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CONCRETE FOR PERMANENCE

Concrete Stave Silos

BROOKS PATENT

JOHN S. COPLY, Agent
MODESTO CALIFORNIA

GUARANTEE

The Brooks Patent Concrete Stave Silos, put up by us, are guaranteed to be of good material and workmanship, and will keep the silage in the best of condition when the silo is properly filled.



WARNING

The "Brooks Concrete Stave Silo" construction is fully protected by United States Patent No. 1,122,250, dated December 29th, 1914, and also our Patent C. S. Door Hanger, which is protected by United States Patent. Any and all infringers or users not properly authorized, will be prosecuted to the full extent of the law.

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Concrete Stave Silos

BROOKS PATENT

AIRTIGHT, FIREPROOF, RATPROOF
WATERPROOF, WINDPROOF
PERMANENT

JOHN S. COPLY, Agent
MODESTO CALIFORNIA

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no. 1.

What the Silo Will Do

It takes a good farmer to make two blades of grass grow where one grew before. It takes a better farmer to grow two bushels of corn where formerly one bushel was grown. The farmer who can make \$2 this year where he made \$1 last year is a good business man. Any farmer can do what amounts to these very things with only a small additional investment and without extra labor. He can build a silo and save all of his crop and make valuable food of it for practically every farm animal. The preservation of corn and other cover crops in the form of silage is an ancient practice. Silage was first stored in underground pits, where much of the contents spoiled. It is interesting to note that the silo originated in France and was introduced into the United States in the latter part of the eighties. Experiments everywhere prove beyond doubt that the silo is an immense success.

Just consider that in converting corn into silage it is easy to almost double the feeding value per acre of the crop. Corn is mentioned because, generally speaking, it is one of the best field crops for siloing.

Perhaps the biggest argument for a silo in connection with scientific feeding is that the silage taken from it, fed in conjunction with alfalfa hay or other legume crops, such as clover, peas, etc., makes nearly a perfect balanced ration. Silage is a juicy, appetizing feed, uniform in quality at all seasons, relished by farm animals, and has a combined tonic and laxative effect upon the digestive organs.

In these days of high land values and increasing cost of all farming operations, it is important that the farmer obtain from his crops the greatest possible feeding value per acre. He must grow forage crops that contain the highest proportion of materials which actually go to make bone, flesh and fat.

About 40 per cent of the entire feeding value of corn is in the stalks and leaves. As the corn crop is harvested on many farms, this portion of its value is lost. Is it good business to go to the expense of producing this crop, robbing the land of its valuable elements, and then losing this 40 per cent of food value by letting the stalks and leaves go to waste?

No other farm building holds as much feed for the same cost of construction. Perhaps no other building contains food the value of which is as great. The average silo in use contains food valued at from four to five hundred dollars and for this reason it is important that a silo should be made of permanent material in order that the food may be saved in case the barn should be destroyed by fire. Many a valuable herd has been sold at a sacrifice owing to the fact that a fire consumed all the feed. If the silo is of permanent construction, it will not be destroyed. In case of fire a temporary building for the herd can be constructed quickly and the silage used for feeding; thereby saving in many cases valuable animals which would otherwise have to be sold if it were necessary to purchase feed on the market.

The Theory of Silage

Silage, or ensilage, as it is also known, is a finely chopped fodder which is preserved in its green condition by being stored in a tank-like structure called a silo.

The process of making and keeping silage is similar to that used in preserving fruits and vegetables. The silage crop is harvested at the proper stage of maturity, and cut into lengths of one-half to one inch by a power-driven cutter. It is then elevated or blown into the silo, where it is well compacted by tramping, thus forcing out the air between the particles.

The making of silage consists largely in a series of fermentation processes. Bacteria pass into the silo with the green fodder and after a short time begin to multiply there, favored by the presence of air and moisture and an abundance of feed material in the fodder, especially soluble carbohydrates. The bacteria feed upon these substances and break them up into acids, like lactic and acetic acid, and simple gaseous components, mainly carbon dioxide and water vapor. Considerable heat is evolved in this process. Most of the bacteria found in silage can not live in the absence of oxygen, and the amount of air available determines, therefore, how far the decomposition processes will run and the resultant losses of nutritive materials. When the supply of oxygen in the air spaces in the siloed mass is exhausted, the bacteria die and the fermentation processes cease, unless more air is admitted; hence it is important that the silo be air-tight and no air be admitted through the silo wall, or at the bottom.

