion.

Of course a machine running at so high a speed, must use up power rapidly, and this machine runs rather heavy for a hand machine, but a smaller machine would have so little efficiency as not to be worth its cost. We arrange this machine to be run by horse, steam or water power when so desired.

We also manufacture 24 inch Centrifugal for



SUGAR CENTRIFUGAL NO. 3.

For Steam or Water Power. Basket 24 inches diam., 12 inches deep.

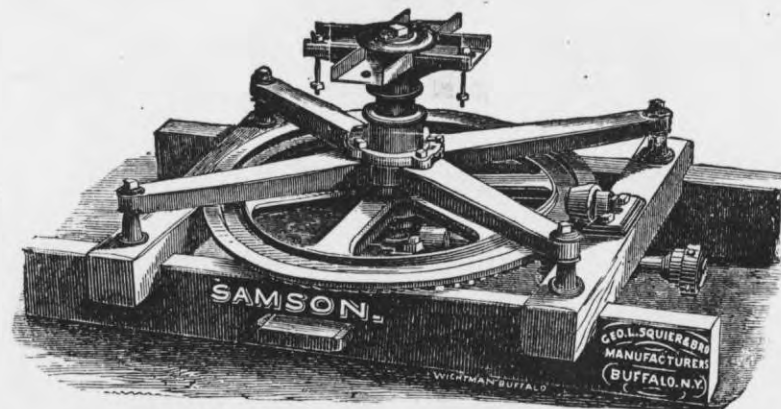
The above cut represents our No. 3 Centrifugal for steam or water power. It is very thoroughly made in all its parts of the best material, as a machine having so high a velocity must necessarily be in order to be good for anything.

The case is made of solid iron, cast in one piece, and very heavy. The basket is made of brass and lined with the best German brass wire-cloth made expressly for this purpose. The spindle is made of cast steel. The upper journal is provided with three brass boxes adjusted with a sleeve-nut below which adjusts all three of the boxes at once. The hub of the basket is made hollow to be filled with wool or cotton, into which a pint of oil may be poured which will then feed itself as wanted to the upper journal insuring perfect lubrication.

The arrangement of counter-shaft and pulley varies according to circumstances, depending upon the position in which it is desired to place the Centrifugal, and the kind of motor by which it is to be driven. The above cut represents one (and perhaps the most common) method of arranging the counter-shaft, but other methods are equally applicable to the machine.

Parties ordering this Centrifugal should state the kind of motor by which it is to be driven, the speed of the motor, the size and speed of the pulley from which it is intended to drive the Centrifugal, the direction in which this pulley revolves and the relative position in which it is desired to set the Centrifugal, and then we can arrange the counter-shaft, pulley and connections in the best manner to give the machine the proper speed. The basket should make from 1,200 to 1,500 revolutions per minute.

This machine can be made in sections for transportation on mule back when so desired



SAMSON HORSE POWER NO. 5.

For Six or Eight Horses. Weight 1400 lbs.

We constructed our series of Samson Horse Powers expressly for Southern plantation use, where the ordinary Horse Powers in the market have proved to be utter failures and of no account. Our aim was to make these powers so simple that the duller mind could comprehend them, and so strong that the most blundering carelessness could not break them, and at the same time adapt them to all the various needs of the plantation. That we have succeeded in accomplishing what we aimed at is abundantly proved by the great success they have met and the great popularity they have attained wherever they have been introduced. During the year 1870 they bore off the FIRST PREMIUM from all competitors at the Louisiana State Fair, the Texas State Fair, the Mississippi State Fair, the Mobile Fair, the Selma Fair, and in fact at every Fair at which they have ever been exhibited.

It is utterly impossible to conceive of a Horse Power more simple than our SAMSON. A heavy timber frame bolted together, sustains a massive master wheel, with heavy patent Flanged Gearing, running upon a heavy Flanged Pinion. Can anything be more simple?

