PRIZE ESSAYS

ON

COOKED AND COOKING FOOD

FOR

DOMESTIC ANIMALS OF THE FARM,

WITH

USEFUL INFORMATION

FOR THE

STOCK FEEDER, FARMERS AND OTHERS.

REVISED EDITION.

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D. R. PRINDLE, East Bethany, N. Y.; and
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1870.

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COOKED FOOD FOR ANIMALS,

BY

E. W. STEWART, of New York;
W. H. WHITE, of Connecticut; and
JOHN WILKINSON, of Baltimore,

WITH

IMPORTANT INFORMATION ON THE SUBJECT BY OTHER WRITERS.

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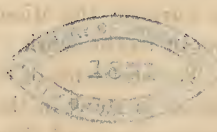

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The Advantages of Cooking Food

FOR DOMESTIC ANIMALS.

COOKED FOOD FOR STOCK.

BY E. W. STEWART, N. Y.

The increase of population is found to be in proportion to the abundant supply of food, and as nations advance in intelligence and civilization, they rely more upon animal products to support the higher brain power. The Japanese, Chinese and East Indians, subsisting mostly upon vegetables, owe much of their physical and mental inferiority to the want of animal food.

Those nations possessing a restless energy, who seek the ends of the earth for enterprise, excel in art, science, philosophy and mental vigor, have been associated from the earliest times, as sung by their sweetest pastoral poets, with flocks and herds. The great Jupiter of the Greeks and Romans were often typified by a magnificent white bull.

And when we come down to our own day, uhder the broad banner of universal liberty and free enterprise, running its iron track across a continent in a few months—even now, nothing excites greater admiration than the splendid proportions of the Short Horn, or the rotund, juicy fulness of the Bakewell and Cotswold. The rearing and feeding of domestic animals has been the leading feature of Agriculture with the foremost nations of the earth. The expenditure of labor and material is greater in this than in any other department, or perhaps, than in all other departments of farm industry.

The number of neat cattle of all descriptions in the United States, is, probably, not less than 22,000,000, of horses 5,800,000, of mules 860,000, of sheep 40,000,000, of hogs 25,000,000; and all these mouths are to be fed. What a field for economy is presented here! If science can aid agriculture in any department, surely this is the field to try its powers. True science is knowledge founded upon experiments; and in our discussion of the topic at the head of this essay, we shall deal more with facts than theory.

PHILOSOPHY OF COOKING FOOD.

Perhaps the first inquiry of the farmer will be, why should food be cooked? Nature does not cook food for animals. This is a pertinent question, and we will do our best to solve it. Nature furnishes the food for herbiverous animals in a green, succulent and soluble state, easily masticated and digested. Prof. Wolff found by analysis, that green clover, calculated dry, has but 25 per cent. of crude fiber, while the same dried into hay has 43 per cent. This shows why hay requires different treatment from grass. But the question returns, WHAT EFFECT DOES HEAT HAVE UPON FOOD?

To illustrate first, with human food: every housewife knows that starch will not dissolve in cold water. Payen mixed starch with water, heating it to 140° F., on a microscopic examination found that some of the smaller grains had absorbed water and burst, but many still remained unaffected and only burst between 162° and 212° F.

Pereira says: "to render starchy substances digestible they require to be cooked in order to break or crack the grains." "Starch," says Raspail, "is not actually nutritive to man until it has been boiled or cooked. The heat of the stomach is not sufficient to burst all the grains of the feculent mass."

Brocconot observes, "that the potatoes employed for feeding cattle should be boiled, as a considerable quantity of alimentary matter is lost by the use of these tubers in a raw state."

Johnston, in his Ag. Chem., says: "when wheat flour is heated to a temperature not exceeding 300° F., it slowly changes, acquires a yellow or brownish tint, according to the temperature employed, and becomes entirely soluble in cold water. Thus one result of baking bread is to render flour-starch more soluble and therefore more easily digested."

These statements of scientific men show clearly the effect of heat upon all our cereal grains and upon root tubers; and the result of practical experiments in cooking these kinds of food for animals fully demonstrate their correctness. Feeding experiments with grain show from 50 to 125 per cent. gain in cooking.

WOODY-FIBER—DOES HEAT AFFECT IT?

It was formerly supposed that the woody-fiber (cellulose) of hay, straw and coarse fodder, was indigestible, and, of course, not nutritious. But this opinion is fast giving way to well ascertained facts, proving the contrary. All settlers in a new wooded country know that animals, when driven to the necessity, can live on the twigs of fallen trees. These twigs are tender, and can be partially reduced by mastication, and thus furnish food to that extent for the animal. We are also familiar with the fact that worms live and grow fat in the bodies of trees, consuming the woody fiber. This is conclusive in establishing the nutritious quality of the hardest wood fiber. And if woody-fiber be nutritious, how can we avail ourselves of its nutrition? Let us see what experiments have been made upon the most unyielding woody substances.

Pereira says: "when woody fiber is comminuted and reduced by artificial processes, it is said to form a substance analogous to the amylaceous (starchy) principle and to be highly nutritious."

Schubler experimented upon sawdust from solid wood, and says: "when wood is deprived of everything soluble, subjected to the heat of an oven, then ground in the manner of corn, it yields a flour, which when boiled with water forms a jelly like wheat starch, and when fermented with leaven, makes a perfectly uniform and spongy bread." Prof. Johnston, speaking of these experiments, says; "woody fiber may be changed into starch thus by the unaided action of heat, and the starch thus produced changed first into gum, then into grape sugar, by the action of dilute sulphuric acid, assisted by a moderate heat."

Tomlinson, in his Cyclopedia, asserts that, "in Sweden and Norway, sawdust is sometimes converted into bread; for which purpose beech, or some wood that does not contain turpentine, is repeatedly macerated or boiled in water to remove soluble matter, and is then heated several times in an oven and ground; in this state it is said to have the smell and taste of corn flour. It has a yellowish color, and ferments on the addition of leaven. When well baked it makes a uniform and spongy bread. By boiling wood flour in water a thick nutritious jelly is formed, like that made from wheat starch."

These facts are quite consistent with chemistry: for cellulose (woody fiber) is chemically identical with starch, and nearly 60 per cent. of our cereal grains is composed of starch, while nearly an equal per centage of hay, straw and coarse fodder is composed of cellulose; and these experiments show that *heat is the agent to convert woody fiber into starch, and thus make it digestible.*

Some interesting experiments were made by two German chemists (Stockhardt and Susdorf) in 1859, in feeding sheep, to determine whether cellulose (woody fiber) could be digested by that animal. They fed two wethers five and six years old, first upon hay alone; second, upon hay and rye straw; third upon hay, and sawdust of poplar wood (and to induce the sheep to eat it, mixed a little bran and salt); fourth, hay and pine sawdust with a little bran and salt; fifth, hay, pulp of linen rags (from the paper maker, this had been steamed) and bran. The animals with their food, drink and egesta were weighed each day. The amount of woody fiber in the wood was accurately determined, and also the amount in the egesta, and the difference between the two amounts of woody fiber represented the amount of woody fiber digested and assimilated by the animals. They found 60 to 70 per cent. of the cellulose of hay, 40 to 60 of straw, 40 to 50 of sawdust of poplar wood, 30 to 40 of pine saw dust, and 80 per cent. of the cellulose of paper pulp was digested. It will be seen that a larger per cent. of the pulp of linen rags was digested than of hay. This was, no doubt, owing to the heat applied; for the fiber of linen is, certainly, tougher than that of hay. The heat of the animal stomach, together with the aid of the gastric juice, is sufficient to appropriate a portion of the dry grains and woody fiber used as food, but there can be no doubt a large per centage is wasted for want of a higher degree of heat.

HEAT IS THE GREAT SOLVENT.

And as the composition of cellulose is identical with that of starch, it must have an equal nutritive power to starch, when in a digestible condition; and thus science shows how this dry and woody fiber may be reconverted into grass or soluble food by the application of heat. And we trust the day is not far distant when millions of dollars will be realized annually by our farmers in meat, milk and wool, from what is now wasted as refuse.

PRACTICAL RESULTS OF COOKING FOOD FOR STOCK.

Having given some of the principal reasons for cooking food, we will now proceed to give various experiments showing its application in practice. We began cooking some thirteen years ago, cautiously at first, with a poor apparatus, but soon discovered that it was a real improvement, and necessary to thrift in feeding stock.

One of the first discoveries made was its remarkable effect upon musty hay, straw and corn stalks, rendering them sweet and palatable. The transformation was so great that hay which animals would not touch, unless starved, was greedily eaten after being cooked.

Peas and beans are readily eaten by horses and other stock when steamed, as also pea and bean straw, which are usually wasted.

MIXING FOODS.

This effect of steam in renewing the flavor of damaged food, suggested the propriety of mixing foods of different qualities and thus produce a proper balance in their constituents: good hay with straw, good hay and poor hay, sweet corn fodder with straw, carrots, turnips, beets, sliced with straw, oil and pea meal with straw, poor hay or corn stalks, blending their qualities altogether by the diffusive power of steam. Thus food, poor in muscle-forming matter, would be supplied with that element and the proper food constituents equalized. This will also effect another important object in feeding, a variety and change of food. Animals thrive much better with a frequent change of food or a mixing of different kinds, as a common diet.

It will readily be seen how, on this plan, all the straw and coarse fodder raised on the farm may be economically and profitably used; and in no other way can different foods be thoroughly incorporated and blended with each other. What a grand step in advance will it be when the millions of tons of straw raised in the grain-growing regions of the United States, shall all be converted into milk, meat and wool to feed and clothe mankind.

QUANTITY OF FOOD FOR A COW.

When experimenting to determine whether there is any saving, and how much, in cooking food, I took the cow as the best animal on which to test it. Having two cows, six and seven years old,

hearty and vigorous, calving in January, I commenced by feeding each ten pounds of hay, one and a half pounds of oil meal, same of pea meal, and three pounds of bran, all steamed together, per day. Upon this sixteen pounds of food each cow gave four gallons of milk per day, and made eight pounds of butter per week. This result was surprising to me; but in order to test the effect of cooking, they were fed two weeks upon the same quantity and quality of uncooked food, and on the second week tested for butter, and it had fallen under five pounds. The uncooked food was then increased in the same proportions to twenty-four pounds, and the product of the butter was eight pounds per week.

They were then put upon cooked food again, and the oil, pea meal and bran increased to eight, making eighteen pounds of cooked food per day; and on the second week twenty pounds of butter were made, showing that the two pounds of additional food per day had increased the yield of butter two pounds per week. Afterwards, on still further increasing the food, the product was not materially increased, showing that in this case the profitable limit had been reached. Every feeder should make it a point to study the appetite and capacity of his cows or growing animals, and feed all that they will eat with a good appetite. The profit always comes from the extra food. A moment's reflection will convince one of the folly of expecting a profit from scanty feeding. Take a steer that weighs 800 pounds in the fall, and is kept so short that he comes out in the spring weighing the same, can any one figure a profit on such feeding? Is not all this food a total loss, except the manure thus made? And yet thousands thus winter their animals! All the food given beyond this would have been profit.

The above experiments, and others similar, were the foundations of my oft repeated statements, that *cooking saves one-third of the food.*

Perhaps a few words are necessary in explanation of the particular combination of food given to these cows in milk. The production of milk requires a food rich in casein or vegetable albumen, oil and phosphate of lime. The pea, oil meal and bran are each rich in one or all of these ingredients. The cow, when in a flow of milk, requires a large supply of muscle-forming and bone-building elements, in order to keep up her own system and furnish these elements to the milk.

EXPERIMENTS OF OTHERS IN COOKING FOR COWS.

Having advised in the setting up of much new apparatus for cooking food for all kinds of stock, and observed the results of many experiments by others, we shall give some of the most important of these under each appropriate head of this essay in confirmation of our experiments and conclusions.

Mr. Geo. A. Moore, of New York, says:—"I experimented with sixty-four cows. Used one of Prindle's Steamers. Steamed a quantity of musty hay. They would eat it entirely up, and seemed better satisfied with it than the sweetest unsteamed hay. Steamed food does not constipate the animal—the hair looks better. Steamed

food increased the milk one-third, and the cows do better when put out to grass. I think cutting and steaming insure a gain to the feeder of at least 33 per cent." *Discussion N. Y. State Fair, 1864.*

Mr. B. A. Avery, New York, writes me of his experiment of 1867–8 :—"Have a steam box in the basement of the barn, holding 400 bushels. I put two pounds of pea meal on a bushel of hay, and have fed from sixty to eighty cows. Milked daily fifty of them, and out of the lot have sold twelve of the oldest (after milking them every day) to the butchers. I think I have saved $10 per head on keeping, say $600 on the stock fed, besides having the milk cows in much better condition than ever before in April.

He writes me again in April, 1869, and after making a statement of his second year's experience, in which he says he fed with cut hay and straw 2½ pounds of pea meal, one pound of bran and 6½ quarts of brewer's grains to each cow per day, all steamed together, he sums up as follows:—"This, you see, gives me a clear profit of $537.26 on four and a half months feed; besides, all the waste of this lot of cows is greedily pieked up from among the manure by a lot of colts that are as fat now as when they left the pasture last fall—a thing I have not had happen before—horses cleaning up after cows. In fact, I should as soon think of giving up the mowing machine and horse rake, and cutting the hay for this lot of stock by hand, as of wintering them on uncooked food."

Dewey and Stewart, of Michigan, after one winter's trial in cooking, write me :—"We have fed sixty-four head of cattle, seven horses and 340 sheep—fattening twenty-two head of the cattle and seventy sheep. We used two pounds of bran to the bushel of straw, which made it better than hay. A small quantity of meal was fed to the fattening stock. We think we have saved one-third of the expense in wintering this stock."

Mr. T. C. Eastman, a cattle broker of New York, who has a farm in Dutchess County, N. Y., and frequently feeds a large number of cows and other cattle, writes me :—"There is no doubt of the advantage of steaming food for cows in milk, and for fattening any kind of stock."

Mr. A. W. Knapp, of Dutchess County, N. Y., has cooked for twenty-five cows, and says :—"The results are that my stock improved, my quantity of milk increased about one quarter as near as I can estimate it, and I did not use more than three-quarters of the amount of hay when cooked that I did when dry. I cooked my meal with the hay. I am thoroughly convinced of the great advantages of cooking, and I propose next season to cook for fifty head."

Prof. Horsfall, of England, has practiced mixing a special food for milch cows, to produce a large yield of milk of good quality, and to keep up the flesh of the cow in a full flow of milk. He says: "My food for milch cows, after having undergone various modifications, has, for two seasons, consisted of rape cake, five pounds, and bran two pounds for each cow, mixed with a sufficient quantity of bean straw, oat straw and shells of oats, in equal proportions, to supply them three times a day as much as they will eat, the whole of the materials moistened and blended together, and after being

steamed are given to the animals in a warm state. The cows also get from one to two pounds of bean meal in proportion to the yield of milk.

Bean straw uncooked is dry and unpalatable; by the process of steaming it becomes soft, pulpy, and emits an agreeable odor. It is rich in albuminous matter, which is especially valuable for milch cows. Bran undergoes a great improvement in its flavor by steaming. Rape cake is rich in albumen, phosphate and oil. I have cooked or steamed food for several years, and my experience of its benefits is such that, if I were deprived of it, I could not continue to feed with satisfaction.

EXPERIMENTS WITH HAY, STRAW AND BRAN.

Careful experiments made by me prove that sixteen pounds of hay steamed, are equal to twenty-four pounds of the same hay uncooked. The test was in feeding five head of cattle one way, and five the other, for two weeks, showing those upon the sixteen pounds cooked to do the best. I reversed it and fed each upon the other's food, and found still those upon the steamed hay to do the best. Half hay and half good oat, barley or wheat straw, well steamed, was found better than hay uncooked. After several comparative trials I found that good oat, barley or wheat straw, with two quarts of wheat bran or coarse middlings to the bushel of straw, well steamed, was quite equal to the same weight of good hay; and on this plan have wintered horses and cattle always with satisfaction.

As a practical illustration of this way of feeding—several years ago, when keeping a stock that would consume thirty tons of hay, I sold seven tons of hay, and purchased with the avails seven tons of middlings and used upon straw, the stock wintering in fine condition. The straw was thus turned into twenty-three tons of hay, worth $18 per ton in barn, or $414. It will be seen by the testimony of Dewey and Stewart, under another head, that they found on a trial the past winter, two pounds of bran on a bushel of straw to make it better than hay.

EFFECT UPON WORKING ANIMALS.

Some who approve of cooking food for fattening animals, still doubt its use for working animals, but when thoroughly tested it will be found as valuable for working horses as those not in use. The food is more easily masticated and digested, and gives the horse all the time necessary to eat his food in the intervals of labor. Certainly, rendering food more digestible should not make it more unhealthy. Cooked food is more laxative than uncooked, as green grass is more laxative than hay, but a proper mixture of food will correct all relaxing tendency. I have had an opportunity of thoroughly testing the healthfulness of cooked food for working horses; five horses having been fed, from eight to twelve years each, every winter upon steamed food, have always been healthy except when badly used. Two of them have been driven upon the road many years with heavy loads to and from the city, fifteen miles, and

sometimes misused by careless drivers. and taken sudden colds, which have always been cured in a few days upon cooked food. These horses are eighteen and nineteen years old, and still sound, and capable of doing a good day's work.

COOKED FOOD WILL CURE INCIPIENT HEAVES AND TROUBLESOME COUGHS MORE EFFECTUALLY THAN ANY OTHER REMEDY.