The making of silage depends also to a considerable extent on the growth of enzymes in the green tissues and on the respiration of the plant cells, which continues as long as these are alive. The relative importance of the various processes concerned in the making of silage has not yet been fully established; it is known definitely, however, that reducing the air supply in the silo to a minimum is an all-important factor in successful silage making, and this is accomplished by solid packing of green fodder and by preventing the entrance of air from without.

The air can not be completely excluded from the silo; there will always be sufficient left in the air spaces of the siloed mass to supply the oxygen necessary for the run of the changes involved in the process of silage making. Unless the amount is reduced to a minimum by careful packing and by providing an absolutely air-tight silo the losses of valuable feed components will be abnormally large, although a good quality of silage may still be secured.

The silo wall must be water-tight so as not to allow moisture from the green fodder to escape, as the silage would otherwise dry out, and molds and yeasts would be able to grow therein and cause the silage to spoil.

A thin layer of silage at the top will spoil, and, by so doing, forms a seal which excludes air and keeps the remainder of the silage in per-

fect condition even for several years. Often this seal is made of green stalks from which the grain has been removed or of a thoroughly wetted and compacted covering of chaff or straw upon which oats are sown and allowed to sprout. Such a covering of sod acts as a wet, air-tight blanket and takes the place of a seal-layer of the more valuable silage.

Crops Available for Silage

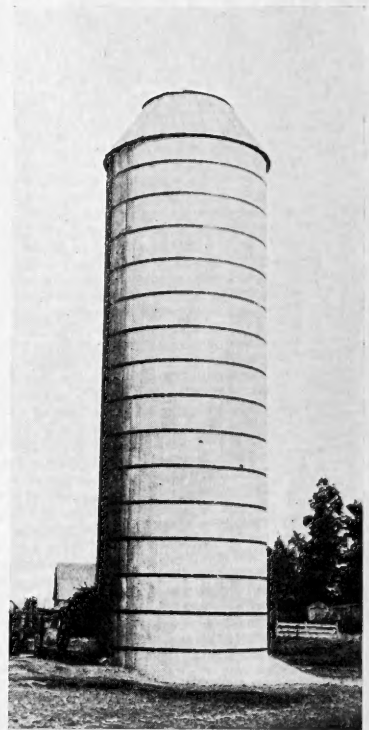
With due care silage can be made from almost any green crop. On account of the excess of air in their hollow stems and the difficulty of removing the same in packing, such plants as oats, rye, barley, clover, alfalfa, and cow-peas must be thoroughly tramped. In fact, with silage of any kind, every three- or four-inch layer should be well tramped, especially next to the wall. By thus driving out the air, there is removed the cause of slimy and moldy silage so often mistakenly attributed to the material of which the silo wall is constructed.

When the silage crop is too ripe and dry to pack well, sufficient water is added either in the cutter or the silo to take the place of the dried-up plant juices. In the same way a fair silage can be made from dry fodder.

Discussion of Silage Crops

Indian corn thus far is grown for forage purposes to only a limited extent in the Pacific Coast States, partly because other forage crops do better in different sections of this territory. Indian corn is, however, pre-eminently the great American silage crop and is, generally speaking, better adapted for siloing processes than any other field crop. The reasons for this are easily seen. The thick stems and broad leaves of the corn plant pack well in the silo when cut; corn is rich in starch and other non-saccharine carbohydrates which insure silage of a moderate acidity, and it is relatively low in protein substances, so that the danger of undesirable fermentations in the silo is removed.

Corn is planted thicker when grown for silage than for grain and a larger proportion of nutrients are, as a result, obtained in the stalks in the former case. The closeness of planting varies somewhat in different sections, according to soil and climate. The common practice in growing corn for grain is to plant in hills three and one-half feet apart