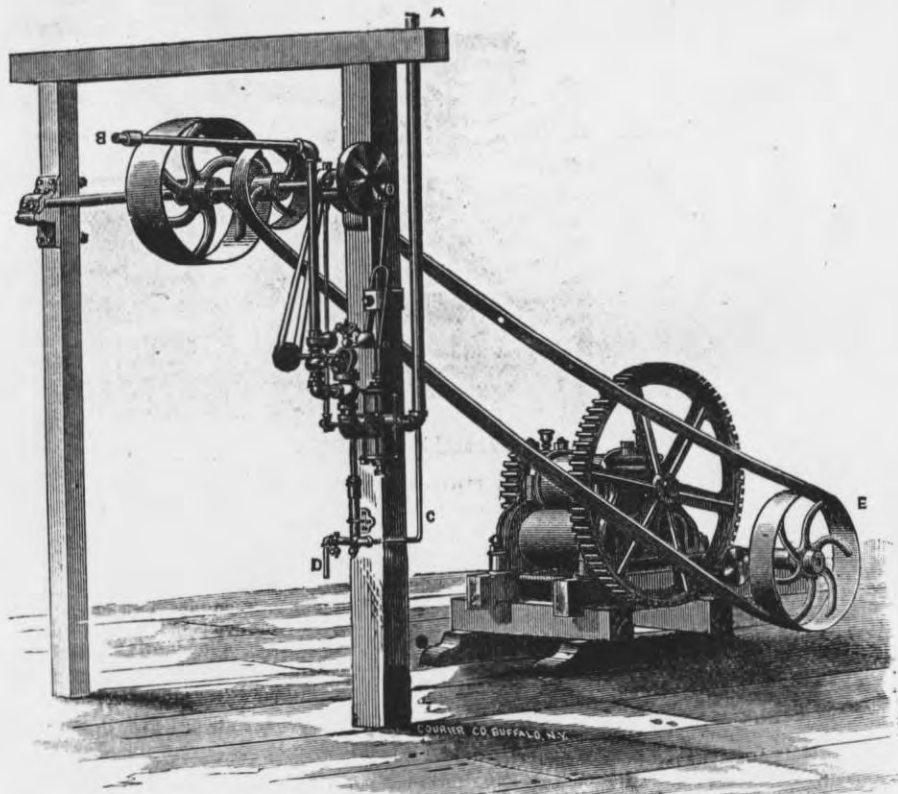
Then consider its strength. The wheels are so massive and the cogs so large and strengthened by flanges that no power which it is possible to bring to bear upon them can break them. The Main Driving Shaft is of heavy wrought iron, and the Counter Shaft and Tumbling Rod nearly twice as heavy as in ordinary powers. No weight of metal has been spared to place its strength beyond all question.

Then examine the devices to ensure durability and perfect adjustability. The top box or hub of the Main Shaft is a heavy casting sustained by cross trees, which, at the same time, brace the Main Frame, and prevent all twisting and warping. Peculiar Babbitted Bushings are fitted to this box and adjusted by set screws. The lower box or step is Babbitted, made oil tight, and has a friction plate upon which the bottom of the shaft runs. This box is perfectly adjustable in either direction upon the bridge tree by wedges. A guide roller runs on top of the master wheel over the pinion to keep it to its work. Altogether we believe our SAMSON HORSE POWER TO BE THE PERFECTION OF SIMPLICITY, STRENGTH AND DURABILITY.

We manufacture four sizes of the Samson Powers, Nos. 3, 4, 5 and 6. No. 3 is a small power, intended for two horses, and adapted to driving a 30 to 40 Saw Gin. No. 4 is a stout four horse power, adapted to driving a 40 to 50 Saw Gin. No. 5 is a six horse power, adapted to driving a 50 to 60 Saw Gin. No. 6 is a tremendously heavy and stout power, for 8 or 10 horses, and adapted to driving a 60 to 80 Saw Gin. All these powers are more than twice as heavy and strong as the ordinary powers in market intended for the same number of horses.

We manufacture various sizes of SPEED JACKS adapted to our different sized powers, by means of which any desired speed may be attained for driving Cotton Gins, Corn Mills, Threshers, Saws, Rice Hullers, or any plantation machinery.

These powers are admirably adapted to driving our Cane Mills, and have just the right speed for that purpose without a speed jack.