Some years ago we purchased a horse eight years old, having the heaves, which were entirely cured by the use of steamed food, and have not since reappeared. We believe the general use of steamed food for horses would double their working ages.

YOUNG ANIMALS.

We have seen it objected that animals raised upon cooked food would be more flabby, having frames less thoroughly knit together, wanting in the requisite stamina, &c. Do such persons believe that grass is the best food for young animals in summer? Would they object to grass as the diet of the young animal through the winter, if it could be provided? If not, why should they object to cooked hay? This is only the nearest approximation to grass possible in the winter. Instead of being unnatural, it is all in accordance with the suggestions of nature. I have raised many colts from weaning age to five years, and never discovered any want of stamina. They are uniformly larger and stronger at the same age, because they thrive equally in winter as in summer.

This system is admirably adapted to the raising of young stock of all descriptions. The dairyman may have his heifers large and strong enough for cows at two years old, and thereby save a year's time and the labor of an extra year's care. Besides, it is found advantageous to develop the milking qualities of the heifer early. If of sufficient growth, she will be likely to make a better cow coming in at two than three years.

SHEEP.

It has sometimes been asserted that sheep possess such an excellent grinding apparatus, that cutting or cooking the food for sheep is quite useless; but there is probably no greater mistake than this. We tested this thoroughly the past winter, and found that instead of sheep being inclined to grind hard, tough substances more readily than neat stock, cutting and cooking hay, straw and cornstalks had a higher value for sheep. On feeding sixty sheep fifty pounds of excellent hay uncut, twelve pounds or twenty-five per cent. was left, and on feeding them fifty pounds of the same, cut $\frac{1}{8}$ inch, it was all eaten except some long pieces which passed through the machine parallel with the knives. Sixty-five per cent. of straw, fed uncut, was left; while straw cut quarter inch, with two quarts of bran to the bushel, well steamed, was all eaten except the long pieces of straw. Cornstalks, cut short and steamed, will

be eaten clean, buts and all, by sheep, when they will eat nothing but the tops and leaves, without cutting. In fact, there is no animal which will pay more liberally for thoroughly cooking its food than the sheep.

Mr. G. A. Moore, before quoted, says:—"I was feeding sheep and cutting for them timothy hay, millet, carrots, and feeding with bean and oat meal. Before steaming, I found by weighing I was putting on two pounds of flesh per week: After steaming I put on three pounds per week, and the stock ate the food cleaner, and I noticed they laid down quietly after feeding."

EFFECT OF COOKING UPON CORN MEAL.

When fattening a lot of twenty steers (all of the same weight, 1100 pounds), I tried the effect of cooking upon corn meal. Commenced feeding each ten, three bushels of uncooked meal per day, with steamed hay and straw. This was readily eaten. Then a bushel and a half of meal was made into a thin pudding, and while briskly boiling, six bushels of short cut hay were stirred in, and all well boiled together. This was fed each day to ten of the steers, while the other ten were still fed upon three bushels of uncooked meal.

This bushel and a half of cooked meal appeared to satisfy the ten steers as well as the three bushels of uncooked. Each ten were thus fed till disposed of to the butcher, nearly four months, and the butcher pronounced the ten fed upon cooked meal the best. This would appear to prove that meal is doubled in value by cooking.

FATTENING HOGS.

Experiments in feeding hogs on cooked and uncooked grain have often shown a gain of one hundred per cent. by cooking, as in the above experiment with the steers. We will refer to a few of these experiments.

Hon. Geo. Geddes, of Syracuse, N. Y., says:—"I find if I take ten bushels of meal and wet it in cold water and feed twenty-five hogs with it, they eat it well; but if I take the same and cook it, it will take the same number of hogs twice as long to eat it up, and I think they fatten quite as fast in the same length of time."

An accurate experiment detailed by S. H. Clay, of Ky., shows that a bushel of raw corn makes six pounds of pork, while a bushel of cooked meal makes seventeen and a half pounds. This result is very remarkable; but James Buckingham, in the *Prairie Farmer*, gives an experiment, where three and a half bushels of corn in the ear made nineteen pounds of pork, and one bushel of cooked meal twenty-two pounds.

Thomas J. Edge, lately, in *Practical Farmer*, detailing an experiment, says:—"I found that five bushels of whole corn made 47¾ lbs. of pork. The same amount of meal well boiled and fed cold, made 83¾ lbs. of pork.

FATTENING CATTLE—SWEET FOODS.

In fattening animals *time* is often a matter of importance to the feeder. Sometimes a month gained is equal to 20 per cent. greater weight at a later period. Cooking food renders its constituents more soluble and digestible, therefore more rapidly entering into the circulation, and causing much greater progress in laying on flesh and fat. As a condiment and appetizer for fattening animals, *molasses has no equal.* A small quantity of sweet, used upon hay, will cause a larger quantity to be eaten with a relish. We have often tried molasses upon poor animals with great satisfaction. A poor horse will show a change in condition in a few days. The molasses is not only an excellent condiment, but an excellent food; and being so soluble and assimilable that it produces an immediate effect upon the condition of the animal. Three pints may be fed to fattening animals per day, but to cows and breeding stock it must be fed sparingly, not more than a pint per day to a cow, as too much sweet will prevent their breeding. When necessary to use straw for fattening stock, the use of molasses diluted with eight to ten proportions of water, to wet the straw before steaming, will be found to render it very palatable, and cause it to be eaten, incorporated with other fattening food, as readily as hay. Some noted chemists have supposed all starchy food to be converted into sugar by the action of the stomach, before it becomes assimilated as food. Perhaps this will account for the remarkable effects of sweet food upon animals.

FERMENTING FOOD.

The merits of fermenting the food for animals have frequently been mentioned with commendation.

But having practiced this system to some extent, and compared it with cooking, I will discuss it in this connection. In my early and defective attempts at cooking, when the food was only partially steamed, it was found to ferment most rapidly.

After twenty-four to thirty-six hours, it was found difficult to induce animals to eat it. A slight fermentation is, perhaps, better than no preparation, as it partially softens the food, but it passes so rapidly beyond the proper point, that the system cannot be recommended.

If we examine the nature of fermentation, we shall see that the result upon the food is entirely different from cooking.

The different stages are:—1st. Saccharine fermentation, changing starch or gum into sugar; 2d. Vinous, changing sugar into alcohol; 3d. Acetous, converting alcohol into vinegar: 4th. Putrid fermentation.

These are steps in the progress of fermentation, and each denotes a further change or decomposition of the material fermented.

Nitrogen must be present to induce fermentation. There must be some nitrogenous matter in the food to act as a ferment when exposed to moisture and heat. Liebig says;—"We may compare fermentation and putrefaction with the decomposition which organic

compounds suffer under a high temperature. Fermentation may be considered as a process of combustion."

During the fermentation of gluten, albumen, caseine, fibrin and other nitrogenous compounds, they are decomposed and various gasses formed in their stead; so they cease to be valuable as food. If hay and straw be moistened with warm water, the nitrogenized matter they contain will cause fermentation to begin, and so far as it proceeds decomposition will follow. If carbonic acid is formed by the fermentation of hay, for example, so much of the heat producing element is gone; and as this is promoted by its gluten, it must have lost in muscle forming matter. This loss will, therefore, be in proportion to the fermentation.

The effect of a high heat is just the opposite.

Nitrogenized substances, when subjected to the heat of boiling water, lose their power, temporarily, of exciting fermentation in other substances, and thus it is found that fermentation, which proceeds most favorably from 68° to 70°, is arrested at once, if the heat is raised to 212° Fahr.

Every cook knows that fermentation of fruit is stopped by boiling, and rendered sweet again..

Steaming is therefore *preservation*, while fermentation is *decay or destruction.*

STEAMING A REMEDY FOR CRYPTOGAMIC DISEASES.

Farmers have often debated whether mildew, rust, smut, and other diseases of wheat, grass, corn, &c., did not render these unhealthful food for stock; and since the Texas cattle disease has been attributed to the spores of a "species of fungous parasite" (*micrococcus*), which has been demonstrated to "infest the blood and bile of infected cattle;" and that this parasite is probably communicated from the indigenous herbage of Texas, (E. Harris' Report), much more anxiety has been manifested on this subject. But whatever danger there may be from cattle eating grasses, or other vegetation infested with this parasitic fungi, cooking offers a complete remedy. We have, for many years, noticed the effect of steaming upon rusty hay, straw and corn fodder. The transformation is complete. The odor is changed, and this change is at once appreciated by the animals to which it is fed. It is well known that cattle do not willingly eat hay or straw thus affected, and are only prevailed upon to do so by hunger; but after cooking, the smell is so changed that they eat it with an appetite. This consideration of health alone would be a sufficient remuneration for steaming the straw in a grain region.

EFFECT OF FOUL SEEDS AND MANURE.

Another important consideration is found in the destruction of the seed mingled in hay or straw, and which if fed in the ordinary way, and spread over the farm in the manure, will grow and increase the evil; but the vitality of all these will be destroyed by cooking, and thus will it contribute to clean farms. The manure is also more

valuable, because more readily decomposed, and is always short and easily spread. Some have estimated the manure from cooked food twenty per cent. higher.

COST OF COOKING.

Next, let us see what it costs to cook food for stock, that we may better determine whether it pays.

When cooking for forty-eight head of cattle and six horses, I found that it took two men and a boy, on the average, two and a half hours per day to cut, mix and steam the food for them. I found that the labor, including the feeding, was equal to ten hours per day for one man. After the food is cooked, the labor of feeding is less than in the ordinary way. I found the extra expense of labor over common feeding, $60. It took ten cords of two feet, or five cords of four feet hemlock wood, to steam for the season, worth about $20, to which add the labor, makes the whole extra expense $80. The amount saved could not have been less than $10 per head, or $540. The saving in amount of food alone would equal this, besides being able to use much coarse fodder, and the better condition of the animals.

PREPARING FOOD FOR COOKING.

Hay, straw or coarse fodder should first be cut and then moistened with a large watering pot (if done by hand) at the rate of at least three gallons of water to five bushels of feed, while it is being stirred up with a fork; then, if bran meal, or other more concentrated food is to be fed with it, it should be sifted on evenly and mixed. A little salt may be added, which will be perfectly diffused through the mass.

THE FEED MUST ALWAYS BE MOISTENED BEFORE STEAMING,

for steam will not cook dry hay or straw; moisture is required to absorb the steam. Many failures have occurred from attempting to steam hay dry. Where the labor is done by hand, a square six bushel basket will be found the most convenient for handling the cut feed and filling the steam box. The feed should be pressed into the steam box as more will be steamed and better.

FOR A LARGE STOCK.

Much labor may be saved by having the cows or animals arranged in the lower story, in two rows, with their heads toward the feeding floor, which should be twelve feet wide, including the mangers; and the steam box placed on the feeding floor, directly under the floor above, on which the straw cutter should stand, over the steam box, provided with a feeding apron, to save the labor of one man in feeding the hay or straw to the machine. Then in a hole through the floor, directly over the steam box, there will be placed a straight cask or cylinder, two feet in diameter, reaching

from top of floor down to near the opening in the steam box without a bottom, but a bar across the lower end, on which an upright revolving shaft will be set in the centre, provided with six arms just long enough to turn inside. This shaft will pass through a like cross bar on top and extending above enough to receive a pulley of the proper size, to revolve it about four hundred times per minute. A bin over head for meal or bran, with a spout leading to the top of the cylinder, as also a cask or reservoir of water, with a pipe leading to it, furnished with a stop cock. A small belt will be carried from the power to the pulley on the top of this shaft.

Now, when ready to fill the steam box, the straw cutter will be set in motion, as likewise the shaft in the cylinder, and discharge a certain amount of cut feed directly into the cylinder for mixing, and the meal or bran can be properly proportioned to the hay as cut, and the water likewise. It will be seen that the feed and meal and water, in passing through the cylinder, will come in contact with these swift moving arms, and, thoroughly mixed, fall into the steam box ready for steaming. Thus, one man, with this apparatus, driven by a good two horse power, can perform the whole operation alone, which would require three or more to do in the ordinary way.

THE STEAM BOX.

Should be made in the form of a round tub, tapering four inches at top, of inch and a half staves and two inch heads, hooped with six heavy bands or hoops; and, in the arrangement we have supposed, there should be two steam boxes, each of which would hold a day's feed for the stock, or a capacity of two and one half bushels for each cow or grown animal, in which case the steaming would be done every other day. A wooden track should be laid in the centre of the feeding floor on which to run the steam boxes. One would be run under the cylinder and filled, and then moved away for use, while the other could be run under, filled and steamed. The man-hole in the upper head of the steam box should be two and one-half by three and one-half feet, where the tub is seven or more feet in diameter. This trap should be made as tight as possible, so as to hold steam. The cover need be only inch and a quarter stuff, and there is no danger of bursting, however tight you fasten it, as it will leak steam under a small pressure. Or a strong cask may be made with two heads—slight bilge in centre, with trunions on each head, upon which to revolve it; introducing the steam pipe through the trunion. This form of box could be made eight feet long and eight feet in diameter, and hold, when well rammed in, about 400 bushels. The man-hole would be at the bilge, revolved up to be filled, and down to be emptied. The man-hole should be surrounded by a strong frame, with hooks at each corner through which to run two bars over the cover; wedges to be driven between the bars and the cover to hold it down firmly.

There is an *economy in using the best straw cutter*, for rapidity and perfection of cutting is a necessity in saving labor. The first

requisite of a good straw cutter is a perfect feeding arrangement, delivering the hay or straw with exact regularity to the knives, which should be four, upon a revolving cylinder, having several different sized gears, to enable the operator to cut long or short, as the nature of the feed requires. With everything arranged in the most convenient manner to be performed as much as possible by power, one man may cut and steam for and feed one hundred head of cattle.

CONCLUSION.

These are the general considerations that have led us to regard cooking food for stock as the most important improvement for the stock feeder to introduce.

The winter feeding is usually regarded as much the more expensive, and any system which will reduce the expense of this one-third, should be eagerly adopted by the intelligent farmer.

We have endeavored to illustrate it in so many aspects, that but few questions will arise which are not here considered. And, although the subject is not exhausted, yet we hope it may be a sufficient guide for those who have had no experience, and that it may be the means of calling the attention of hundreds to this great economy in stock feeding.

That we may have some slight conception of the saving this system would make, if universally adopted, let us suppose that it would save $3 on keeping each of the neat cattle, or $66,000,000; $5 upon each horse and mule, or $33,700,000; $2 upon each hog, or $50,000,000; and $0.50 upon each sheep, or $20,000,000; making in all $169,700,000 as the saving for a single year, and we believe this is not one half of the real economy that would result on its general adoption by the farmers of the United States. Is not this consideration vast enough to interest the millions of farmers?

COOKING AND FEEDING COOKED FOOD TO STOCK.

BY W. H. WHITE, OF CONNECTICUT.

Cooking food for feeding to stock is little understood and less practiced. The natural food and sustenance of our domestic animals of the farm is undoubtedly green herbage. After this is masticated and taken into the stomach, it is there readily dissolved by its juices with the digestive process, and assimilated into the system, thus supporting and contributing to the development of the animal, and the other objects in view. But as this green food is not to be obtained at all seasons in all places, it devolves upon man to provide a substitute of as near the same nature as possible, for consumption during this period; and in order to insure the keeping of this material without decomposition, it is necessary that it should undergo certain processes of curing and drying.

This process changes the character of the food to a hard, woody fibre, and the object of cooking is to restore the food as near as possible to its natural state, as well as soften the grain and render the extract of the nutriment less laborious. All food taken into the stomach of an animal must go through a process analogous to cooking, and then a rther process before it can be assimilated into the system. If the cooking is performed before feeding, the food is much more readily assimilated, taxing the powers of the animal less in that direction, and giving an opportunity for directing its energies to the development of other desirable points.

A considerable portion of the nutritive matter of the food of animals is starch. Chemists inform us that starch is not actually nutritive until it has been boiled, and the minute particles or grains burst or broken by the action of heat.

The different lamina or layers of which each grain or part of a plant consists, increase in cohesion from the centre outwards. While the innermost layers present but little resistance to the digestive powers, the outer layers are hard to overcome. A considerable portion of uncooked food passes through the intestines whole, and entirely unaffected, even in its vitality; and chemists, on examining the excrements of hot blooded animals fed on raw food, find unbroken grains of starch, showing that much alimentary matter is wasted and lost. There is also danger of accidents in feeding uncooked roots, tubers, &c.

The food an animal takes into its stomach must serve a variety of purposes, depending upon the object in feeding, or the end to be

obtained. In our vegetable products there exist substances more or less analogous to the several kinds of fat of the bodies of animals, so there also exist, ready formed, the phosphate of lime, phosphate of magnesia, common salt—of these the bone and muscles are largely composed. These are also associated with gluten, albumen and casein, all of which the food contains.

Johnston, in his Agricultural Chemistry, in speaking of the action of heat on woody fibre, says:—"If wood be reduced to the state of fine sawdust, then boiled in water to separate everything soluble, afterwards dried by a gentle heat, and then heated several times in a baker's oven, it will become hard and crisp, and may be ground in a mill into fine meal. The powder thus obtained is slightly yellow in color, has a taste and smell similar to the flour of wheat; it ferments when made into paste with yeast or leaven, and when baked gives a light homogeneous bread. Boiled with water it yields a stiff tremulous jelly, like that from starch. BY THE AGENCY OF HEAT, THEREFORE, IT APPEARS THAT THE WOODY FIBRE MAY BE CHANGED INTO STARCH."