C. L. Butler, Modesto, Calif., built this 12x40 Brooks Stave Silo.

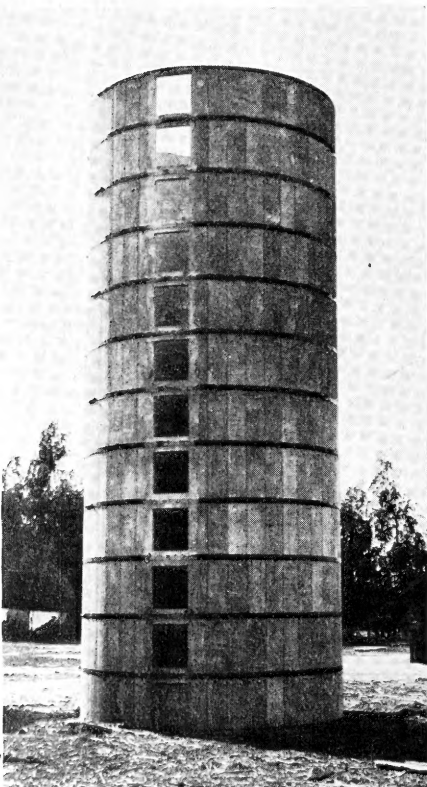
both ways; when intended for silage it is generally planted in drills three and one-half feet apart, with stalks eight to ten inches apart in the row. This will secure a fair proportion of ears and a maximum yield of feed materials in the crop taken off the land.

Experiments conducted with regard to the effect of different methods of planting corn have shown that the yields obtained are not materially influenced by the distribution of the seed so long as the amount of seed per acre remains the same. The question of planting corn in hills or drills may, therefore, be decided wholly on the score of convenience of cultivating and harvesting the crop.

In growing corn for the silo a variety should be selected that will mature in the particular locality given and that will yield a maximum amount of dry matter to the acre. Dent varieties, like Reid's Yellow Dent, Leaming, Minn. 113, or U. S. 160, will produce large yields of both grain and forage under our conditions. As the quality of silage made from well-matured corn is better than that from rather immature corn, the best practice is to allow the grain to nearly ripen before the corn is cut for the silo. This is advantageous also because of the rapid increase in the yield of feed materials in the corn plant during the last

stages of the growing period when the kernels begin to harden. If the grain is fully matured by the time the silo can be filled, a quantity of water added to the blower as the corn goes into the silo, or to the mixture in the silo, will secure a good quality of silage.

The amount of silage that can be obtained from an acre of corn will vary with the fertility of the land, the season, and the care used in growing the crop, from fifteen tons, or below, to thirty tons in exceptional cases. A fifty-bushel crop will yield eight to twelve tons of silage per acre, depending on the amount of foliage and stalks that accompany the ears. The general practice adopted by farmers in the corn belt is to silo the corn "ears and all"; the entire crop is run through a cutter and filled into the silo, where it is evenly mixed and tramped down carefully, especially along the silo wall. Carefully conducted experiments have shown that this method of handling the crop is more economical and convenient than to husk and grind the corn separately and feed it with silage made from the corn fodder or stover. One acre of corn silage made from the whole corn plant, including the ears, has been found to have a similar feeding value as



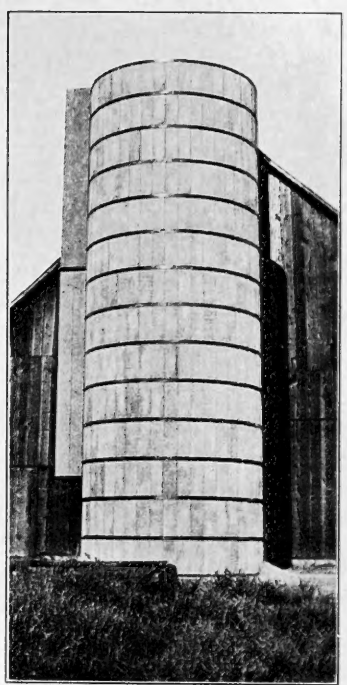
A 12 x 30 Brooks Stave Silo Owned by M. L. Appleton, Modesto, Calif.

one and one-quarter acres of silage made from corn fodder fed with the corresponding amount of ground corn.