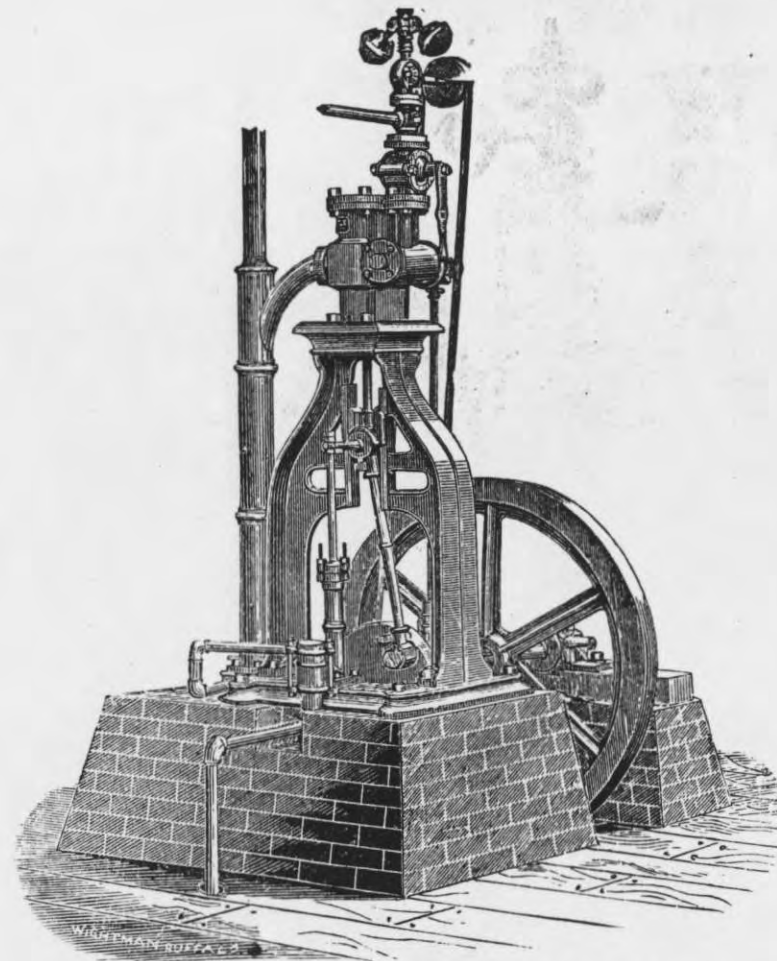
THE BUFFALO POST ENGINE.

Driving a No. 1 Florida Mill.
FOUR SIZES.

No. 1, 3 Horse-Power, Cylinder 3 × 6. | No. 3, 6 Horse-Power, Cylinder 5 × 10.
No. 2, 5 Horse-Power, Cylinder 4 × 8. | No. 4, 10 Horse-Power, Cylinder 6 × 12.

The great increase in the use of steam, both for driving the mill and for evaporating, has created a demand for a different class of engines and boilers from those usually found in the market. The farm engines in common use have barely sufficient boiler capacity to drive the engine, while the steam evaporators require two or three times as much steam as the engine; hence it is necessary for those who desire to both grind and evaporate by steam to have a boiler of three or four times the capacity of the one usually furnished with the engine. Frequently second-hand boilers can be found near home that will answer the purpose, and the farmer wants only an engine with his mill.