And, in speaking of the action of heat on starch, he says:—"When flour, potato or arrowroot starch is spread out on a tray, then introduced into an oven and gradually heated to a temperature not exceeding 300° F., it slowly changes, acquires a yellowish or brownish tint according to the temperature employed, and becomes entirely soluble in cold water. *It is changed into gum.* During the baking of bread this conversion of starch into gum takes place to a considerable extent. Thus Vogel found that flour which contained no gum gave, when baked, a bread of which 18 per cent., or nearly one-fifth of the whole weight, consisted of gum. Thus one of the effects of baking is to render the flour starch more soluble, and, therefore, more easily digested."

It is a property of starch to "readily dissolve in boiling water, and thicken into jelly or paste as it cools, but is insoluble in cold water. In the act of digestion starch undergoes the changes indicated above into gum or sugar, the latter being, as supposed by some, absorbed. The starch and sugar of the food of herbiverous animals is what supports respiration, and according to the theory of some eminent chemists contributes to the formation of the fat of animals.

For the purpose of showing the proximate value of some of the principal articles of food fed to stock, I here introduce tables from Morton's Cyclopedia of Agriculture:

AVERAGE COMPOSITION OF WHEAT STRAW.

Muscle producing substances,.....	2.05
Heat producing substances,.....	35.06
Wood fibre,.....	56.87
Mineral substances,.....	6.02
	100.00

CULTIVATED GRASSES, DRIED AT 212° F.—Way.

Flesh forming principles,	10.34
Fat-producing "	2.51
Heat producing "	41.29
Woody fibre,	37.18
Ash,	8.68
	100.00

CORN FODDER AND BEAN STRAW.

	Salesbury. Corn Fodder.	Way. Bean Straw.
Flesh forming matters,	8.200	16.38
Heat and fat producing matters,	35.273	33.86
Wood fibre,	50.251	25.84
Ash,		9.45
Water,	6.276	14.47
	100.000	100.00

INDIAN CORN AND WHEAT BRAN.—Salesbury.

	I. Corn.	W. Bran.
Flesh forming principles,	15.192	18.00
Heat producing "	78.866	63.00
Fat producing "	5.945	6.00
Water,		13.00
	100.000	100.00

OATS AND RYE.

	Emmons Oats.	Johnson. Rye.
Flesh forming principles,	18.477	16.00
Heat producing "	73.376	69.00
Fat producing "	8.179	
Soluble phosphates,		3.06
Water,		11.04
	100.000	100.00

BARLEY.—Johnson.

Flesh forming principles,	6.1
Heat and fat producing principles,	69.3
Husk,	13.8
Water,	10.8
	100.00

BEANS AND PEAS.

	Peas.	Beans.
Husk,	8.3	7.0
Legumen and albumen,	26.4	23.6
Starch,	43.6	43.0
Sugar,	2.0	0.2
Gum, &c.,	4.0	1.5
Oil and fat,	1.2	0.7
Salts, &c.,	2.0	1.0
Water,	12.5	23.0
	100.00	100.00

These tables indicate at a glance the relative value of the different kinds of food, and need no elucidation here; but that there is a greater value, not here indicated, received from them when steamed or cooked, is the experience of those who have made the experiment; some of them of little supposed value, proving equal to the best; and a further advantage is derived in showing how to mix proper food, to best serve the object in feeding.

In order to the proper cooking of hay, stalks, straw, grain, &c., the former must be cut or chaffed, while grain must be gronnd; potaoes and roots should be washed, if fed with the dirt and soil they are too loosening.

Here steps in B, and says your theory of cooked food for stock looks very plausible, and seems well fortified with arguments, but how does it work in practice? How are we to cook the food for a large stock? And will it prove as profitable in practice as in theory? In short, can it be made practicable and economical? I answer that where experiments have been judiciously conducted, it has been found perfectly practicable, and also *pays* in the saving of feed, and the better condition and profit of the stock.

Were this fact only verified under the practice of a single individual, I should be the last one to urge its general adoption: but having been tried by numbers of individuals in different sections, and under varying circumstances, with uniform beneficial, practical, and economical results, it remains no longer a doubtful or untried experiment, nor the theory of a fanciful brain. It is applicable for either a small or large stock, requiring fixtures only of different capacities, although the comparative expense for only four or five head would be greater than for forty or fifty head.

Steam is being introduced on many farms, for performing much labor to which other power has heretofore been applied, such as threshing grain, cutting fodder, sawing wood, &c.; steam is one of the most, if not the best, practical means of cooking food; and where it is impracticable to have the stationary steam boiler and works, we are furnished, through the inventive faculty and genius of man, portable steamers and boilers, which are not only practical but economical for cooking and steaming, as well as doing much other work of a less heavy nature, with less expense than with the larger and more costly machinery. These steam generators and

boilers are being improved, so as to be more generally useful, and withal are so reasonable in price that the latter need be no serious objection, especially as the saving in feed and improvement of a stock of twenty to thirty head in a single season will cover the ex pense of the entire fixtures, and then they are good, with fair usage, for a large number of years, and will do eqnally good service. Prindle's steamer is acknowledged to stand at the head of all portable steamers, with its latest improvements, for steaming, and has been brought to such a state of perfection that it is applicable to a variety of purposes of the farm, besides the mere steaming of fodder for the stock, which is not in my province to here notice.

These steamers, or other boilers, &c., can be set in any convenient building or shed, and the steam be conveyed through suitable steam pipes any reasonable distance, to be connected with the steam boxes for holding the feed to be cooked. The great matter is to make these boxes strong enough to resist the pressure when applied sufficiently to reduce the feed to a pulp, but for ordinary purposes a two inch pine or oak plank chest, iron bound, will be found sufficiently strong. There should be two such chests, for convenience in feeding and cooking, where the object in feeding is different, or where better food is desired for one part than the other of the stock. The size is determined by the amount of stock the food is cooked for. Two chests, each of the capacity of one hundred and twenty cubic feet, is sufficient for a stock of fifty head of horned cattle and one hundred sheep and three horses. These chests should be set convenient to the stock to be fed, or boxes may be arranged on trucks and shifted, for convenience in feeding, on the same floor level. Well filled and packed, as they should be for cooking well, these chests will hold sufficient for one day's feeding. Steam every afternoon, and the feed is ready for use the next morning, and will keep sufficiently warm through the day. The chopped hay, straw, and stalks are mixed and well moistened before they are put into the steam boxes; and if meal or bran is fed, it is mixed with it, the same as for cut feed in the ordinary way. When the box is well filled, the lid is shut down, made fast, and steam let on and kept up from one and a half to two hours, at a pressure of ten to fifteen pounds. The expense of fuel for cooking this amount of fodder is about one cord of wood, or its equivalent, a week, and the wood need not be of the best quality.

A very convenient arrangement would be to have the feed and cutting machines on a floor above the steam chests, resting on the floor, supported by a lower story; the boxes, in such case, should have a side door near the bottom, besides the top cover, for convenience in taking out the feed. The boxes may rest on the floor or be raised on a firm support, as circumstances call for. Set up your steamer or boiler in a building or shed, far enough away to be safe from fire, have a chimney with screen damper to shut off sparks of fire in a windy time, high enough for a good draught.*

Conveniences would seem to be called for in providing stabling handy for feeding stock on cooked food, on a large scale. The

* If smoke pipes and chimnies are properly constructed, no more danger need be apprehended than in any stove pipe.

particular arrangements in all cases it is impossible to give, and must be made to adapt themselves to circumstances. The most we can do here is to say the steam boxes should be set, if stationary, with the stables on either side of them, and in as near a proximity as it is possible for convenience. Water should be provided for moistening the feed, being brought into the chests by conductors. Pipes with a sprinkling apparatus attached should also be provided, the fountain head being sufficiently high to furnish pressure for sprinkling, &c.

I next and lastly notice the profit and advantage of feeding cooked food to stock. In the first place, there is always found a considerable amount of fodder on every farm that returns no profit except for the manure and compost heap. This, by cooking, is rendered palatable, and furnishes no inconsiderable amount of nutriment; and in being consumed by the stock, less is lost to the manure heap than is gained by the stock. This is saved, and a less amount of storage room is required to store food for the same amount of stock, which, in these times, is no inconsiderable saving.

Two-thirds of the amount of food cooked and fed will keep stock in better condition than if the whole amount be fed raw, as is proved by experience and observation, and the testimony of those who have given it a trial. It is not the case in a single instance only, but much proof could be introduced to corroborate the same. Much more experience has been had in feeding cooked food to fattening hogs than to other neat stock of the farm.

COOKED FOOD FOR HOGS.

The almost invariable testimony in feeding hogs with corn, grain, or potatoes, is, that two bushels of cooked food make as much or more fat than three bushels fed raw.

In the *Practical Farmer* for December, 1868, "Agricola" states: —"I have demonstrated to my own satisfaction, with the use of the Prindle steamer, and careful weighing, that while five bushels of boiled mush will make 84 lbs. of pork, three bushels of meal and five bushels of potatoes will make 72½ lbs. of pork." This shows the effect of mixed food cooked. In the same paper, T. J. Edge experimented with food in three different states on five pigs, fed at different intervals of a few days each, and found that five bushels of whole corn made 47¾ lbs. of pork; five bushels (less miller's toll) ground and made into thick slop with cold water, made 54½ lbs. of pork. The same amount of meal, well boiled and fed cold, made 83½ lbs. of pork. In the *Practical Farmer*, of February, 1868, J. D. Isett says that "he formerly fed his team horses 70 lbs. of chop for each horse per week, besides the hay they would eat, and that by cooking his chop he found that his horses did better, looked better, kept in better spirits, and in every way were better, fed on 50 lbs. per week than on the larger amount uncooked, making a saving, as he claims, in eight weeks, of $57.60." He also states in the same article: "I am now feeding my cattle and horses one bushel of wheat bran a day, and thirty bushels of cut cornstalks

and chaff, hay seeds or straw, mixed with fodder, and stable them. They are all in a nice thriving condition, and improving on the feed with some straw or hay in bulk, which they care very little about. I feed the horses, which work regular, six in number, four ears of corn, with their share of the steamed food, morning and evening—making a total cost of feed, thirty bushels cut corn fodder, one bushel of bran, and forty-eight ears of corn, to thirty-two head of stock per day, which, I think, is as little as can be got through with in this cold region."

I might go on and quote from discussions at fairs, farmers' clubs, &c., from well known and eminent agriculturists, some of whom claim from experiments that two pounds of mixed cooked food fed to sheep equal three pounds of the same food fed raw. And others that one bushel of cooked meal will go twice as far fed to hogs as when wet up with cold water and not cooked. Others go still further, and claim a greater difference.

The same difference is stated as experience in cooking hay and fodder for horned stock and horses. It is unnecessary to introduce further testimony, as all give the same result.

Many fail at first in steaming dry fodder from attempting to do so without wetting it, or wetting insufficiently, which should be carefully attended to.

THE ADVANTAGES

OF

COOKED FOOD FOR DOMESTIC ANIMALS.

BY PROF. J. WILKINSON, BALTIMORE, MD.

A personal experience with, and close observation, for a period of over 40 years, of the comparative economy of feeding cooked and uncooked food to milch cows, fattening cattle, swine, horses, and poultry, has thoroughly established the conviction that there is great economy in judiciously cooking food for all the domestic animals named above.

The *horses* referred to were work horses, as I have never tested cooked food for those kept for speed or road driving, and my opinion is that uncooked food would be preferable for such. Neither have I had any experience in feeding sheep on cooked food, but believe that the return for the labor and cost in thus preparing their food, in the foddering season, will be found quite as remunerative as that realized from cooking for any other animal, and especially for ewes nursing lambs.

More than fifty years ago the father of the writer, who was an extensive farmer in Eastern N. Y., reared and fattened annually a large number of swine. His practice was, as soon as the crops were gathered in autumn, to confine the swine in close, warm pens, and from that period until they were slaughtered they were fed entirely on cooked food, consisting of sweet apples, potatoes, pumpkins, and Indian corn meal. To these was added, while hot, the slops of the kitchen and the refuse of a butter dairy of 20 to 25 cows.

Careful experiments with the same quantity and quality of food, cooked and uncooked, were repeatedly made, with the same animals, until, to use his own words, *he "was convinced that he could not afford to feed uncooked food;"* and yet, with the rude apparatus used by him, the labor and expense attending the operations of boiling and steaming (for he did both), were certainly 50 to 75 per cent. greater than with the best modern apparatus.

The valuable lessons in the economy of feeding cooked food to swine, acquired by the writer at an early age, under paternal instruction, were never forgotten, but were cherished and practiced perpetually, with the adoption of such improvements as were made

from time to time in apparatus for steaming and cooking food, not only for swine, but for all the animals that I have named.

I conducted an Agricultural School and experimental farm for eight years, and experimented with feeding cooked and uncooked food of every description used, for cows, horses, swine, working and fattening cattle, and poultry, and carefully noted the result, which was in all cases very remunerative, so much so, that even with the defective, inconvenient, and expensive apparatus, used for want of better, in steaming, manipulating, and feeding, I decided there was an average net profit of fully 20 per cent., that is, in feeding the variety of animals named; but in feeding swine for fattening, and milch cows for profit, in cold weather with warmed steamed food of every description, there was a profit of over 30 per cent., when the animals were kept at a proper temperature, and fed with proper proportions of nutritious rich food, and that less so. The advantages of steaming food for animals are numerous.

Every variety of grain, ground or unground, roots, fruit, vegetables, and forage, are rendered more palatable when animals are once accustomed to it—more nutritious, because they are more readily and more perfectly digested than uncooked food, and less liable to produce flatulency or bloating (called by the farmer *hoove* or *hoven*)—the cathartic or purgative tendency of fruits and roots is greatly diminished, and a larger quantity of food possessing qualities producing these effects, may be fed with impunity. While the qualities stated, imparted to food by steaming, are invaluable in their chemical effect, a mechanical one, produced by thoroughly steaming and macerating the most palatable and highly nutritious provender, with which, as it were, to "*sugar-coat*" less palatable and coarse forage, so that a larger proportion of it will be eaten, is no less important. The advantages arising from inducing animals to consume a liberal proportion of woody, coarse food or forage, with that which is highly nutritious, rich and hearty, are, that they are much less liable to become clogged when the food is thus mixed, than when the rich and palatable is fed separately. Ruminants are particularly benefited by feeding the macerated grain, roots, and the like, or coarse, cut and steamed forage, as they then have the power of raising and ruminating all the food thus mixed, and of extracting from it a larger proportion of the nutriment than can be effected when the various qualities of food are not incorporated. The secretions and digestion are greatly promoted by feeding a character of food that may be fed in such abundance, that the stomach and bowels of the animal shall be kept well distended. The correctness of this theory is well established, and to this mainly, the usual high condition of animals in pasturage, with no other food than grass, may be attributed their greater growth and thrift, than when fed liberally with grain, with a limited quantity of less nutritious food. The experience of the writer in feeding milch cows with steamed food, with the proportion of rich and less nutritious that he has recommended, is that he can make milk and butter, and doubtlessly the same is true in making beef and mutton, cheaper with the same animals when stall fed, than when pastured on land suitable for mowing and tillage,

and the quality of all the products will be much superior, and the additional amount of manure manufactured and saved will be an important item of profit. Steaming food properly, seems to impart to that which is dry, harsh and unpalatable, in a great degree, the succulent, palatable quality of grass, and yet not to a degree that it is injuriously laxative.

Indian corn on the cob, if properly steamed, will be eaten by both cattle and horses, and is more economical thus fed than the corn without the cob. A cow may be fed two and a half bushels or more of tart apples per diem, if they are well steamed, mashed and mixed with cut straw, hay, or stalks of corn. The yield and quality of the milk and butter will be good, and the health of the animal as perfect as when fed on any other character of food; but it will require six or eight days gradual increase to reach the maximum. The quantity of straw, hay, or stalks fed with the apples should be as great as the animal can be induced to eat. That there is great economy in steaming food for domestic animals generally, I think, is generally conceded by stock owners; but there are various reasons why steaming is not more generally practiced. The chief is the prevailing opinion with farmers that steam generators are dangerous, troublesome, and expensive, and so complicated that one unaccustomed to their use would be unable to manage them with safety and profit. Hitherto there have been just grounds on which to base such opinions; but of late, science, inventive genius, and a just appreciation of the actual demand for a cheap, safe, durable, and effective steam boiler, that any novice can run, has developed and given to the world, the farmer among others, a combined cauldron and steam generator that seems fully to meet every want in that direction. I refer to "Prindle's Patent Agricultural Steam Boiler and Furnace," which is, in the opinion of the writer, just what the farmer has so long needed; and it is so simple, yet superior in construction, and made of such various sizes, that the owner of two or fifty cows can obtain just what he requires. Its safety valve I esteem one of the most valuable inventions of the age.

I might extract innumerable reliable published statements o the result of the experience of those who have carefully experimented with cooked and uncooked food, fed to a variety of animals, acquired both in this and other countries, which not only sustains me in the correctness of the statement of my experience, but far exceed what I claim for steaming.

Could the farmer only save, by steaming the food of his animals, in the shape of the cereals usually ground, the cost of cartage to and from the mill, and the toll for and waste in grinding, it would, with many, be a heavy item; but I am satisfied that this is not more than thirty per cent. of what may be saved, if the operation is conducted as it should be.

Special care should be taken in preparing roots for steaming or boiling for ruminants, that the earth be all removed, as pebbles, and even particles of sand, are very injurious and dangerous in the stomachs of this class of animals.

It is a common practice with those who cook food for animals, to salt the mass. I have tested both methods, viz.: that of season-

ing the food, and of placing rock or other salt accessible to the animals at all times, and I much prefer the latter. Some animals relish a much greater quantity of salt than others, on the same food, and too much salt is much worse than too little.