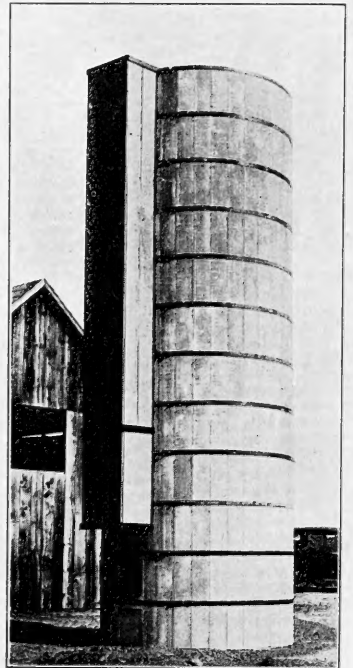
Sweet sorghum has been highly recommended as a silage crop under western conditions on account of its being more drought resistant than Indian corn. It will give better yields than the latter crop in regions where the rainfall is too low or too irregular for growing a good crop of corn. The sorghums are less liable to damage by insects than corn and remain green far into the fall so that they may be siloed considerably later than this crop. Yields of green sorghum of twenty tons may be secured on fertile land, or one-half again as much as an average crop of corn. In making silage from sorghum it is important that it be harvested late, when the seed has become hard, as it will make a very acid silage if cut at an earlier stage of growth. Cut at the time stated, it will make a good quality of silage of nearly similar feeding value and palatability as Indian corn silage. The two most important varieties adapted to forage and silage are Early Amber and Orange.

The *grain sorghums*, or non-saccharine sorghums (kafir, milo, Egyptian corn, feterita, etc.), are used for silage to a limited extent in this and other western States. They make a good silage if cut when the seed is ripe, and it is relished nearly as well by cattle as Indian corn silage. It is eaten in somewhat smaller amounts than this, e. g., for dairy cows twenty to twenty-five pounds per head daily is an average feed. In Kansas it was found that kafir silage ranked second to corn silage as a feed for dairy cows and that it is better than sorghum silage for the production of milk. In dry, hot sections, where the grain sorghums give relatively large yields and where Indian corn can not be successfully grown, these crops will doubtless assume great importance in the future as silage crops on dairy and other stock farms. In trials at the University Farm at Davis, Cal., the largest yields have so far been obtained from dwarf milo, feterita, and brown durra (Egyptian corn), in the order given.

Alfalfa is used only to a limited extent as a silage crop. There is ordinarily no difficulty in making it into good hay under the conditions present in the western States where this



J. H. Boren, Modesto, Calif., Is Proud of This 12 x 35 Brooks Stave Silo.



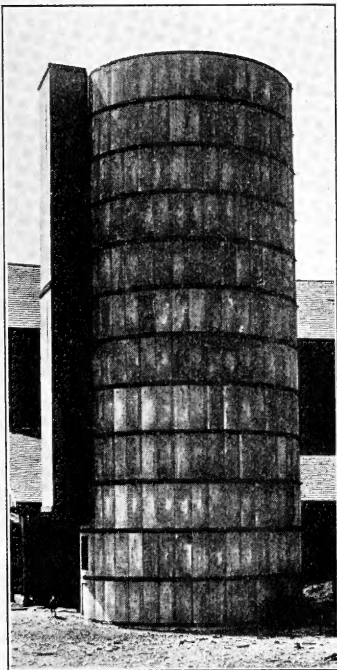
G. A. Allen, Modesto, Calif., Owns This 10 x 30 Brooks Stave Silo.

crop grows to best advantage and is of the greatest economic importance. It is, however, made into silage by many farmers, especially in case of the first and last cuttings. Since foxtail (*Hordeum murinum*) is often a serious pest in alfalfa fields during the early part of the season, the first crop is siloed by some farmers, and the foxtail thus rendered harmless; the beards remain soft in the silage and do not cause trouble to the animals eating it, as is generally the case when this crop is made into hay, especially if cut rather late when the foxtail heads are nearly ripe. Silage from such weedy alfalfa will be of good quality if put up in accordance with the directions given and is often better than that from pure alfalfa. The last crop of alfalfa is also sometimes siloed in the western States, owing to the rainy weather that is likely to prevail at this time, rendering it difficult to make hay from this crop.

If run through a cutter and siloed as soon as possible after mowing, before it has wilted much, and carefully tramped down in the silo, it will make a good aromatic silage, well relished by dairy cows, steers, sheep and other farm animals, after they have become accustomed to it. Like all silage made from leguminous crops, it has a strong and less agreeable flavor than corn silage, owing to the butyric acid formed therein, but stock soon learn to like it. It has not been shown, however, that alfalfa silage has a higher feeding value than corn silage, ton for ton, although it is considerably richer in protein and generally contains more dry matter per ton than the latter silage.