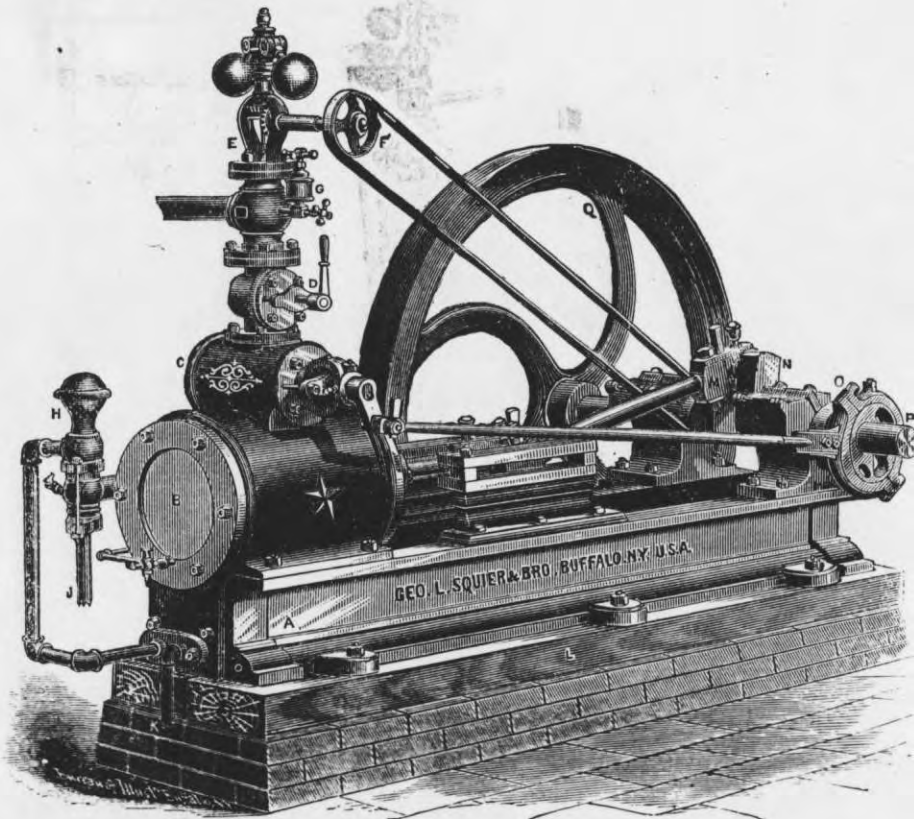
For the farmer who desires an engine only to run a small mill, most of the engines in market are too complicated and expensive, and to meet his requirements we have constructed a series of simple post engines, represented in the above cut, which are cheap and, at the same time, well made, strong and effective; they can be bolted either to an upright post or to a horizontal beam or timber, and thus the weight and expense of a heavy bed-plate and foundation are dispensed with. The crank of the engine connects directly with the line shaft, on which pulleys can be located for driving mill, centrifugal, pump, etc., or a threshing machine, and any other machinery can be driven from the same shaft. These engines are as simple as it is possible to make an efficient engine, and yet contain all the necessary parts, including pump and governor. All the working parts are made as carefully as the most expensive engine, the saving being chiefly in the weight of metal and not in the labor expended on the working parts. Their prices are low, and we feel confident that they will be the means of those farmers who want small engines



AMERICAN VERTICAL STEAM ENGINE.

THE above cut represents our Vertical Steam Engines, which are especially adapted for driving our Sugar Cane Mills. Long stroke engines are required to drive a cane mill to the best advantage, and we therefore make our engines with longer stroke than is usual with ordinary engines. They are made very strong, and as simple as possible, all unnecessary parts being dispensed with. Great pains has been taken to construct the engine so that every part can be conveniently reached for alterations or repairs, and so that when repairs are necessary they can be made in the most simple and expeditious manner. They are, therefore, peculiarly adapted to those countries where few machine shops or conveniences for repairing are found. Vertical engines are coming more and more into use on account of their simplicity, durability and compactness, and are admirably adapted to driving Sugar Cane Mills.

We manufacture six sizes of these engines, from six to forty horse power, adapted to the various purposes for which engines of like power can be used. The smallest size is constructed in sections for transportation on mules.