It was my purpose in commencing this article to confine myself mainly to a faithful recital of my own experience and observation in the subject matter under consideration, and were it not that I fear that the too great length of this desultory paper will detract from its usefulness, I might add a detailed account of my mode of steaming and feeding that would interest many readers. But suffice it to say, that I confidently recommend steaming for the animals that I have named, *all grains*, *roots*, *fruits*, *vegetables and all coarse forage*, and I believe that all who will judiciously test it, will find it as I have found it, very remunerative. I beg, however, in conclusion to say, that while we now have a very perfect steam generator, we still need great improvement in the arrangement and construction of the vessels in which to steam and macerate food.

The season of working the large cheese and butter dairies of this country is rarely more than $\frac{7}{12}$ of the year, as the dependence for food is on green vegetation, and generally on the pasturing system. With a properly arranged apparatus for steaming and preparing proper food, with proper stabling, and economical and good arrangements for controlling the temperature of the stables and dairy rooms, I am perfectly satisfied that three months could be added to the season, that neither the health of the animals nor the quality of the products would be in any way impaired, and the net annual profit would be greatly augmented. With the aid of the same steam generator used for cooking the food, the desired temperature of the dairy rooms could be maintained with ease, and a more uniform temperature secured than can be effected with the natural temperature of the most favorable season.

I have furnished plans for a number of farm barns recently, in almost all of which I have made special provisions for steaming food for all the animals kept. I generally arrange them so as to obtain the water from rain water cisterns, and so place all the apparatus that it is secure from the effects of frost, and effectually guard against fire, which are important.

I also so arrange the stable that I can avail myself of the steam generator as an auxiliary to the ventilating apparatus, by the aid of which I am am enabled to effect the most perfect ventilation.

A proper supply and change of the air for animals is as important as the quality and preparation of their food.

I would respectfully ask the indulgence of the reader of this, while I add a few sentences on a very important matter in this connection.

I have known of two cases of the death of valuable cows that could be traced to no other cause than inflammation of the stomach, occasioned by swallowing pebbles and short pieces of nails, which were discovered by a post mortem examination. The pebbles were believed to have gotten into the food by setting the cornstalks fed on end in the field, and by cutting and mixing that portion of the stalk with the balance.

This should never be done, but a portion of the butts should be chopped off, and not be used as forage.

The butts are not only liable to have stones and soil in the pith, injurious to cattle, but it frequently occurs that the saccharine matter of the stalk, particularly that portion resting on the ground, absorbs water and ferments, and produces acetic acid, which is not beneficial, and tends rapidly to acidify a mass of cut and steamed food, that would otherwise keep sweet for a number of days.

The pieces of nails found in the stomachs of these animals, were probably swept up with the cut stalks on the feed room floor.

EXTRACTS FROM

A PAPER PREPARED BY H. S. COLLINS,

Collinsville, Connecticut,

FOR THE LEGISLATURE OF THAT STATE.

"In a country like New England where every farmer keeps neat stock, their management is of the first importance. On them the farm relies; without them it would be nothing. On their quality and products depend the profits, and without their manure the land would soon be worthless. As cows greatly predominate, not only in New England, but also in the middle States, their treatment should be the first care of the farmer.

Here, where our main endeavor is to secure food enough for our animals through the long winter, where a milch cow must be fed fully *two hundred days*, and, to do her justice, partially fed twenty or twenty-five more, the *question of winter management of cows is the one great problem to solve.*

In a state of nature, cattle feed only on green and succulent materials. The grasses and succulent food of summer contain abundance of moisture, ferment readily and digest easily. When we force our cattle to grind up woody matter, not easily moistened nor easily soluble, there must be a waste of force, and much must escape undigested that is of value.

Cutting and steaming reduces these dry substances to a condition more nearly approaching their natural food. It breaks up and softens the hard fibres, moistens and swells the food, greatly assists the animal in its preparation, and renders available much that would otherwise remain undigested. Take, for instance, wheat straw, thought by many only fit for litter, immense quantities of it being thrown into barn yards to be trodden into manure. We find by analysis of A. Voelcker, that one hundred parts of wheat straw contains

$1\frac{3}{4}$ parts of oil—very nutritious,
$19\frac{1}{2}$ parts of soluble in dilute acid,
$5\frac{1}{2}$ parts of organic matter soluble in water,
$1\frac{1}{8}$ parts of soluble inorganic matter,
$13\frac{1}{8}$ parts of water,
59 parts of insoluble and indigestible.

Of the five and a half parts organic matter soluble in water, one and one-fourth parts are albuminous or flesh forming material and four and one-fourth parts sugar, mucilage, &c. Now, it is not only the rich oil and the organic matter soluble in water which are available, but also that soluble in acid, for the stomachs of cattle possess this necessary acid, by which their digestive power is very largely increased.

We have then available as food in a ton of wheat straw—

35	pounds of	oil,
390	"	digestible,
26	"	albumen,
85	"	mucilage.

Let us see how far actual experiments justify this analysis. Mr. E. W. Stewart, of New York, says: 'I tried a long series of experiments to determine the quantity of middlings or meal necessary to mix with a bushel of straw to render it equivalent to the best hay. It was uniformly found that a bushel of straw with two quarts of middlings was quite equal to the same weight of *cut* hay, and was worth twenty-five per cent. more than *uncut* hay. It was also found that the animals would eat twenty-five per cent. more hay uncut than cut. The same experiment was then tried with corn meal, and one and a half pints found to make a bushel of straw equal to hay.' Mr. Skinner, of New York, made experiments on feeding in a similar way, weighing his fodder daily. He 'fed forty-four head of milch cows on steamed straw and shippings, and twenty-six head on hay not steamed.' The straw was cut and steamed with the shippings. Each cow received ten pounds of straw and eight pounds of shippings, and the expense, including labor and fuel, was twenty-nine cents per head daily. The twenty-six cows on hay cost thirty-five cents per head daily, showing a balance of six cents per day each in favor of the straw and shippings. 'Those fed on the straw were full and plump, were gaining flesh and doing better than those fed on hay.'

In Alcsuth, Hungary, similar trials were made about the year 1839, on a very large scale, resulting in a decided success. The trials were made on

208	draught oxen,	108 days—	daily profit of steaming,	$13.00
2,000	old wethers,	120 days	" "	12.50
34	stud horses,	180 days	" "	1.42

The profit on 180 days winter feeding on the above animals being $4,850, an amount quite worth saving.

Cooking largely increases the bulk of the grain, a great advantage in preparing it for feeding to cattle.

4	measures of	corn	have been increased to	13
4	"	barley	" "	10
4	"	bran	" "	14

Probably more experiments have been made in cooking food for pigs than for any other animals. These have been uniformly

successful, both in saving of materials used and in the increased production of fat. Stephens, one of the highest English authorities, says, in his *Book of the Farm:* 'It has been found by direct experiment that pigs fatten much better on cooked than on raw food. *It is only waste of time and materials, and also loss of flesh, to attempt to fatten pigs on raw food of whatever kind,* for although some kinds of food fatten better than others in the same state, yet the same sort when cooked fattens much faster and better than in a raw state.' The question simply is—what is the best sort of food to '*cook* for fattening pigs.'

Numerous experiments in this country confirm the opinion, that the saving by cooking is fully as high as thirty per cent. Indian corn, especially, should never be fed whole, particularly to horned cattle. The kernel is nearly impervious to the gastric juice, and will pass undigested. No grain is more improved by cooking, or of greater benefit in fattening; but it should be fed sparingly to milch cows, and, as a rule, only to those whose condition it is desirable to improve. It furnishes abundance of phosphate of lime, of which the bones of animals are more than half composed, and is of great value to the growing stock. The cobs of ripe corn are worthless, except as furnishing bulk, as they contain almost no nutritive matter. The bran both of wheat and rye, is one of the most valuable milk-producing foods. It is much improved by steaming, giving forth a sweet flavor and increasing largely in bulk. It is necessary, however, to cook it daily, as it readily ferments and becomes sour. When the coarser kinds are fed largely for milk—oil meal, corn meal, or some fattening food will be needed to prevent a loss of flesh. In my own neighborhood rye bran is thought more valuable than wheat, and commands a higher price, and my own experience is in its favor. It is usually of a better quality, but I see nothing in its analysis to justify this impression. In some sections rye is much infested with ergot, and I have of late years hesitated to buy the bran in market, but I have heard of no bad results from its use. Buckwheat bran is largely milk-producing, but is thought by some to be injurious to the health of cows. I have fed it for several years, and perceived no such effects, but have been always careful to use it in connection with other materials. Cows having four to six quarts of this per day will milk freely, but lose flesh more rapidly than on wheat or rye bran.

Linseed oil-cake has been long and favorably known as an article of food for cattle. It increases fat and milk, and is of great use to the farmer. More lately, cotton seed meal has been found to supply its place, being in some respects still more valuable. It is richer in oil and albuminous material, and should, therefore, be fed in less quantity than linseed meal. Some have attributed bad effects to its use—both loss of calves and injury to milch cows—but the greater weight of testimony is in its favor. Calves are easily injured by over-feeding with rich material, or by too sudden change of food. I have fed it for years, buying by the car load, and have not seen any ill effects from its use; but I prefer linseed for calves as being probably more gentle in its action, and never give either to young calves without first cooking it to a jelly, and

mixing it with other warm food, beginning with a very small quantity. The flavor of cotton seed meal is peculiar, and generally disliked by cattle at first, though they soon become fond of it. Nothing gives so glossy a coat to either old or young animals, and no cattle food has been so cheap in proportion to its real value as cotton seed meal. To milch cows two or three quarts daily may be given with marked effect, both on their condition and yield of milk, and without communicating any perceptible taste to the milk. Some feed four to six quarts per day, but my own experience is strongly in favor of variety of food, and I do not find a proportional increase from feeding largely of any one material. Oil meal is somewhat laxative in its effects, and cows calving in winter being often troubled with constipation, a feed of two to three quarts of oil meal daily for a few weeks before and after calving, will produce a better condition, give them more strength, and tend to increase the future yield of milk. Cotton seed should always be decorticated. I have never fed cotton seed meal dry, usually have steamer it. To extract all its nutriment and use it to the best advantage it should doubtless be cooked to a jelly.

Barley is not often used here for feeding cattle, except near cities where brewer's grains or malt sprouts are obtainable. These increase the flow of milk largely, and are often fed in too large quantities. The grain itself I have found nearly equal to wheat and rye, and on suitable soils it is more profitable to raise for feeding cattle than any other cereal. For both fattening and milk it is excellent, and for horses is probably better than any other feed.

Beans are much used as cattle food in England, and their chemical composition would show them very valuable, but they are too high in price here to be much fed. I have bought second quality beans when I could get them for $0.75 to $1.25 per bushel, and fed them ground into meal with good effect. Peas I have never been able to buy at such prices as I could use them for cattle food.

Roots are almost indispensable where dry hay is used. Fed in small quantities they do not lessen the amount of hay consumed, but act rather as an appetizer, prevent constipation, enable the animal to obtain more nutriment from its other food, increase the milk, and keep the cow in a more healthy condition. Sugar beets I find the best for cows, and though this root is said not to give as large a product per acre as mangold wurtzel, there is little or no difference with me. The leaves of beets are of much value for soiling. My practice has been to commence early and harvest them only as fast as I could feed the leaves. My cows always increase in milk and do well upon them. Chemically the leaves are said to possess more nutritive value than the roots themselves.

Carrots make the best of winter butter, but cost me too much to feed the cows. Swede turnips are useful, but must be fed sparingly to milch cows on account of the strong flavor given to the milk. Potatoes, though not ordinarily raised as food for stock, are yet always in the farmers' hands, and more or less fed every year. They rank high in nutritive value, far above other roots.

The finer grasses I usually reserve to feed to such working cattle or young stock as are in other barns, and cannot be fed with

steamed food. For milch cows all grass should be cut early. Oat straw is next in value to hay, and is readily eaten. Wheat straw comes next, and is valuable to me in mixture, but it needs to be well steamed. Barley straw I use when it is bright and good. It is not as good as oat straw, and is almost worthless uncooked, on account of the long beards. Rye straw is hardly worth steaming, and when used is mixed in sparingly. Pea or bean straw is useless to me uncooked, but when steamed is savory and readily eaten. It is rich in albuminous material, containing about twice as much meadow hay, and is valuable for milch cows.

Annexed is a table showing the comparative value of the different cattle foods alluded to, which is worth careful study:

	Per centage of fat formers in 100 lbs.	Per centage of flesh formers in 100 lbs.	Total nutritive per centage in 100 lbs.
Potatoes,.....	18.9	1.4	20.3
Sugar Beet,.....	13.6	.9	14.5
Mangel Wurtzel,.....	12.6	1.0	13.6
Parsnips,.....	7.0	1.2	8.2
Carrots,.....	6.6	.6	7.2
Swedes Turnip,.....	5.2	1.0	6.2
White Turnip,.....	3.3	.9	4.2
Best English Hay,.....	36.3	13.5	49.8
Lucerne Hay,.....	38.0	12.7	50.7
White Clover,.....	40.0	18.7	58.7
Red Clover,.....	18.7	22.5	41.2
Indian Corn,.....	66.7	11.0	77.7
Rye Meal,.....	55.8	14.3	70.1
Linseed Cake, English,.	51.0	22.1	73.1
Linseed Cake, Americ'n	48.6	22.2	70.8
Oat Meal,.....	51.1	18.0	69.1
Barley,.....	52.0	13.0	65.0
Peas,.....	41.9	23.1	65.0
Beans,.....	39.7	24.0	63.7
Buckwheat,.....	52.1	9.0	61.1
Cotton Seed Meal,.....	33.49	41.25	74.74

COOKED FOOD FOR FARM STOCK.

To accuse farmers of being in any sense extravagant or imprudent, would be to fly in the very face of generally expressed popular sentiment. As a class, they are proverbially regarded as economical, with, of course, here and there an occasional exception. But when the real facts are fully and fairly considered and understood, it must be confessed that, in a great many important particulars, they are among the most wasteful of the community. They may not dress expensively, furnish their houses extravagantly, load their tables with costly and enervating luxuries, drive fast horses, or indulge in any of the whims and caprices which are invariably connected with what is generally termed high living; and yet there are very many of them who, in the management of their farms, are improvident and wasteful to a culpable degree—in the breeding and rearing of farm stock; in the want of attention to the comfort and health of their horses and cattle; and to the almost universal disregard of economy in stock feeding. It is to this last item that we propose more particularly to address ourselves in the remarks which are to follow.

In the earlier periods of agricultural history, the feeding of stock, in common with almost every other operation of the farm, was regarded as a matter requiring little thought or attention. Except in rare cases, little or no thought was given to the economy of feeding, nor was it a common thing to suppose that science had anything to do with this important department of the farm.

Recent scientific theories, practically illustrated, have conclusively proven the possibility of so preparing stock food that its value shall be nearly doubled, without involving a corresponding increase of cost in its preparation. This was the important point sought, and its attainment the object of much patient and persevering research and experiment. Now that there appears to be no reasonable doubt in the minds of intelligent men who have devoted to it their time and attention, the season has arrived when the farming community at large should enjoy the benefit of these discoveries. In many sections, this long and much needed reformation has already commenced, and the value of these scientific theories, in relation to stock feeding, is being practically tested. In other sections, a spirit of earnest inquiry has been aroused, which cannot but result advantageously to the general stock interest of the nation.

The importance of this subject can scarcely be over-estimated; and in no way can it be more satisfactorily demonstrated than by a

reference to the figures of the Census of 1860, which shows that, in the Northern States alone, the number of horses was 5,277,950; of asses and mules, 390,457; of neat cattle, 16,675,325; of sheep, 17,198,219; and of swine, 19,180,379. Such statistics as these are almost over-powering, and yet, it must be remembered that they refer to only one portion of our country. They foot up the enormous total of 58,722,321 animals, and all of them to be subsisted on the products of the soil alone.

To maintain the digestive organs of domestic animals in a perfectly healthy condition, should be an object of primary consideration with the farmer. Impaired digestion is the legitimate cause of nine-tenths of the diseases which afflict men and domesticated beasts. This may seem strong language, but the assertion is sustained by unanswerable facts. The avoidance, therefore, of everything calculated to impair the digestive powers of animals becomes a subject which claims general attention.

Nature has provided every animal with a digestive apparatus, which is capable of performing a certain amount of duty only. These organs should not be unduly taxed; when this is done, the result is inevitable disease. To avoid this, it becomes important that food should be presented for their action in a perfectly masticated condition. Where this is not the case, a double duty is imposed upon them—the vital energies are taxed in dissolving a mass of unbroken food to a degree that amounts in many cases to such absolute exhaustion as to prevent the proper assimilation and absorption of the chyle. As a result, the damage sustained by the system, instead of being restored by the food taken, is, if anything, increased. The entire process is debilitating. These are not new theories—they are the plain teachings of science, practically exemplified daily in man as well as in beasts. Stock owners are therefore deeply interested in the subject. They should know precisely what character of food to give their animals in order that their digestive organs may not be taxed beyond the limit which nature intended.

The ruminantia, or animals that chew the cud, have not the power of digesting grains and certain herbs, unless they have been previously broken. Unbroken seeds and herbs, enclosed in linen bags, introduced into their stomachs, merely undergo a moistening or softening process. Similar grains and herbs, mashed or broken, and introduced in bags of the same character, undergo complete digestion. The same experiment made upon horses show like results. Such experiments are practical, and ought to be conclusive.