Clover and other legumes are not often used as silage crops for the reasons stated above, and when so used it is generally under similar conditions as those just given for alfalfa, when they can not very well be cured into hay. As the legumes have a large proportion of leaves and tender stems, they dry out rapidly and must be run through a cutter and siloed as soon as possible after being mowed. Clover, like alfalfa, is cut for the silo when about one-third of the plants are in full bloom, or before the first single heads are beginning to wilt. According to trials conducted at several experiment stations, the largest yields of dry matter and of all feed components, except fiber, are obtained from clover when it is cut at this stage. If the cutting has been delayed beyond this stage, the safer plan is to add water to the clover, either as it is elevated into the silo, or in the silo itself after each load or half-day run.

The losses of feed materials in the siloing processes in the case of clover, alfalfa, etc., are but slightly larger than for corn, so far as can be judged from the limited data at hand regarding this point. When put up in the manner stated in an air-tight silo, the necessary loss of



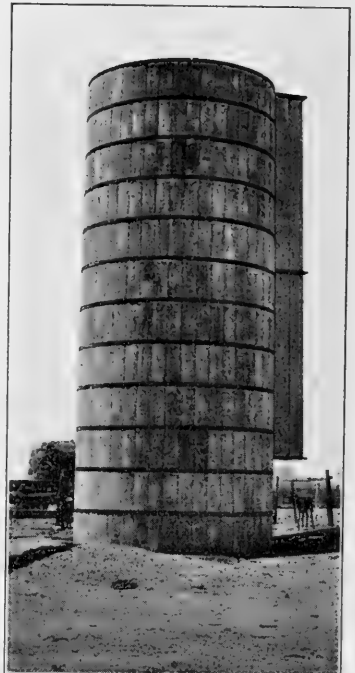
A 12 x 30 Brooks Stave Silo on Farm of O. G. Thomas, Manteca, Calif.

dry matter in these crops will not be likely to exceed 10 per cent. This is a much lower loss than that sustained in making hay from alfalfa (and probably from clover and other leafy legumes as well), on account of the unavoidable and often considerable abrasion of leaves and tender parts in the process of hay-making. This loss has been estimated at 15 to 20 per cent of the hay crop, as a minimum, and as high as 60 per cent in the extreme cases. Aside from the losses sustained through abrasion, rain storms may reduce the value of the hay by one-half. The losses from either of these sources are avoided in preserving the crop in the silo, and in their place a small loss of about 10 per cent or less will occur under ordinary favorable conditions, through fermentations and respiration of the plant cells.

The reason why legumes are not siloed more generally must be sought in the fact that it is more difficult to secure a good quality of silage from these crops than from Indian corn, unless the necessary conditions for success in making legume silage are clearly understood; furthermore, the flavor of the silage is not, as a rule, as agreeable as that of corn silage, and farm animals do not relish it quite as much at first. When once accustomed to legume silage, however, they do well on it; dairy cows will eat twenty to thirty pounds of clover or alfalfa silage per head daily. On account of the larger amount of protein furnished in this feed than in the corn silage, less or cheaper concentrates may be fed in the rations and the cost of production thus decreased.

Pea or corn cannery refuse is often put up in large silage stacks near canning factories or in ordinary silos. It makes a valuable feed for fattening cattle, sheep or dairy cows, and compares favorably with corn silage; by some feeders it is considered superior to corn silage, especially for dairy cows. It is also fed to horses, mules and hogs to a limited extent. Like other kinds of silage, it should be fed with dry hay or corn stalks and, for best results, with some grain feed, and not as the exclusive feed for the stock, as is sometimes done.

Green oats, volunteer grain, and other cereal fodders are occasionally siloed when grown for forage or in case they can not be used for



W. E. Sharp, Empire, Calif., Is Glad He Has This 12 x 30 Brooks Stave Silo.

grain. They are cut when the kernels are past the milk stage and filled into the silo after having been run through a cutter. If the grain has become nearly ripe, it is necessary to add considerable water to the green fodder as it goes into the silo either through the blower or in the silo after each load, and the cut mass must be carefully distributed and tramped down along the wall of the silo. Oat, barley or wheat silage made in this manner is of excellent quality and furnishes a very palatable, nutritious feed for cattle and sheep.

Beet tops and leaves are generally siloed in European beet-growing countries by being placed in large trenches in the field and covering these with boards or straw and a layer of dirt. Preserved in this way, they make a slimy, strong-smelling silage, which is, however, greatly relished by milch cows and fed heavily on the dairy farms on the Continent. Because of the shallowness of the pits, very large losses of feed materials are sustained by this method of siloing, viz, 25 to 33 per cent or more of the dry matter in the leaves and tops.