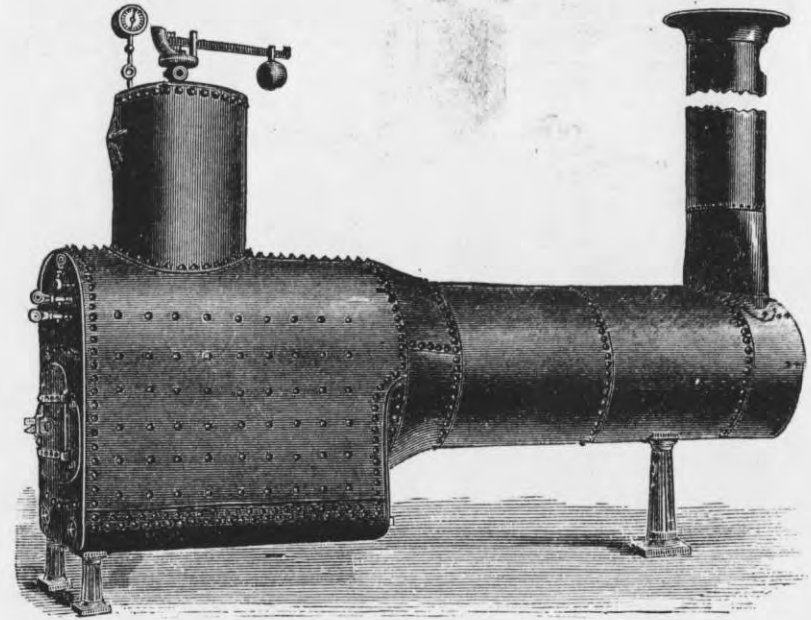
HERCULES ENGINES.

Medium Stroke, Horizontal Engines. Eight Sizes, from 12 to 50 Horse-power.

The above engraving represents our HERCULES ENGINES, which are medium stroke, horizontal engines, and are suitable for running any kind of plantation machinery. When sugar mills are driven by these engines the mills should generally be double geared to give the rollers the proper speed. These engines are thoroughly well made in every particular, of the best materials, and cannot fail to give good satisfaction.

The cut on the next page represents our LONG STROKE BUFFALO ENGINES, which are especially adapted to driving large sugar mills. In these engines we use the DOUBLE BUFFALO ROTARY VALVES. These valves are similar to the celebrated Corliss valve, and are located near each end of the cylinder, cutting off short, and preventing the enormous waste of steam required to fill the ports when there is but a single valve located in the centre of the cylinder. In long stroke engines this is an important item, amounting to a saving of 10 to 20 per cent. of the steam. The rotary valve has proved to be much more durable than the old style slide-valve, and is rapidly coming into general use. We can furnish the slide-valve for those who desire it, and the diagram on the preceding page represents our LONG STROKE BUFFALO ENGINE, WITH SLIDE-VALVE.

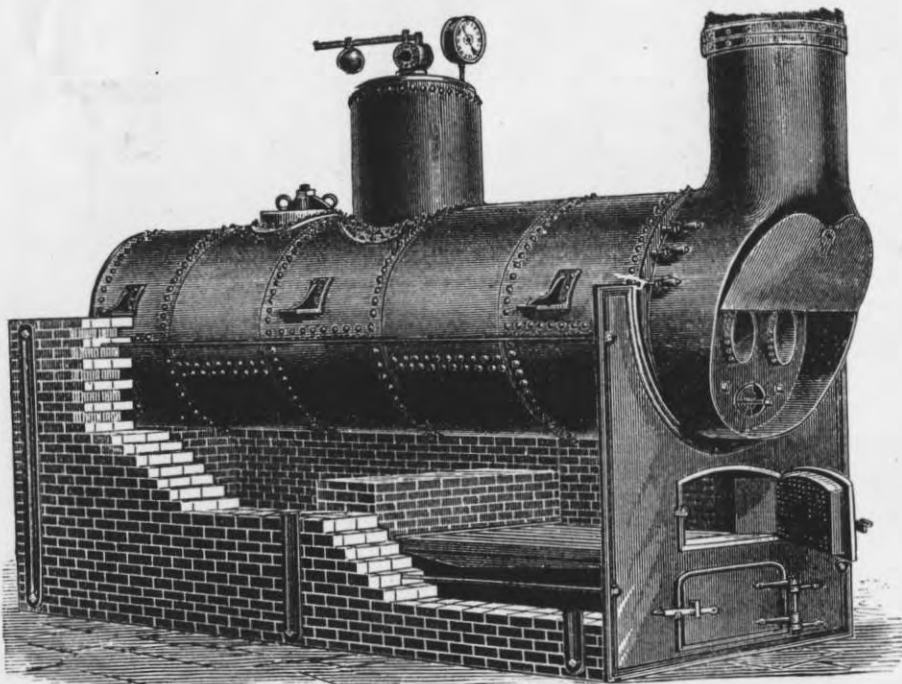
These engines are thoroughly made of the best materials, are simple in construction, easily managed and very durable.