Experiments with the gastric juices taken from the stomachs of different animals, and mixed with various kinds of broken food, produced no perceptible effect, except to prevent putrefaction, while the significant result was obtained that they did not act upon grains or certain herbs at all, until they were ground or broken, and mixed with the saliva. These interesting facts prove the absolute necessity of presenting food of this character to animals which have not the power of masticating it, in a triturated or broken condition.

Taken whole into the stomach of a ruminant, or indeed of any animal, seeds retain their vitality. The gastric juices do not affect

them, and, as a consequence, their nutritive principles are entirely withheld from the absorbent vessels. The feeding of whole grain, therefore, to ruminants, as the ox and sheep, is to be regarded as simply wasteful.

In the case of horses, who have the power of masticating their food, the feeding of whole grain may not at first appear so objectionable, but there are strong arguments against it. Some horses *bolt* their food; others, from defective teeth or sore gums, are unable to masticate it properly; while, in nearly all cases, a greater or less number of the unbroken grains are swallowed whole, and, of course, pass off undigested. We have shown that the gastric juices do not affect whole seeds; the farmer, therefore, who desires to avoid the risk of having such seeds pass through animals unchanged, and who prefers to have them subjected to the solvent powers of the gastric juices, and made to undergo the entire process of assimilation, and rendered profitable, will readily understand what course he should pursue.

But is not whole grain, as well as the broken, susceptible of such preparation as will obviate all the difficulties we have pointed out? Is there not a method by which whole or broken grain, hay, and other stock food can be so improved in its good qualities, and at such a cost as to render it an object with the farmer to adopt it?

Steaming or boiling, it is well known, effects great changes in the chemical as well as mechanical condition and quality of food. Many substances, which in their raw state are indigestible and unfit for food, become nutritious and wholesome when steamed or boiled. Some of these are not merely indigestible, but inedible, and wholly unfitted as food for man or beast, in their natural state. The action of heat and moisture produces an entire change in their character, and renders them valuable. There are others which, in their raw state, are innutritious and unpalatable, but which, when boiled or steamed, become valuable and acceptable articles of food.

If thorough mastication be essential to perfect digestion, then the mechanical division of food must be regarded as greatly facilitating that important operation, and, of course, in rendering such food more advantageous to the animal, and consequently more profitable to the owner. A distinguished writer says:—

"The boiling of cattle food, by performing or facilitating its division, is one of the best means known of promoting digestion, and even of increasing the quantity as well as quality of the alimentary substances, which undergo this process. This advantageous result appears to originate in part from the circumstance, that the molecules of the alimentary substance are separated by the coction they undergo, and thus present a greater surface to the influence of the gastric juice; and partly from the influence of the water wherein they are immersed, as well as of the high temperature to which they are exposed, augmenting the nutritive powers. The water seems actually to become solid, as in the making of bread, by entering into union with them, or imparting its hydrogen, which afterwards becoming united to carbon, may contribute towards the formation of fat.

"These facts have been established by a great number of experiments, with roots, grains, and even with boiled hay or grass, used for fattening domestic animals. Potatoes and Jerusalem artichokes, which, in their natural or raw state, are either cared for but little by the cattle, or are unprofitable, acquire, by boiling, new properties, which render them extremely advantageous after having undergone this operation.

"As a confirmation of the soundness of these views, regarding the superiority of boiled over raw food for the fattening of cattle, we have only to consider for a moment what actually takes place every day in the case of man. We here see how greatly substances which have been submitted to the action of heat, such as bread, meat, soups, broths, and other articles, surpass those used in their natural state. A small quantity of wheat, maize, barley or rice, well boiled, and eaten warm with a little milk, gains in nutritive matter an immense superiority to the same quantity of these substances, eaten without this preparation. The same remark is applicable to all kinds of grain."

We thus find that science as well as experience demonstrate unmistakably the advantages which are to be derived from the use of steamed or boiled food. It is asserted, on competent authority, that these advantages are fully equal to 30 per cent., and by some they are claimed to be greater.

We have already alluded to the importance of thorough mastication, in regard to digestion; and that one of the most prolific sources of indigestion, and the diseases which almost invariably follow it, is the presentation of imperfectly masticated food to the action of the gastric juices of the stomach. Although the teeth of the horse are adapted to grinding of grain, yet *he* is not usually given sufficient time; he consequently performs the masticating process imperfectly. Now the structure of the horse's stomach is such, that the digestion of partially broken, or even whole grain, is better secured than in some other animals. It is supplied with a coating that "acts in a triturating way," and thus promotes the digestion of the food submitted to it.

Notwithstanding this "triturating" apparatus, grains frequently pass through the alimentary canal in the same condition as when they entered the stomach, with the exception of the ordinary changes wrought by the animal heat and moisture to which they have been subjected. The fact, therefore, stands unimpeached, that this portion of his food has not been digested, and consequently has not proven of the slightest advantage to him. A horse's stomach is remarkably small in proportion to the other parts of his body. This is one of nature's wise provisions. Its location with reference to the diaphragm, is such, that any undue distention of it, not only distresses the animal, but is frequently the cause of irreparable injury. Indigestible food does not pass so quickly from the stomach as that which readily submits to the action of the gastric juices. As a consequence, raw whole grain sometimes remains there longer than it should, and not unfrequently produces diseases which result fatally, or at least impair the permanent usefulness and value of the animal. Inspiration is interfered with by the undue distention of

the stomach; and hence we so frequently find the animal quickly blown, when put to active exercise immediately after a full meal. If, therefore, the food is presented in an already partially masticated condition, such as is produced by the process of boiling or steaming the digestive organs act upon it more immediately, and all danger from too much detention is removed; to which must be added the important fact, that the whole, or at least a greater portion of the nutritive matter of the food taken, is turned to the animal's advantage.

In the case of ruminants, who are furnished with four stomachs, the food is re-masticated after it has passed into the *rumen* or first stomach. Liquid, or food that has been thoroughly comminuted does not undergo this process of re-mastication, but passes at once into the third and fourth stomachs. But this is not the case with such dry and solid vegetable matter as usually constitutes the food of this class of animals. It is not necessary to enter into a minute detail of the process generally known as "chewing the cud," which is in fact the reducing to pulpiness, or liquidity, such articles of food as hay, fodder, &c. Mr. Wilson says:—

"One important practical lesson suggested by the nature of rumination, is the proper feeding of cows, in order to produce the greatest quantity of milk. If they are fed on very dry food, such as hay, the greater portion of fluids in the blood will be spent in the process of rumination and digestion, and the milk will be scanty; but if they be fed on aliment which abounds in liquid, such as mangel wurtzel, or brewer's grains, and distiller's wash, as in Holland, they will ruminate much less, a less quantity of saliva will be required for chewing the cud, and a large proportion will go to the production of milk, though this will be thinner and not so rich in cream as the milk produced from drier food." These are facts which the milk dairyman should take into earnest consideration.

Having thus shown what are some of the advantages to be derived from the use of cooked food—although many others might be named—the question that naturally suggests itself is, "will it pay?"

On this point there appears to be some little diversity of opinion, though those who are skeptical in regard to the profitableness of the cooked food system, are generally such as have either not practically tested the matter; or, if they have done so, had not the proper kind of appliances for its economical trial. There are few farmers who, in view of the increasing scarcity and price of fuel, could be prevailed upon to believe that, with an ordinary kettle or caldron, or with any number of them that might be found requisite for the purpose, food for their stock could be cooked with profit. The cost of the fuel would not be the only obstacle. The handling of the cooked material, in putting it into the kettles or caldrons, and its transfer when cooked to the troughs of the animals to be fed, would necessarily involve a heavy outlay of time and labor. It would not be safe to locate such large open fires as would be absolutely necessary, to cook any considerable amount of food, anywhere in the immediate vicinity of the barn or feeding sheds. As a consequence, the materials would require to be carried from

and to the place where they would be wanted for the animals, which, if the stock were large, would demand either considerable outlay for a light railway, or the carrying of it by hand in buckets or other vessels. In addition to this, the process of cooking the amount of food that would be needed for the stock of a farm of ordinary size, would be slow and tedious, as well as expensive; and unless proper attention was given to it all the time the cooking was in progress, there would be great danger of having the material ruined by scorching or burning.

For these and other reasons that might be adduced, it is easily understood why farmers who have no other conveniences than those referred to, would naturally come to the conclusion that cooking food for their stock would be attended with more cost than profit.

But, in this age of progress, farmers who desire to feed their stock on boiled or steamed food, are not confined to such primitive resources. The skill and ingenuity of American inventors have fully overcome these obstacles. With the use of these modern improvements, not only are dangers from fire avoided, but such other arrangements have been devised as lessen not merely the consumption of fuel, but in a great measure the expense of handling and re-handling the raw and cooked material. By the use of steam generators, which can now be procured at a cost but little exceeding that formerly paid for a simple caldron, fuel is largely economised—much less attention to the steaming process is necessary—it is much more easily and rapidly accomplished—almost any desired amount of food can be steamed by one and the same operation; and, what is equally important, the cooked material can be kept *warm* for a considerable length of time. This latter is very desirable, for the reason that when fed moderately warm, the cattle appear to relish it better; while, at the same time, it refreshes them more quickly than when allowed to become cold before it is given to them. Cooking renders it more digestible, and it is more easily assimilated. The absorbing vessels are thus enabled more readily and fully to act. Animal heat is necessary for digestion; therefore cooking renders food more nutritious. No horse likes it when cold; many refuse it, and most of them prefer the raw article to that which has been boiled and become cold.

Were it necessary, the testimony of a large number of the best farmers of Pennsylvania, and other States, could be furnished in behalf of the economy of boiled or steamed food, prepared by means of these lately and greatly improved appliances. The subject has been carefully investigated by shrewd and intelligent men, who have given it their close attention, for the sole purpose of determining the great question of economy; and the almost unanimous conclusion—so far as the writer has had opportunities of ascertaining—is decidedly in favor of the cooked food system.

THE ADVANTAGES OF COOKING FOOD

FOR DOMESTIC ANIMALS.

The U. S. Agricultural Report of 1865 has an able article on "Steaming Food for Stock," from the pen of E. W. Stewart, of New York State. Mr. Stewart writes after years of experience in this branch of agriculture, and he sums up the result of cooking as follows :—

First. It renders mouldy hay, straw, and corn stalks perfectly sweet and palatable. Animals seem to relish straw taken from a stack which has been wet and badly damaged for ordinary use; and even in any condition, except "dry rot," steaming will restore its sweetness. When keeping a large stock, we have often purchased stacks of straw, which would have been worthless for feeding in the ordinary way, and have been able to detect no difference, after steaming, in the smell or the relish with which it was eaten.

Second. It diffuses the odor of the bran, corn meal, oil meal, carrots or whatever is mixed with the food, through the whole mass; and thus it may cheaply be flavored to suit the animal.

Third. It softens the tough fibre of the dry cornstalk, rye straw, and other hard material, rendering it almost like green succulent food, and easily masticated and digested by the animal.

Fourth. It renders beans and peas agreeable food to horses, as well as other animals, and thus enables the feeder to combine more nitrogenous food in the diet of his animals.

Fifth. It enables the feeder to turn everything raised into food for his stock, without lessening the value of his manure. Indeed, the manure made from steamed food decomposes more rapidly, and is therefore more valuable than when used in a fresh state. Manure made from steamed food is always ready for use, and is regarded by those who have used it as much more valuable, for the same bulk, than that made from uncooked food.

Sixth. We have found it to cure incipient heaves in horses, and horses having a cough for several months at pasture have been cured in two weeks on steamed food. It has a remarkable effect upon horses with a sudden cold, and in constipation. Horses fed upon it seem much less liable to disease; in fact, in this respect, it seems to have all the good qualities of grass, the natural food of animals.

Seventh. It produces a marked difference in the appearance of the animal, at once causing the coat to become smooth and of a brighter color—regulates the digestion, makes the animal more contented and satisfied, enables fattening stock to eat their food with less labor, (and consequently requires less to keep up the animal heat,) gives working animals time to eat all that is necessary for them in the intervals of labor, and this is of much importance, especially with horses. It also enables the feeder to fatten animals in one-third less time.

Eighth. It saves at least one-third of the food. We have found two bushels of cut and cooked hay to satisfy cows as well as three bushels of uncooked hay, and the manure in the case of the uncooked hay contained much more fibrous matter, unutilized by the animal. This is more particularly the case with horses.

These have been the general results of our practice, and, we presume, do not materially differ from those of others who have given cooked food a fair trial.

From Thos. J. Edge, Esq., in the "Practical Farmer," December, 1868.

[Thomas J. Edge is one of our very best practical farmers, and a most accurate one in his observations and experiments.—*Editor.*]

To Paschal Morris:

Thy letter asking for the result of my experiments with cooked food for pigs was duly received, and, but for the pressure of fall work, would have been answered ere this.

My first experiment was with old corn, in three forms, viz.: shelled and fed whole; ground and made into slop with *cold* water; and ground and *thoroughly cooked.*

The pigs, five in number, were from the same litter, and were the produce of a good common sow, crossed with a Berkshire boar.

In each case the food was given them as fast as consumed, and all possible care taken to avoid any waste or irregularity of feeding; in every case of a change of food three days was allowed before the weighing for the experiment, in order that the effect of a *sudden* and *entire* change of diet might not affect the result.

I found that five bushels of whole corn made 47¾ lbs. of pork. Five bushels (*less miller's toll,*) of corn ground and made into thick slop with *cold* water, made 54½ lbs. of pork. *The same amount of meal well boiled and fed cold, made* 83½ lbs. *of pork.*

With the whole corn the pigs had the slops from the kitchen (*no milk*) and for drink with the boiled mush, one or two quarts were thinned with cold water or *slop* from the house; in each case the house slop was used in some form or other, but all the milk was reserved for small pigs. The fifteen bushels of corn cost $1.30 per bushel; and thee will notice that, while the pork made from the whole corn *barely paid for the corn*, that from the same amount of ground corn *cooked*, paid the whole cost of the corn and a little more than *one dollar per bushel over*,—and that the economy of grinding and making into slop will fully warrant the extra trouble and expense. How could it be otherwise, when the whole economy of profitable feeding consists in bursting or breaking the *indigestible* hull which encloses the *minute* particles of the food?

In the above experiment the data are based upon pork at $14 per cwt., and corn at $1.30 ber bushel; but it will apply as well to other prices.

The second experiment was exclusively with new corn, in two forms, viz.: on the ear, and shelled and ground before boiling; and all in each case was what we know as "nubbins" on soft corn. The best of this class of corn was reserved for the pigs, and the worst fed to the cattle. Ten bushels on the cob made 29½ lbs. of pork, fed in the usual way, *on the ground.* The same amount of shelled, ground by horse-power, and well boiled, made 64 lbs. of pork. Of course a portion of that fed on the ear was wasted; but it is the common plan, and forms but a fair test to the comparative merits of cooked food. I have made no experiments with sound new corn, but may have a favorable opportunity before the season is past; but would suppose that my experiments with old corn would form a good criterion to judge by.

Thomas J. Edge.

$50,000,000 ANNUALLY WASTED.

In connection with the foregoing see U. S. Agricultural Report of 1865, page 407, which says :

AMOUNT OF COARSE STRAW AND FODDER WASTED.

If we take the amount of grain and Indian corn raised in the United States, as by the census of 1850, we shall find, by allowing forty bushels of grain to the ton of straw or corn fodder, that there were about 30,000,000 of tons. Now, at least, one-third of this is wasted for every purpose except manure, and vast quantities are not even used for that. Suppose we estimate this at one-half the value put upon it by Mr. Mechi, or five dollars per ton, and we have the enormous sum of $50,000,000 wasted, for want of proper economy, in a single year. We believe this estimate much below the real loss. These facts are worthy of a thorough examination by the farmers of the whole country. Let them study their own interests. Many of them will see where they have thrown away enough in ten years to double their property.

WHEY.

This article of food, which is now so largely increasing, through the multiplication of cheese factories, has given much trouble to many farmers who do not understand the true method of using it. Whey is not a perfect food in itself, as it contains only a part of the constituents necessary to support animal life and health. It is composed nearly all of milk and sugar, retaining but a slight proportion of casein, or cheese and butter. But there are many other partial foods which are highly prized for feeding purposes. Whey has about the same composition as the turnip ; and even this, alone, is quite insufficient food for an animal. Mix whey with some highly nitrogenous food, such as oil meal, pea meal, oat meal, or bran, and it becomes a profitable food for cows, hogs or young animals. One pound of oil or pea meal, or 1½ lbs. of oatmeal or bran to three gallons of whey, will make it a well balanced food for the production of milk, or the growing of the young animal.

The constituents of whey have the advantage over the same elements in vegetable food, of being more soluble, and therefore, more easily digested and assimilated. Liebig, and some other eminent physiologists, have supposed that starch is changed into sugar in the process of digestion, and, in this form, is absorbed into the system. If this theory be well founded, then whey is in the proper condition for absorption, and its elements would point it out as a highly fattening food ; its elements being, chemically, the same as fat or butter. There have been numerous cases where hogs have been made very fat on whey, with a small portion of nitrogenous

food, which proves that its office is to produce heat, oil or fat in the system. From our experiments in feeding whey to cows, calves or hogs, we regard it as worth from eight to ten dollars per cow for the season.

But whey as obtained from the factory is generally sour; and to obviate this difficulty many have resorted to heating or boiling it. It ought to be cooked with other food—oil, pea meal, bran, &c. This is easily done by steam. Put the whey and other food into a barrel, and introduce the steam pipe at the bottom of the barrel.