Beet pulp is preserved in similar trenches or shallow pits in western States where the manufacture of beet sugar is an important industry. The siloed ("cured") beet pulp is an excellent feed for fattening steers, sheep or dairy cows. As it is made mostly in regions where alfalfa is the main hay crop, it is, as a rule, fed with chopped alfalfa hay, which it supplements nicely, being high in insoluble carbohydrates and relatively low in protein. Its feeding value may be considered equal to about one-half that of corn silage.

Of other materials that are occasionally made into silage may be mentioned: Soy beans and cow peas (alone or with Indian corn), vetches, apple pomace, wet brewers' grains, sorghum bagasse, sugar



Every Owner of a Brooks Patent Concrete Stave Silo Is a Booster. Mr. Bishop Is a Typical Booster-Owner.

cane tops, potato tops, hop vines, sugar beet tops and shocked corn, rye grass and clover, alfalfa and Hungarian grass, thistles and other weeds. None of these crops are, however, of sufficient importance to call for more than mere mention.

General Remarks on Making Silage

In order to make good silage the crop must have a water content between 60 and 80 per cent; about 70 per cent gives the best quality of silage. With a water content toward the upper limit given, the silage will be very high in acidity, while if much below 70 per cent of water is present there is great danger of spoiled silage, and white or other molds appearing in the silo. Silage from such dry feed is, moreover, not as palatable as that containing a normal percentage of water. A limited amount of water added at the time of filling the silo will aid in making silage of good quality from a crop that has been allowed to dry considerably before cutting.

Indian corn is preferably cut for the silo by means of a corn binder, at the time of approaching maturity, when the kernels are beginning to harden. Legumes are cut at the beginning of bloom, and the cereals when the kernels are in the milky stage; in case of barley rather before than after this stage. Sweet sorghum and grain sorghums are cut when the seeds are hard and fully matured. This is of special importance in the case of sweet sorghum, which will make a very acid silage when cut at an earlier stage of development.

It is advisable to shred or cut the feed fine, in case of Indian corn and sorghum into half-inch pieces, and for cereals and other fine-stem forage into one-inch pieces.

During the filling of the silo one or two men must be kept in the silo distributing the cut mass and tramping it down carefully, especially along the wall. A cement tamper may be used to advantage in this work, which is of the greatest importance in securing good silage and minimum losses of feed materials in the siloing process. If need be, water can be added in the silo when filled, by means of a garden sprinkler, and the mass may be left to ferment and settle. Most farmers fill up the silo a second time after a few days to a week, as it will have settled four to six feet by this time in the case of tall silos that have been filled rapidly.

The silage will ordinarily be ready for feeding in two to three weeks after filling. In opening the silo the top six to twelve-inch layer of spoiled silage is removed, below which a good quality of silage will be reached. The silage will improve in quality as the silo is being emptied until the last foot or two is reached, which will be likely to be rather acid if the siloed mass contained considerable water or a good deal of water was added and the silo is not provided with a drain. If used for feeding, this sour silage should be fed to stock in only very small quantities.

The silage is kept level in the silo all the time during emptying so that as little silage as possible is exposed to the air and secondary fermentations thus avoided. A sufficient amount of silage should be removed daily to keep the silage from spoiling, viz: one to two inches, according to the air temperature. The silage must be fed out more rapidly in warm than in cool weather. It is, therefore, important that the diameter of the silo be no greater than that the stock on hand will be able to eat a layer of silage daily of the thickness suggested.

Once sealed in the silo, the silage will keep indefinitely without material changes after the first few weeks. Instances are on record of silage a dozen years old or more having been found of excellent quality and eaten by stock with great relish. If a silo is not completely emptied by next filling time, the new crop may be placed directly on top of the old silage; if this is carefully leveled off immediately before filling there will be no spoiled silage at the juncture of the two crops.

In emptying the silo it is convenient and, in case of outside silos almost necessary, to provide a chute or conveyor through which the silage may be thrown directly into the feed truck or the wagon. The silage should be placed before the stock in one or two handlings and should not be allowed to dry out appreciably before being eaten by the animals, as it will otherwise lose some of its palatability. In the case of weedy alfalfa silage and barley silage the foxtail and barley heads,



J. M. Benoit, Modesto, Calif., Has a Wonderful Herd of Cattle, and His 12 x 35 Brooks Stave Silo Is Equally Good.

respectively, will soon dry out, if left exposed, at least in hot weather, and will be likely to injure the mouths of the animals, especially if siloed at a rather advanced stage of maturity.