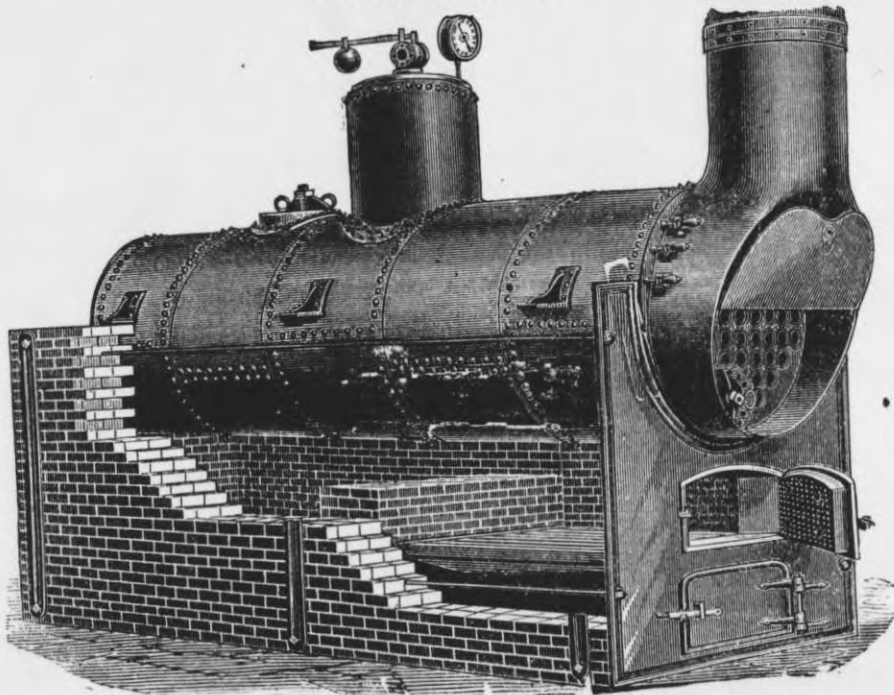
LOCOMOTIVE BOILER.

The above cut represents our LOCOMOTIVE BOILER, which is often the most convenient style of boiler for small and medium sized engines, as it requires no brick work and can easily be moved from place to place and set up almost anywhere. It is a tubular boiler, made of the best materials in the most approved manner. The grates and fire-front are all constructed in the front shell, and the boiler is all complete with steam-gauge, safety-valve, gauge-cocks, etc.—everything complete to run except smoke-stack. We can furnish smoke-stacks, if desired, at the prices named in our list, but as they are bulky to ship it is often cheaper to procure them where the boiler is to be used.

The first engraving upon the next page represents our TWO-FLUE BOILERS, and the second engraving our TUBULAR BOILERS. We do not usually put a steam dome on the smallest-sized two-flue boilers unless it is specially ordered, as there is no necessity for it on very small boilers. These boilers are made of the best quality of C. H. No. 1 American Charcoal Iron, stamped by government inspector, which is the best boiler iron in the world. They are all thoroughly made in the best possible manner. We can furnish either style of boiler desired with any sized engine. The prices of engines and boilers in our list include grates, fire-front, steam-gauge, gauge-cocks, safety-valve, and everything complete except cold-water pipe and smoke-stack.



TWO-FLUE BOILER.



HINTS TO THOSE ORDERING MACHINES AND REPAIRS.

MACHINES.—Every kind and style of machine manufactured by us has a **DISTINCT NAME**. If there are different sizes of the same name, each size has a **DISTINCT NUMBER**, as Pearl No. 2, Pearl No. 3, Pearl No. 4, etc. It is therefore very easy to designate the exact size and style of machine wanted. To make the matter doubly sure, the leaf in the catalogue containing the illustration of the machine can be cut out and sent with the order.