Steaming is much better than boiling in a kettle, as there is no necessity of stirring, and no danger of burning. The cooking stops fermentation, and enables the feeder to keep the whey until it can be fed. Mr. Harris Lewis, a large and intelligent dairyman of Herkimer County, N. Y., has adopted this system of cooking the whey, and recommends it highly. E. W. S.

[NOTE.—The practice of taking whey home from cheese factories at some little distance, has some objections over the course pursued by some stock company factories, who furnish the hogs and feed it out at the factory as fast as produced. All the latter method lacks to insure success is the proper preparation of the whey, as above set forth, the convenience of good clover pasture near by, and the better care of the hogs.]

HOW TO PREVENT COOKED FOOD FERMENTING.

Some feeders practicing the cooking system have been much troubled by fermentation, where the food has not been used immediately. This has been caused by too little cooking. Cut hay, straw and bran or meal, thoroughly steamed, will not ferment for two days, even in warm spring weather. Partial cooking hastens fermentation and souring, but every housewife knows that thorough cooking will restore sour preserves and keep them sweet for a time.

The steam box should be kept clean, for any taint of ferment about the cover will be communicated to the new food. So barrels used to steam hog feed in should be occasionally thoroughly cleaned.

Steaming or boiling is frequently done so imperfectly as only to boil a small portion of the food, and this just warms some of it to the proper temperature to produce rapid fermentation. If all those who cook food for hogs will take pains to cook the whole contents of the barrel or kettle for a sufficient time, they will not be troubled with fermentation.

Another cause of fermentation is in not having the mass sufficiently thick when done, and in *emptying immediately into a cooler.*

STEWART.

COOKING CORN OR WHOLE GRAIN.

Grinding grain renders it much more easily digested, as the small particles of meal have many hundred times more surface to come in contact with the gastric juice, and this meal takes much less time to cook than whole grain. But in many parts of the country, mills for grinding are distant, or charge so much that the expense is an item well worth saving. This may be done by thoroughly cooking the whole grain. Long cooking more perfectly bursts the grains of starch composing its kernel, than any grinding alone can do. It is, therefore, only a question of time in cooking. Corn should be boiled at least four hours, to render all its nutriment available to the animal. It is a great advantage to soak whole grain twelve hours or more in water before boiling. This will cause the boiling water to penetrate it and *burst the grains of starch in less time* than with hard, dry kernels. STEWART.

EXPERIMENTS IN FEEDING CATTLE IN ENGLAND.

COOKED AGAINST FERMENTED FOOD.

It is necessary that the food of an animal should contain the five following articles, otherwise it will lose flesh: starch or sugar to supply the carbon given off by respiration; fat or oil to supply the fat; gluten or fibrin to make up the waste in muscle or cartilage; earthy phosphates to supply the waste of the bones; and saline matter (principally sulphate and chlorides) to replace the waste by excretions. The absence of one or more of these will serve to prevent an animal from being perfectly healthy and thrifty, and hence the benefit of a mixed kind of food. The following experiment in feeding cattle with cooked and with fermented food, was lately tried upon one of the largest estates in England. Four heifers were selected, as equal in all respects as possible; and six pigs were also selected, from the same family; each lot was divided by the selection, alternately, of an animal. All were weighed, and at the end of each week during the experiment, each animal was weighed. In the first week of the experiment, the fermented food consumed was much less than the other, and the increase of the pigs in live weight was considerably more, and the heifers also seemed to have made rapid advances. The second week, however, changed the scene entirely. Those on cooked food were making steady progress, while those on fermented food had produced scarcely an increase from the preceding week. It was then observed that the bowels of the lot using fermented food had been confined, and had become free in the second week. The apparent success of the first week was the result of indigestion and accumulations of undigested matter in the intestines. The experiment continued for twelve weeks—those on cooked food thriving and increasing, the others not. On slaughtering them it was found that the intestines of the three fed on fermented food were full of worms—thus accounting for their not advancing. There was a difference in the return of the lots of pigs in favor of those fed on cooked food of £1 7s. 3d. From this we may deduce that the value of the different articles of food should be properly considered in two relations; first, as nutritive, second, as digestible. Those which are the most nutritive in proportion to the quantity of carbon, oxygen, hydrogen and nitrogen which they contain; they are digestible in proportion to the facility with which they are acted on by the gastric juices.—*American Stock Journal, Parksburg, Pa.*

TESTIMONIALS IN FAVOR OF COOKED FOOD.

Loudon's Encyclopædia of Agriculture, remarks: "Unless food be thoroughly deprived of its vegetative powers, before it enters the stomach, the whole nourishment which it is capable of affording cannot be derived from it. The most effectual mode of destroying the living principle is by the *application of heat*, by steaming or boiling."

Morton's Encyclopedia of Agriculture, says: "The process of cooking renders soluble that which would otherwise be imperfectly digested, it removes in some cases what would otherwise be unwholesome, and it renders savory what would otherwise be distasteful."

Professor HORSFALL, of England, in speaking of the preparation of Food for Stock, says: "I have cooked or steamed food for SEVERAL YEARS, and my experience of its benefits is such that if I were deprived of it *I could not continue to feed with satisfaction.*" (See U. S. Report of Department of Agriculture for 1865, page 406.)

Mr. MECHI, near London, has also practised Cutting and Steaming Straw, &c. His experiments have been quite extensive, and the result most favorable to COOKED FOOD. (See same Report, page 407.)

Hon. G. GEDDES, of Syracuse, N. Y., says: "He thoroughly proved, years ago, that cooking, independent of grinding, at least doubled the value of food."

Professor MAPES says: "He has proved that nineteen pounds of cooked corn are equal to fifty pounds raw, for hog feed.

Mr. MASON, of New Jersey, "Found that pork fed with raw grain cost 12½ cents per pound, and that from cooked, 7⅞ cents."

C. M. CLAY, of Kentucky, showed: "That one bushel of dry corn made 5 pounds 10 ounces of pork, boiled corn 14 pounds 7 ounces, and boiled meal 16 to 18 pounds."

The Society of Shakers, N. Y., says: "For fattening animals, swine particularly, we consider three of cooked equal to four of raw meal."

S. H. CLAY, of Kentucky: "Found by experiment that a bushel of raw corn makes 5½ pounds of pork, whilst a bushel of cooked meal makes 17½ pounds."

JAMES BUCKINGHAM gave, in the *Prairie Farmer*, an experiment with raw and cooked meal, and found that a hog fed on 1¼ bushels raw meal gained 19 pounds, and another fed on one bushel cooked meal gained 22 pounds.

Experiments made by Mr. OWEN MERCHANT, of Warsaw, N. Y., more than twenty-five years since, prove that a yoke of poor oxen, valued at about $40, were fatted on cooked potatoes and bran in five weeks and three days, and made extra beef, which was sold in the market for first quality.

Mr. A. AVERY, of Syracuse, N. Y., says after two years trial: "I think I have saved ten dollars per head on keeping (say $600 on the Stock Feed,) besides having the milk cows in much better condition than ever before." He says again, in April, 1869, "This, you see, gives me a clear profit of $537.25 on four and a half months' feed.

Messrs. DEWEY & STEWART, of Owosso, Mich., say: "We have fed sixty-four head of cattle, seven horses, and three hundred and forty sheep, fattened twenty-two head of the cattle, and seventy sheep. We think we have saved one-third the expense in wintering this stock."

Mr. L. C. EASTMAN, of Duchess Co., N. Y., says: "There is no doubt of the advantage of steaming food for cows in milk, and for fattening any kind of stock."

Judge WATTS, of Carlisle, Pa., says: "Cooked food is a clear saving of food. and a benefit to all herbiverous and carnivorous animals—in fact, a complete success."

The *Ohio Cultivator*, of February, 1862, referring to the preparation of food for animals, says: "Cooked or steamed food is another of the almost indispensables to every well managed farm. This is is a point which has been settled beyond controversy. Time alone is required to bring it into general use. Like

the thresher, mower and reaper, the introduction of apparatus for steaming food upon the farm, will be the work of years, but the time WILL COME when it cannot be dispensed with by those who do not desire to range themselves with the prodigal and improvident ones."

The New England Farmer, of Boston, Jan. 18, 1862, in speaking of steaming and boiling food for stock, and of the recent different experiments made, says: "*All tend to show* the decided advantage of economy in cooking, or partially cooking the *food for our animals*," and further remarks, that "the experiments, thus far, have been made under several disadvantages, the principle of which has been the want of PROPER APPARATUS with which to do the work."

NEW YORK, Aug. 16, 1870.

D. R. PRINDLE, Esq.—*Dear Sir* :—The Steamer sent me last winter works well, and I am fully convinced that there is economy in steaming food for all kinds of stock. Horses and sheep, as well as cattle and hogs, enjoy it and thrive upon it. With care and a good steamer, there need be literally no waste of fodder, while the stock will be kept in excellent condition.

Respectfully, Yours, L. A. CHASE,
American Agriculturist.

From the Practical Farmer, Sept., 1869.

COOKED FOOD FOR STOCK.

If you would have your stock outshine
Your neighbor's o'er the way,
By being large, and fat, and fine,
Take heed to what I say.— .

This casting out your feed to stock,
Without first being cooked,
A losing game it is—at least
To me it long hath looked.

But still the practice doth prevail,
'Tis strange, but yet 'tis true—
All, I suppose, for want of proof
Upon the point in view.

Now, "to the wise one word's enough,"
A maxim old, 'tis said;
Mark well, for on two-thirds the food
Your stock may all be fed.

To do the thing, I'll tell you how,
'Tis easy quite, and plain;
Just take a peep in "Hardware Row,"
A *Steamer* there obtain.

And PRINDLE'S is by far the best
Of any yet produced—
For satisfaction it will give
Wherever introduced.

When you with one have been supplied,
Just place it near your well,
And by its use you soon will find
That on your stock 'twill tell.

Upon the subject do but read,
And then I'd have you talk;
When, doubtless, you will all decide
To cook your food for stock.

Bates Co., Missouri. C. N. TEETER.

ESSENTIALS TO DAIRYING.

BY LEWIS F. ALLEN.

No man need expect to succeed in the dairy business, unless well provided with good shelter for his cows, as well as the proper grasses and water, and accommodations for milking, feeding, or whatever else appertains to the convenience and labor connected with it. It may be well to enumerate a few of these items, which are here offered for consideration.

1st. Permanent blue grass and white clover pastures on dry, elevated soil, or their equivalent in other grasses or herbage, enabling the cows to give abundance of rich, good flavored milk. Common prairie and lowland grasses will not answer.

2d. Abundance of pure water, supplied by living springs, running brooks, or permanent rills. Ponds, or stagnant water, is not healthy for dairy cows, and will not aid in making a high flavored cheese or butter.

3d. Barn stables, or sheds, into which the cows may be driven in excessive heats, or cold storms, for shelter, at all excessive temperatures, whether of heat or cold, of drought or moisture, affects the milk both in quality as well as quantity, which influences, more or less, the quality as well as the quantity of the dairy products.

4th. Quietude of the cows, continually, whether at pastures, or in their yards or stables, together with gentleness in their treatment, and a continuous lovable care for them, so that they repose entire confidence in those who go among, care for, and handle them.

5th. Plenty of salt, once a week, to keep their bowels open, and their appetites good.

6th. Steady milkers; the same milkers to the same cows, continuously as may be possible, that the cows get accustomed to those who draw their milk; and let the milking be done silently, without talking, as all unnecessary noises disturb the cow, and more or less affects the equable and steady flow of her milk. The milk cow is a very sensitive animal.

7th. Perfect cleanliness in the pails and vessels which receive the milk, and clean hands to the milker. For these purposes a bucket of water, wash bowls, and a soft linen or cotton cloth to wipe off the udders, should always be in attendance.

8th. In addition to all these requisites, when prolonged drought dries the pastures, green crops of grass, the small grains of Indian corn should be sown in spring, to help out the pasture grasses, and keep up the flow of milk. For the want of these, oftentimes half the dairy products of the season is lost, Their food should be daily cut, and fed to the cows in clean mangers.

The enthusiastic dairyman, just beginning the business, may say, "If I have to encounter all these difficulties, I may as well throw up the business at once, for I have neither the capital to expend in so multifarious a preparation, nor have I the convenience on my farm to supply all requirements, even if I had the moneyed means to provide them." The answer to this is: "No man should attempt dairying unless he goes into it as a permanent business; and every kind of permanent occupation requires a certain amount of preparation to prosecute it to its most successful results. He may have his cheese house, his kettles, caldrons and presses in ever so good order, and which can be suited in one place about as well as another; but the material of what his cheese or butter is to be made, must be of good quality and perfectly arranged, or his work will prove a failure.—*Prairie Farmer.*

A TABLE TO CALCULATE PERIODS OF GESTATION

OF FARM ANIMALS, &c.

Showing the time at which the average gestation of domestic animals expires, dating from the first day of each month in the year.

TIME. Cow 283 DAYS.	TIME. SHEEP AND GOAT, 288 DAYS.	TIME. Sow, 113 DAYS.
January 1st....Oct. 10	January 1st....May 31	January 1st...April 23
February 1st...Nov. 10	February 1st....July 1	February 1st...May 24
March 1st.....Dec. 7	March 1st .....July 29	March 1st.....June 21
April 1st.....Jan. 7	April 1st.....Aug. 29	April 1st.....July 23
May 1st .....Feb. 6	May 1st .....Sept. 28	May 1st.....Aug. 21
June 1st.....Mar. 10	June 1st .....Oct. 29	June 1st.....Sept. 21
July 1st .....April 9	July 1st.....Nov. 28	July 1st.....Oct. 21
August 1st.....May 10	August 1st.....Dec. 29	August 1st....Nov. 21
September 1st..June 10	September 1st..Jan. 29	September 1st..Dec, 22
October 1st.... July 10	October 1st....Feb. 28	October 1st....Jan. 22
November ....Aug. 10	November 1st..Mar. 31	November 1st..Feb. 21
December.....Sept. 10	December 1st..April 30	December 1st..Mar. 23

The period of gestation of the mare is very irregular, being from 11 to 13 months; that of the she ass (jenny,) about 12½ months; of the bitch, 63 days; of the cat, 50 days; of the rabbit, 28 days.

A HUNGARIAN DAIRY.

Yesterday we went out east of Pesth, to look over the farm of a gentleman, who, it is said, has the finest lot of cows in Hungary. We found about sixty head of really splendid cattle, of mixed Holland and Swiss breeds, very large and smooth skinned, admirably kept, in stables so clean and airy that we had fully anticipated and were prepared to relish the excellent cold milk which was presented to us for refreshment.

These cows are not pastured—that is, they do not depend on pasturage, although they are allowed sufficient run for exercise and health. Their food consisted of cut straw, Hungarian grass, and "bran mash." The stables were furnished with straw cutting and steaming apparatus on quite an extensive scale, everything indicating a high degree of order and economy.

The native Hungarian cattle are of a light dun color, in shape and appearance much like our Texan cattle, and with like immense horns. As we came down the Danube we passed very many large droves of them, drinking or bathing at the shores. They were very interesting in appearance, particularly as they are all of a color, in this more resembling wild than domestic animals.

Upon the farm referred to, is raised chiefly rye and Indian corn, with Huugarian grass and vegetables for the stock.—*C. W. Marsh, in Chicago Post.*

ARRANGEMENT FOR DUMPING STEAM VESSELS, &c.

Trunions placed upon the central portion of a steam vessel, with a handle near the bottom and vessel setting up a little from the floor, will be found, when properly managed, more convenient than the usual mode of shoveling or dipping out. Handles or ears also, placed near the central portion of the vessel in lieu of the trunions, with a *block and tackle* or other power, and short ropes with hooks for hooking into the handles or ears, may be used when it can readily be hoisted for emptying into the *low cooler* or mash *vat.* Some such arrangement would be very convenient for any good sized hog pen, as when one vessel is cooked and emptied another may be steamed, and so on successively without other steam vessels (the usual mode), here comes in the economy of cooking by steam,—several vessels, successively, by the same fire, instead of one kettle full, (the primitive style of our fathers.) In the absence of the above, two or more vessels may be used for cooking successively. Or a vessel may be placed on a truck and steamed; when it can be drawn along a track direct to the feeding trough, and save much time in handling, &c. P.

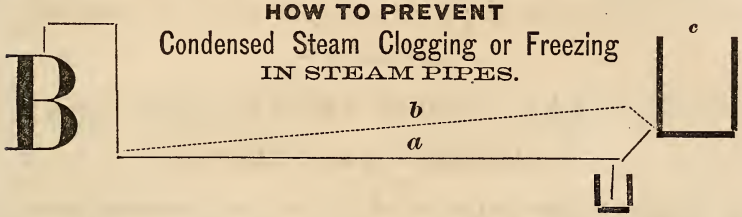
LAYING STEAM PIPES.

Many enquiries have been made through the public journals within the last few years on this subject, but as yet nothing practical, explaining the many failures, has come to the eye of the writer. Inexperience and want of proper care and judgment in this branch of farm economy has caused many failures, and the frequent discouragement of the would be *progressive farmer.* To explain this subject, so that a child need not err in tracing the cause of failure, &c., we will first illustrate the folly of laying steam pipes in the ground, or *otherwise*, without *perfect protection from cold or water*, by a simple comparison, thus. Every housewife knows that to cool any substance or liquid quick it is best done by setting the tin or iron vessel *into cold water*, or air, as may be. Then a child should see at a glance that cooking or conveying steam through a metal pipe in a ditch of cold *earth* or *water*, as may be, would never be successful. The writer has known many who have been so extremely cautious as to place their pipes in a ditch and fill carefully with sawdust, &c., not thinking that the ditch would fill the first *rain* or *thaw*, as might be, with water. Comment is unnecessary to show the folly of such attempts, as the heat expends itself in its passage through the ditch or water, as may be, and thus condenses the steam, and failure is the result. The effect of cold air on metal pipes is often the cause of failure. Hence the importance of *ample protection* to steam pipes, boilers, and steam vessels. Provision must also be made for the escape of condensed steam. See illustration, page 51.