If the machine is to be driven by power *already provided*, we should be informed of the speed, diameter and width of face of the driving pulley or gear. For instance, if the machine is to be driven by a **STEAM ENGINE** already in use, we should know the number of revolutions per minute made by the engine shaft when doing ordinary work, and the diameter and width of face of the driving pulley. If we are desired to furnish a pulley for the engine shaft, the exact size of the shaft and the depth and width of the key-seat should be given. If the machine is to be driven from a line of shafting already provided, the speed of the line and the diameter and face of the driving pulley should be given. If the machine is to be driven by a **WATER-WHEEL** already built, we should know the number of revolutions per minute of the wheel when at work, also the diameter and face of the pulley or gear on the water-wheel shaft. If we are desired to furnish a pulley or gear to go on the end of the water-wheel shaft, we should have a sketch of the size and shape of the end of the shaft. It is also well to give us the diameter of the water-wheel, length of the buckets, and quantity of water, so that we may judge of the amount of power it furnishes. If the machine is to be driven by a **HORSE-POWER** already provided, we should be informed of the number of revolutions per minute of the driving shaft or tumbling-rod, when the animals are walking at their average speed, and the diameter and face of the gear or pulley. If a speed jack is used, then we should know the speed, diameter and face of the pulley on the speed jack.

If a **PULLEY** is ordered to fit a shaft, the exact diameter of the shaft and width and depth of key-seat should be given. If a **GEAR** is ordered to fit another gear, the diameter and face of the gear, and the number and pitch of the teeth, the size of the eye and key-seat, should be given; also whether it is a spur (straight) or a bevel (angular) gear. Always state whether the measurements are *English, Spanish or French*.

In ordering gears, pulleys and other things, when exact sizes and proportions are not essential, it is well to give us a little discretion, as we may not have the patterns of the exact size given, but, as we have a very large stock of patterns, we may have those so near the size that it will make no practical difference, and in such case the purchaser would be saved the expense of making special patterns. Patterns are always expensive, and the cost of them may often be saved by a slight variation of dimensions.

When **WATER-WHEELS** are ordered, we should always be informed of the quantity of water and height of fall. If the quantity of water is small, it is important to know whether there is a reservoir or pond where the water can accumulate during the night, or when the wheel is not in use. It is also desirable to send us a sketch of the stream and ground, showing where it is desired to locate the wheel and machinery.

In ordering **KETTLES**, it is always better to order our standard sizes, as we have patterns for no other sizes, and such patterns are very expensive.

REPAIRS.—In ordering parts for repairs, it is well to cut from the catalogue or any periodical that may contain it, the engraving of the machine and mark the piece wanted. If this cannot be done, a rough sketch of the form and dimensions of the piece with the name and number of the machine should be furnished. All of our machines of the same kind and size are precisely alike, made from the same patterns, and the parts are interchangeable, with the exception of some sizes in which we have made improvements. In the case of improvements some of the parts of the machine which were made previous to the improvements, differ from those made since. To meet such cases, we have devised a system of **REGISTRATION**, by which every machine that we make has its own distinct number, and is registered. Whenever any change is made in any part of any machine, the change is noted on the register, and the date of sale of the machine, and to whom sold is also noted. Take, for instance, Samson Sugar Mill No. 967, there is no other Samson Sugar Mill in existence having that number on it. Therefore, if the person who owns that mill should write to us for repairs and give us that number, we could, from our register, tell at once whether any part of that mill differed in any particular from the Samson Mills we are making to-day, and could be sure to send just the right piece, and so of every size and kind of machine we make. It is, therefore, important for parties ordering repairs to give us the special number of the machine. If the number has become obliterated, let us know when, where and through whom the machine was ordered. If ordered by your merchant through a merchant in this country, give us both names if possible, as we may have only the name of the merchant in this country through whom the machine was ordered. We can then probably trace out the number from our register. To guard against the loss of the number, it is well for the purchaser to make a record of the number when he receives the machine, also the date of the purchase and the name of the party through whom it was ordered, and then he can always refer to this record when ordering repairs.

Careful attention to the foregoing hints will obviate delays and preclude mistakes in filling orders.