PRINDLE.

FREQUENT CAUSES OF FAILURES IN THE USE OF STEAM.

For the benefit of the inexperienced, we note some of the principal causes of failures in this department of farm labor:—The effort to convey steam a great distance without proper protection of the pipes from water and cold, and provision for the escape of condensed water from steam pipes, to prevent clogging or freezing in winter, &c.; are often causes of failure. The use of green or wet wood, or the want of a good, clear combustion, loss of steam, or improper steam vessels, defects in boilers, or want of *proper check flues*, of nearly one-third circumference of furnace (as now made in Prindle's) have sometimes brought ill success to the operator. Any defects in boilers, or want of success in operating them satisfactorily, should be reported to the manufacturer or inventor, (not agents.) This rule will apply to any new farm machinery where the working is not properly understood. P.



B represents the boiler; line (*a*) steam pipe from boiler to steam tank (*c*) on a descending grade; dottedline (*b*) the same on an ascending grade. A *vessel filled with water*, with a small drip pipe extending into it, is placed at the lowest *point* or *points* of steam pipes, as may be. It will thus be seen that while the condensed water seeks its level in the vessel below, that the steam passes on into the steam tank unobstructed. In the ascending grade (*b*) the vessel and drip pipe is placed at the opposite end or lowest point.

THE ROAD TO SUCCESS IN THE USE OF STEAM.

Place the boiler where it can be protected from cold, where water is convenient, also as near to steam vessels as possible.

Secure a good draft by sufficient size and height of smoke pipe, or its connection with a chimney, which is preferable. Use good fuel, and do your work quick. Protect everything from cold and wet. Use wood steam vessels, and of as thick material as convenient, to prevent radiation and loss of heat. For *small wood*, cobs, chips, &c., use a suitable grate instead of wood bars, which secures a better combustion and prevents choking with ashes, embers, &c. Have all steam vessels perfectly tight, and always avoid the loss of steam. When steam is up it is economy to cook several vessels successively, instead of one large one. Study the experience and teachings of others, and, if not at first successful, learn the cause of failure and the remedy will appear. P.

PROTECTION OF PIPES THE ONLY ROAD TO SUCCESS.

When it becomes necessary to cook at some little distance by steam, it is usually done by laying a ¾-inch bore iron gas pipe, protected in a proper manner, or a wooden pipe or pump log of one inch bore is sometimes used, for a moderate distance, without protection. Iron or metal pipes should be lain in a small substantial box, about four inches square, and laid upon blocks about one inch from the bottom, and the box well filled in and around the pipe tightly with wool, hair, felt, &c., as may be obtainable. Other non-conducting substances are sometimes used, such as sawdust, pulverized charcoal, &c. The hair from tanners, properly prepared by whipping a little, is probably the cheapest, and as good as any. *We* see no reason why *rags* will not answer as well, although we have never tried them. Another indispensable feature is ample protection from water by proper underdraining, placing the box and steam pipes above. Sufficient capacity should be given the ditch, so that no flood will affect the pipes. Where steam is to be conveyed in pipes a boiler *one size* larger is *generally required.* PRINDLE.

WOOD STEAM VESSELS BETTER THAN IRON!

OR PRACTICE VERSUS THEORY.

Practice teaches us that wood is a very good non-conductor of heat or cold. Iron is found to be the reverse. Hence wood retains its heat much better than iron, and costs less. Many writers, in recommending iron for steam vessels, do not consider this fact, and thus mislead their readers. Iron tanks or steam vessels may be used by covering with plank, or encased up with boards, and packed between with some non-conducting substance, to prevent the escape of heat. Feed, when properly cooked in vessels packed in this way, will keep warm for some time, thus obviating the necessity of cooking every day. Wood vessels made of 2-inch plank, of good durable material, is found to answer all purposes, and costs much less. Iron is also found to corrode, unless galvanized, and we think cannot come into general use. With two good tanks it will not be necessary to cook oftener than every other day.

The little "*Norwegian Dinner Pot*," which recently figured so largely in some of our agricultural papers as valuable for cooking food for stock, is a vessel of *metal or wood* encased in wood, and packed with wool or felt between, making as nearly as possible a perfect refrigerator, and will keep ice as well as hot water; *but does not generate heat.* Hence the error so recently disseminated.

Some valuable hints from this circumstance may well be considered, as to *keeping feed hot or cold* for some length of time, or in preventing frost from various vessels or pipes in winter.

PRINDLE.

ENGINES, WROUGHT-IRON BOILERS, &c.

Illustrations of various patterns of Steam Engines, Tubular Boilers, &c., are so common place as not to require a repetition at our hands. Good substantial tubular boilers with engines, although rather expensive and dangerous for common use, are found to be well adapted to the farmer's wants, where a sufficient amount of constant work will warrant the outlay. Great cantion and some considerable experience is necessary, however, to insure success, as with the best of high pressure boilers, many accidents are of daily occurrence. See *Country Gentleman*, Sept. 29, 1870, "Steam on the Farm;" also *Progressive Batavian*, Oct. 7, 1870, "Death of C. S. Craft," whose head was blown off, while asleep 8 or 10 rods distant, engineer escaping unhurt; also *Western Rural*, Oct. 20, 1870, "Several men killed and wounded near Richmond, Ind." Although the engine is as indispensable as "*Animal Power*," we repeat too much caution cannot be exercised in their use on the farm

PRINDLE.

HINTS

TO THOSE WHO INTEND TO PURCHASE BOILERS, OR OTHER COOKING APPARATUS.

1st. Beware of the ordinary thin sheet iron cylinder boilers, with small water space, as the deposition of lime from hard water, corrosions, scales and sediments, will soon fill up or destroy the boiler, or, at least, render it unsafe in the hands of the inexperienced. Such is the opinion of practical boiler makers.

2d. Sheet iron pans having been recommended by some, it may be well to consider a few things before adopting them. Are these pans capable of standing ten pounds of pressure to the square inch? Can wooden covers be packed steam-tight under such pressure, and remain so any length of time? Can such covers be prevented from warping? Do you know how to prevent substances which are cooked over a perforated bottom *in a pan* from falling through, and burning in the pan below? The writer, in twenty years experience, has not been able to answer these questions in the affirmative.

3d. Avoid a cast iron boiler that is so made that when any part fails it cannot be replaced, without a loss of the entire furnace and boiler.

4th. As all the ingenuity of the age is at work to supply the increasing demands for some apparatus well adapted to domestic use—one that is simple, safe and practical—one that obviates all the objections hinted at—it will be well for purchasers to examine carefully each claimant before investing money for such a purpose.

5th. With a steam pressure of from five to twenty pounds per inch, food cooking may be done in detached wooden vessels, even at some distance from the boiler; hogs scalded in a wooden vat at a convenient point; clothes boiled in tubs or barrels; bath tubs

warmed by extending pipes, &c. By this agency food may be cooked in large quantities, which is impossible with the ordinary cauldron, and the trouble attending this, in the old way, avoided, as well as the scorching of the substances consequent on cauldron cooking.

6th. Use no boiler in domestic use which has not been proven to be PERFECTLY SAFE AND DURABLE.

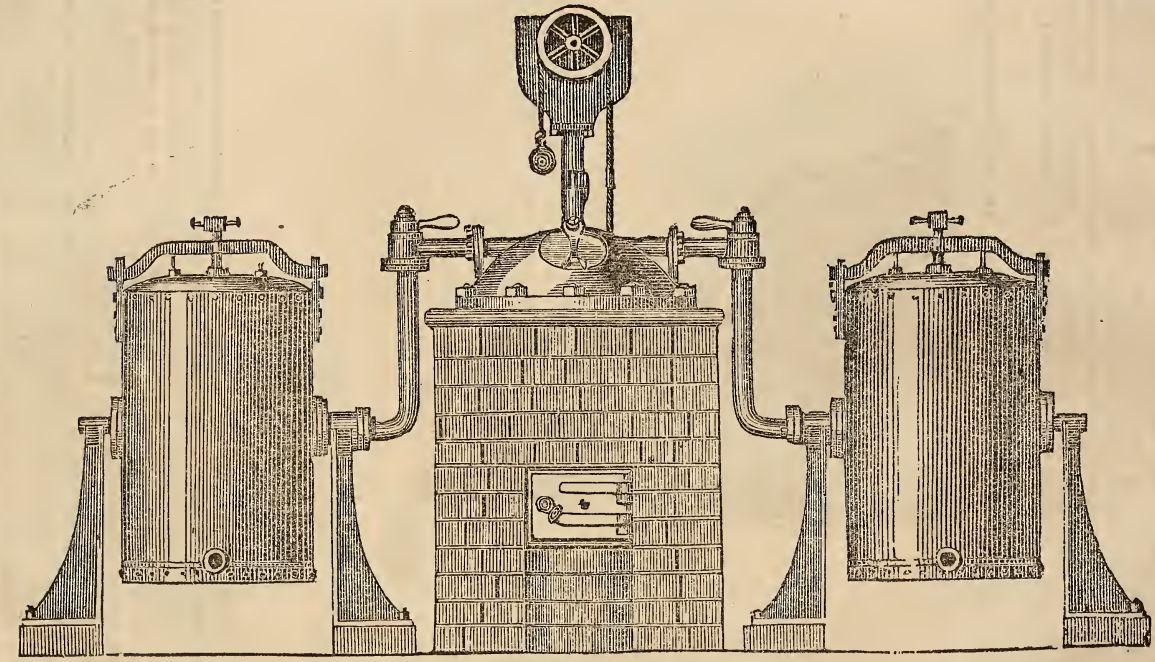
These are some of the considerations which should guide the farmer in making choice of the means of cooking food for his farm stock—a mode of preparation now conceded to be a great annual pecuniary saving. PRINDLE.

ADVANTAGES OF STEAM IN FARM ECONOMY.

The application of steam to the various purposes of farm economy may appropriately claim a place alongside of the improvements which have recently been made in the means of transmitting intelligence through the agency of the telegraph.

Steam is capable of performing almost anything, where force is required, in the cycle of human industry; yet fears of explosion and scalding have deterred many from availing themselves of this great labor-saving agency, and hence its limited use in farm economy. The lack of a perfectly safe and easily managed low pressure apparatus, competent to meet all the demands of domestic use, has greatly retarded the introduction of steam in farm management.

The prominent advantages of using steam in cooking, heating and boiling, are found in the celerity with which these operations are performed, and the limited amount of water and fuel required, rendering the labor of the operator an easy task, as well as the adaptability of any kind of vessel, wood or otherwise, to the purposes to be accomplished. By using a steam apparatus, as indicated, in cooking food for stock, there is no refilling of kettles to get the desired quantity, as in the ordinary mode; no occasion for constant watching and stirring to prevent burning. By this method there is no cleaning of kettles for any separate job. By this agency large quantities of food may be boiled or steamed at the same time by the addition of vessels as circumstances may render necessary, and when desirable steam can be conveyed through pipes or logs some distance, care being taken to prevent condensation, thus diminishing the chances of danger from fire if any there be. Steam is thus made available for the various purposes of domestic economy, as well as for the manufacture of many compounds rendered dangerous from contact with fire under ordinary circumstances. By this agency clothes may be steamed in the barrel, the water in the bath tub warmed in the adjoining room; hogs scalded after having been fattened on the food prepared by it; tallow rendered in wooden vessels without danger of burning, &c. Steam propels boats, rail cars, mills, factories,—in fact everything in the commercial line; and there is certainly no good reason why the labor of the farmer should not be expedited by the same means. This is readily done by the low pressure, simple and safe apparatus, which is here commended to public approval. PRINDLE.

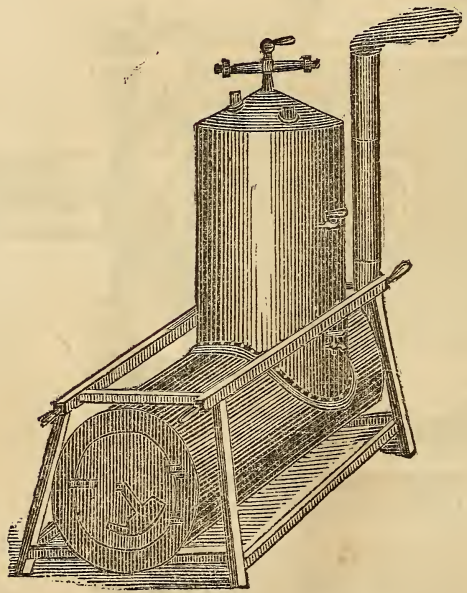


APPARATUS FOR COOKING FODDER, (Not Portable.—See description, next page.)

The reader will please compare this cut with the Prindle Illustration, page 61.

As a matter of comparison with the Prindle Steamer, and other modern improvements, as to cost, simplicity, portability, adaptability to all the wants of the farmer, we have no hesitation in presenting our readers the above cut, of European origin. It will be noticed that the apparatus is set in brick work, therefore not portable. The expensive fixtures, as shown in the cut, with cooking vessels of iron, trunions, costly covers, &c., are dispensed with in the more modern improvements of the present day.

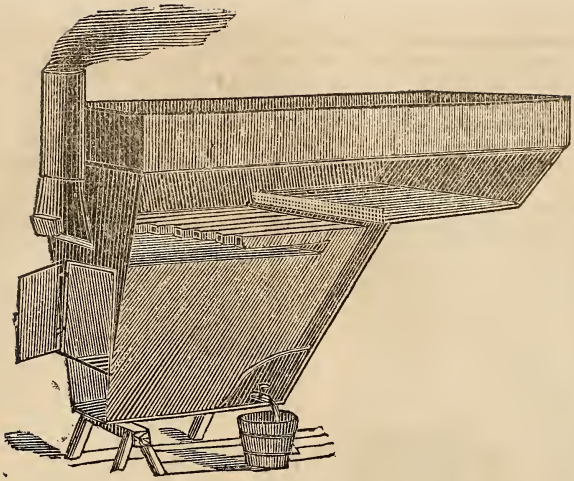
In practice, wooden steam vessels are found to be superior to iron, and cost much less (see article on steam vessels). The reader will notice in the above cut an attempt to produce an apparatus similar to the Prindle Boiler; but practice and modern improvements has demonstrated the impracticability of *bolts and nuts* for a convertible caldron and steamer, as nuts, bolts, &c., corrode, and twist off, and are also in the way of the packing, thus preventing the ready removal of the dome or steam chamber. The amount of expense and machinery attached to this apparatus makes it impracticable for general use, although some of its features are noteworthy.



No. 2.—HORIZONTAL CYLINDER BOILER, with Water Tank, &c.

This cut represents a wrought-iron Steamer, intended more for heating water and dairy purposes It is constructed on the principle of the upright, or one cylinder within the other, and has, like them, a great radiating surface and, consequently, loss of heat. No way appears to be provided to clean them, except to blow them off like tubular steam boilers. This boiler, we believe, has never come into use, and is rather costly to make, like all wrought-iron boilers that are of sufficient strength for safety or durability.

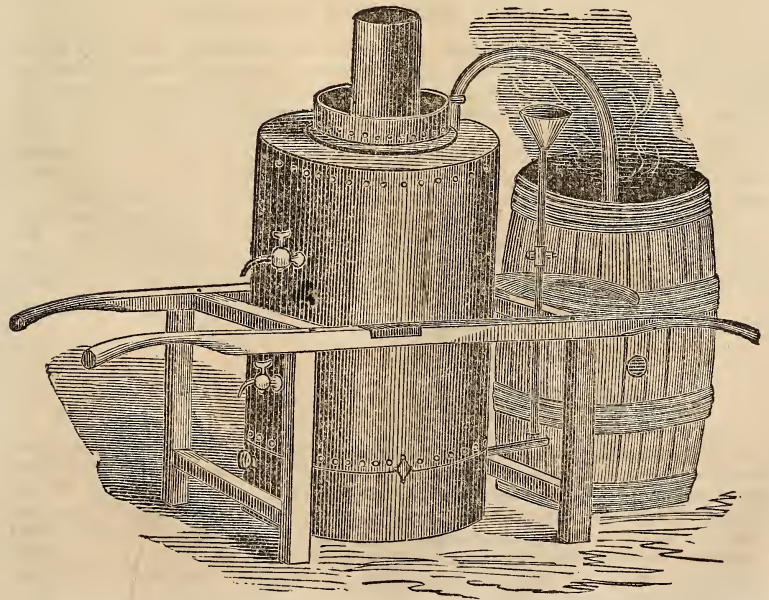
N. B.—The entire surface of this boiler being exposed to the air or cold, it will be seen to radiate or lose a large per cent. of its heat.



No. 3.—SORGHUM, AND OTHER PANS, AS FODDER COOKERS

This cut represents a common sheet iron apparatus, first introduced for a sorghum evaporator; but since cooking for stock has received such an impetus, it is now claimed, with a slight modification, to be adapted to cooking on the farm. It will, however, be noticed that no pan can be used for all kinds of cooking, as hominy, or other substances, except, perhaps, corn in the ear, as they will either fall through the false bottom, or the juices will run through and will burn on to the pan below. No ordinary sheet iron pan can stand steam under *much pressure*, hence are not adapted to all kinds of cooking on the farm.

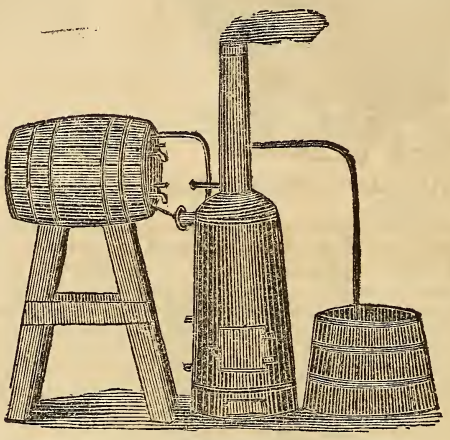
N. B.—Dry Corn, before it can be steamed, must be soaked thoroughly, or boiled in water.



No. 4.—UPRIGHT CYLINDER BOILER.—(For description see next page.)

The preceding apparatus is made of wrought iron, in two cylinders—one within he other, having but a small space for water. This upright form is not new nor does it differ materially from the horizontal cylinders which are sometimes used in brick work, or as shown in cut No. 2, which combines the same with its water reservoir. It is an acknowledged fact that all sheet iron boilers, with very small water space, will in time fill up with sediment, lime from hard water, &c.; and when used for only a portion of the time will corrode within, and soon become unsafe.

All boilers made of wrought-iron should be made of good thick materia and by a known and reputable *boiler maker*, or they will be unsafe for domestic use



No. 5.—THE ANDERSON STEAMER.

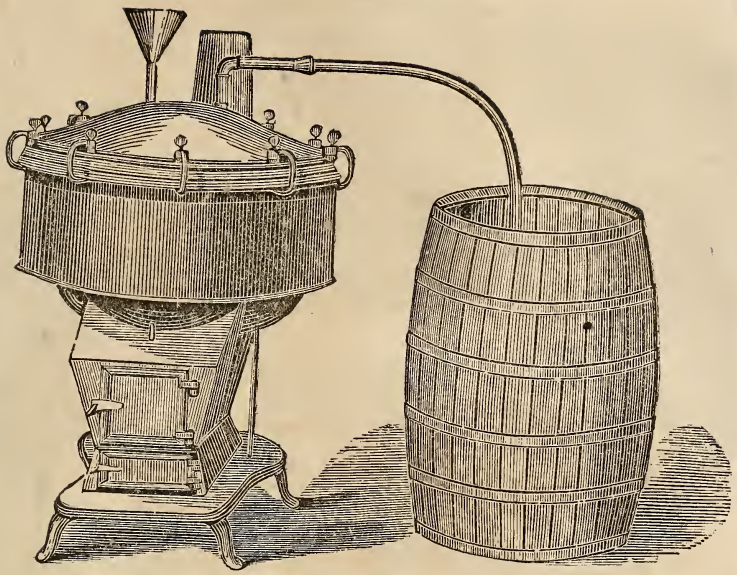
The above apparatus is made similar to the preceding, with very small water space between, and requires nearly a *constant supply of water*. Nothing new appears in this steamer, as elevated water feeders, pipes, cocks, &c., are old, and can be attached in various ways to any boiler, but are generally in the way, and not as economical for practical use as some other modes of feeding the boiler

This boiler being made of thin iron, and with a *small water space*, is deemed short lived, and will fill up with lime and sediment, as no way is provided to clean them out, except to blow them off similar to the common steam boiler.

Like other thin sheet iron boilers, when corrosion within takes place from not being in constant use, they are soon rendered unsafe and short lived. Al the hoops that are now being added to this boiler will not prevent danger, when corrosion takes place within. Such are the opinions of eminent boiler makers.

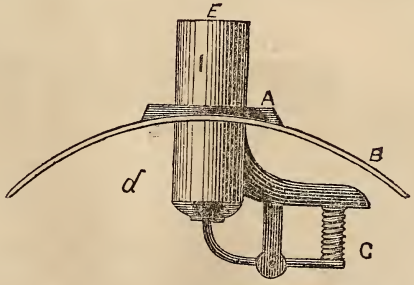
COIL TUBING AS A STEAM GENERATOR.

This apparatus has been tried by *coiling* or forming iron tubing into various shapes or forms, and placing the same in a suitable furnace for heating. The lower end of the coil receives the cold water, while the upper conveys off the steam. These coils are expensive to make, and have long been known by scientific men to fill up with depositions of lime, scales, &c., from hard water, thus rendering them in time worthless for steam generators. As conveyors of steam, where no lime is deposited, this objection is removed. See the testimony o scientific men on this subject.



No. 6.—A COMBINED CALDRON AND STEAMER.

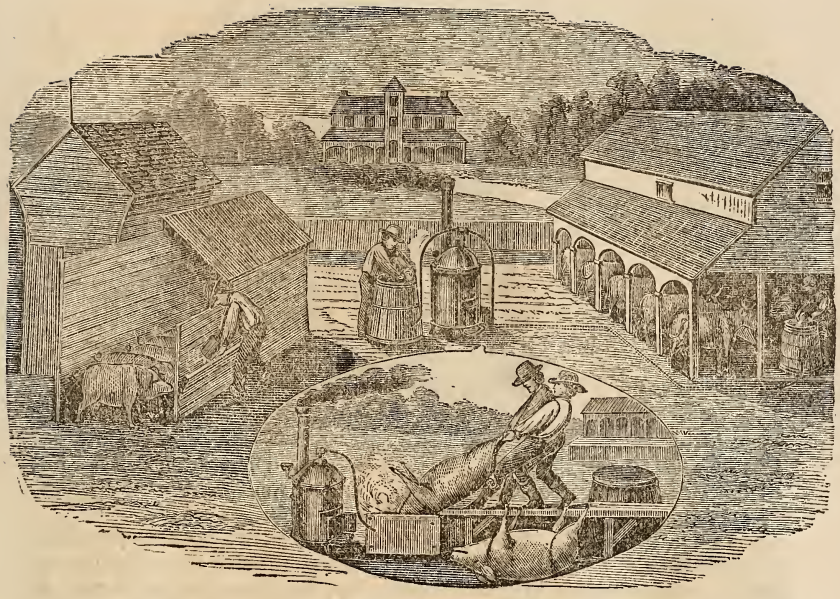
The above cut represents an Illinois coal furnace, with a common caldron and without the dome, as would appear in the cut, is used with a tin or sheet-iron cover; and, to make it sell well, it is said not to blow up. All of which is very true, as *no kettle, when not under pressure, is liable to burst.* Failing in this deception, the parties have now added a dome for steam, as shown in the cut, similar to the Prindle Boiler, of which it is an infringement; and steps are now being taken to prosecute all persons selling or using it. NO COMBINED AND CONVERTIBLE CALDRON AND STEAMER, EXCEPT THE PRINDLE, is now in use, unless an infringement on the *Prindle patent.* The furnace to the above cut has a small base, and is liable to tip over; and it will be seen to radiate a large per cent of the heat, for want of proper linings, &c.



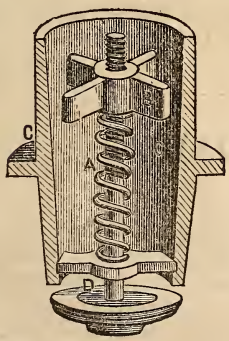
No. 7.—SAFETY VALVE AND APPENDAGE, a New York City device.

This little device shows plainly a designed infringement of the Non. Explosive Safety Valve of Prindle's, the only difference being the substituting of the spring within the boiler where it cannot be reached to adjust or keep in order, without taking off the dome to the boiler. It is therefore considered impracticable, and shows conclusively the importance of Mr. Prindle's invention See cut of the Prindle valve.

PRINDLE'S NON-EXPLOSIVE STEAMER AND CALDRON. Illustrated Twelve Page Circulars Free.

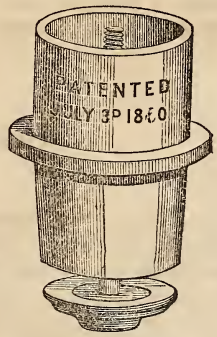


This Cut Represents the Prindle Steamer, as Adapted to Farmers' Wants.
SEE CUTS ELSEWHERE.



Section of Prindle's new Patent vacuum and pressure valve, showing all its parts. A is a spiral spring which controls the vacuum valve D. B a nut or guide for sustaining in position and controling the spring and lower valve. C the flange or steam joint which rests on the boiler, and held by weights.

PRINDLE'S PATENT PRESSURE and VACUUM VALVE.



This cut shows the perfect valve as it appears when in use on the boiler resting upon the flange with clapper D in the boiler. By the use of this simple device all danger from explosion is quite impossible. No boiler would be practicable for domestic use without something of the kind.

N. B.—It will be noticed that when the boiler is out of water, *a vacuum is* formed instead of pressure. Hence, the suction acts upon the spring, and opens the lower valve, as shown above, thus making a *pressure* and *vacuum* valve in one device.

FARMER'S BOILER & FURNACE.

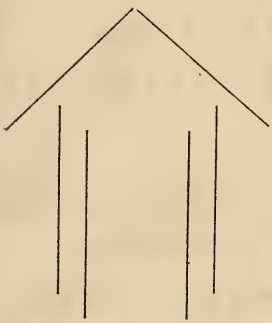
For soap, lard, tallow, sugar, oil, COOKING FEED, &c., &c. UNLIKE ANY OTHER it has an air chamber around the fire box, to prevent loss of heat. It cannot tip over, having a broad *base*. Is light to handle and cheap. This open boiler can be had separate from the *steamer fixtures*, and of various sizes. *No other portable caldron and furnace* has the great advantage of being readily converted into a steamer *without infringing the Prindle patent.*

MAKING STEAM BOXES.

These may be in the form of a round tub, a little tapering, or square, with frame to clamp it, and should be of inch and a half or two inch staves and two-inch heads, of good, clear, durable lumber. A trap two feet square is made in the top head when it can stand erect, (the best mode.) This should be sawed in beveling, at an angle of 45 degrees, which will be easier to pack steam tight.—A small door is also sawed in same manner near the bottom, and to be secured with suitable *clamps*, packing, &c., steam tight. These tanks are usually made with a false bottom two inches high, on stringers of inch strips, and made of narrow slats or boards 4 to 6 inches wide, in two parts, or movable for cleaning. These stringers under the false bottom have notches on lower edge to let the steam or condensed water have full and unobstructed passage.

The above description of tanks relate to those usually made for steaming cut feed. Large, thick oil barrels, &c., are frequently used for cooking-vessels for hogs. Experience will teach any one to vary the construction of the tanks or other appendages as circumstances require. (See article on Steam Boxes by Stewart, &c.)

SPARK CATCHER.



These devices are made in various ways, but are seldom required. Fear, or fancy, however, may require a passing notice of them. No more danger exists from a smoke pipe from a very low pressure steam generator than from any ordinary stove-pipe.

The cut shows an additional section, or drum, one foot in length,—two inches distant from smoke-pipe to which it is attached, with cap over the whole, and is said to serve as a spark extinguisher, as well as a *cap*, which is indispensable to any smoke-pipe. Another device is sometimes used, made of wire cloth of about $\frac{1}{8}$ inch meshes, one foot wide and directly under the cap, above the pipe.

In either case the supports are narrow strips of iron, riveted on to the various parts. These can be made by any common tinman.

Wire cloth is liable to fill with soot, and hence requires cleaning by whipping, or it will obstruct the draft. This is the greatest objection to its use. With the *check flue* on the *Prindle boiler*, no danger is apprehended from this source. A sufficient length of pipe or chimney is the best safeguard.

N. B.—Great caution is required in the use of any device that will obstruct the draft.

☞The brevity, and haste with which this little work has been prepared, in the intervals of *farm labor*, is a matter of no little regret; and we trust the reader will pardon all errors or omissions in treating thus hastily this important subject, with the assurance that this work will be revised at an early day, and made to keep pace with the modern science of stock feeding.

PRINDLE.

FARMERS, STOCK BREEDERS AND OTHERS!

SAVE YOUR FEED!
ECONOMY IS WEALTH!

COOKING FOR STOCK!

THE

PRINDLE AGRICULTURAL STEAM BOILER & CALDRON

Is especially adapted to all the wants of the Farmer, Stock Feeder, Planter and others. It is

SAFE, CHEAP AND PORTABLE.

OPENS AND SHUTS, is easily cleaned, and can be managed by any person of ordinary capacity. *No other Combined Apparatus is in market, unless an infringement of this patent.*

N. B.—Illustrated Circulars giving full details, free.

D. R. PRINDLE, Patentee and Prop'r,
EAST BETHANY, N. Y.

BARROWS, SAVERY & Co., Manufacturers,
PHILADELPHIA.

COLLINS & BURGIE, Manufacturers,
CHICAGO, Ill.

CAUTION.

Since the introduction of a safe apparatus for generating steam for domestic purposes by the subscriber, many attempts have been made, and are now making to palm off upon the public other kinds of boilers. Some have merit for *steam alone,* some are short-lived and unsafe, while *all* that have come under my notice are not *convertible,* that is, cannot be opened and shut at will, or cleaned, and consequently will corrode and form scales of lime, iron, &c., upon the inside, thus rendering them subject to premature decay, and that more especially when not in constant use upon the farm. This is an established fact, laid down by scientific men, hence the importance of my claims.

N. B.—ALL INFRINGEMENTS will be promptly prosecuted.

☞Twelve Page Illustrated Circulars free.

D. R. PRINDLE,
Patentee and Proprietor of the Original Prindle Steamer,
EAST BETHANY, N. Y.

D. R. PRINDLE,

Practical and Experimental Farmer,

AND PATENTEE

OF THE ONLY STRICTLY

NON-EXPLOSIVE CONVERTIBLE STEAM BOILER AND CALDRON.

☞See ILLUSTRATED 12 PAGE CIRCULAR, sent free by all authorized agents.
PRIZE ESSAY BOOK sold wholesale and retail by the subscriber.
N. B.—A liberal discount to the trade.

D. R. PRINDLE, East Bethany, N. Y., or
BARROWS, SAVERY & Co., Philadelphia, Pa.

PRICE LIST

OF

PRINDLE'S AGRICULTURAL STEAMER & CALDRON.

PRINDLE'S PATENT
AGRICULTURAL STEAM BOILER and FURNACE.

		WEIGHT. WOOD.	COAL.	PRICE. WOOD.	COAL.
No. 1—1 barrel,		330lb.,	380lb.,	$45.00	$50.00
No. 2—2	"	480lb.,	575lb.,	65.00	70.00
No. 3—3	"	610lb.,	670lb.,	85.00	90.00
No. 4—4	"	810lb.,	927lb.,	105.00	115.00

(N.B.—Nos. 2 and 3 are common sizes for Farmers.)

Steam Boiler without Furnace

FOR BRICK WORK.

No. 1—1 barrel,	.....	250lb.,	$35.00
No. 2—2	"	400lb.,	50.00
No. 3—3	"	450lb.,	60.00
No. 4—4	"	500lb.,	70.00

PRINDLE'S PATENT
AGRICULTURAL FURNACE
AND CALDRON.

		WEIGHT. WOOD.	COAL.	PRICE. WOOD.	COAL.
No. 0 —15 gallons,		175lb.,	209lb.,	$18.00	$20.00
No. 1 —20	"	260lb.,	320lb.,	24.00	28.00
No. 1½—30	"	305lb.,	380lb.,	28 00	32.00
No. 2 —40	"	365lb.,	460lb.,	23.00	38.00
No. 3 —50	"	485lb.,	545lb.,	38.00	43.00
No. 4 —60	"	.....		43.00	50.00
No. 5 —80	"	.....			
No. 6—100	"	.....			
No. 7—120	"	.....			

CAPACITY OF THE PRINDLE STEAMER.

To enable any person to judge of the size best adapted to their wants, we give an average approximation as adapted to *cooking for stock*, &c., as a basis, believing that an opinion may be formed readily as to other kinds of business for which it is adapted.

No. 1 will cook for a few Hogs; heat a barrel of water, or steam 20 bushels cut feed, &c.

No. 2 will cook easily for 50 hogs or less; boil four barrels water at a time, or steam 50 to 70 bushels cut feed twice a day, or cook for 250 men, doing all the boiling, such as VEGETABLES, MEAT, COFFEE, &c., &c.

No. 3 will cook for 50 to 80 hogs, or 75 to 100 bushels cut feed twice a day, &c.

No. 4 will cook for 80 to 100 hogs. This size is well adapted to small tanneries.

N. B.—Nos. 2 and 3 are as small as are generally sold to farmers.

☞***DOUBLE CAPACITY*** may be obtained, (where portability is no object,) by setting two in Brick Work, with arch and flues for wood or coal. (*See Price List without Furnace; also Illustrated Directions for Using, &c. Always sent free.*

N. B—It is Economy to order a size large enough for all purposes.

Barrows, Savery & Co.'s

SUCCESSORS TO SAVERY & CO.'

CORNER OF SOUTH FRONT and REED STS.

PHILADELPHIA.

MANUFACTURERS OF

PRINDLE'S PATENT

Agricultural Steamer and Caldron

FOR WOOD AND COAL.

SAVERY'S PATENT

DINING ROOM WATER COOLER

And Refrigerator Combined.

BARROWS' PATENT

Enamelled Bath Tubs, Wash Stand Tops, Sinks, &c.,

AND A FULL ASSORTMENT OF

Cast Iron Hollow Ware,
Enamelled and Tinned Ware,
Wrought and Cast Handle Sad Irons,
Wagon Boxes,
Field & Garden Rollers, &c., &c.

JAMES C. HAND & Co.,

FACTORS,

No. 614 and 616 Market St., Philadelphia.