Feeding Silage

Silage makes an excellent feed for dairy cows, fattening cattle and sheep, and is also fed to advantage in small quantities to other classes of farm animals. The following amounts of well-preserved Indian corn silage may be fed safely to the different classes of live stock, somewhat smaller amounts of other kinds of silage being given, viz:

Dairy cows, twenty-five to forty pounds per head daily.

Heifers and young beef stock, ten to twenty pounds.

Fattening steers and beef cows, twenty to thirty pounds.

Horses, five to ten pounds.

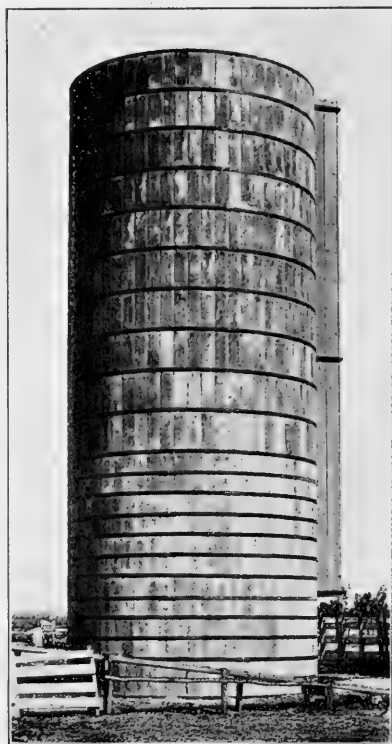
Wintering work horses, ten to twenty pounds.

Sheep, two to three pounds.

Brood sows, two to three pounds.

In feeding silage to horses and mules it is important to pick out lumps of moldy or decayed silage, as fatal results may follow the feeding of such silage. Other stock appear less sensitive to moldy feed than horses are, but such silage can not be fed safely in any case and should be thrown away. Alfalfa silage has been found to make a good feed for sows, fed as suggested, a couple of pounds per head daily.

Silage should never be fed as the sole rough feed to any class of farm animals, but always with dry roughage, like alfalfa, wild or grain hay, corn stalks, sorghum hay or cereal straw. In the case of dairy cows, growing or fattening animals, an allowance of grain feeds with silage and hay will produce good results, the amount to be given depending on the quality of the roughage, the production of the animals, and the relative prices of hay and grain. It may be stated, as a general rule, that when grain is worth more than twice the price of a good grade of hay it will only pay to feed it sparingly, except in the case of heavy-producing dairy cows, which can not be maintained at a maximum production unless they receive a liberal amount of grain, say a pound for every five to seven pounds of milk, according to the quality of the hay fed and of the milk produced.



Thos. F. Griffin, Modesto, Calif., Is Mighty Proud of This 16 x 40 Brooks Stave Silo.

Silage Rations for Farm Animals

The following rations are given as examples of combinations of different feeds with silage and dry roughage, with the amounts in each case that may be fed to the various classes of farm animals under the conditions present in California and Oregon:

Dairy cows:

- (1) Indian corn silage, 35 lbs.
Alfalfa hay, *ad lib.* (about 8 lbs.).
Concentrates (rolled barley, oats, dried beet pulp, wheat bran or shorts, linseed meal, cottonseed meal, cocoanut meal, etc., two or three mixed, according to current market prices), 5 to 8 lbs. per head daily.
- (2) Alfalfa silage, 25 lbs.
Wild hay or grain hay, *ad lib.* (about 10 lbs.).
Concentrates (same as before mentioned).
- (3) Kafir or milo silage, 30 lbs.
Alfalfa hay *ad lib.* (about 10 lbs.).
Concentrates (as before).

Fattening steers:

- (1) Alfalfa silage, 20 lbs.
Grain hay, 10 lbs.
Rolled barley, 8 lbs.
- (2) Indian corn silage, 25 lbs.
Alfalfa hay, 10 lbs.
Rolled barley, 6 lbs.
Cocoanut meal, 2 lbs.

Wintering cattle:

- Corn or sorghum silage, 20 lbs.
Alfalfa hay, 5 lbs.
Oat straw, 10 lbs.

Work horses:

- Silage, 5 to 10 lbs.
Hay, 10 lbs.

Oats and barley (1:1 by weight), or barley, wheat bran and cocoanut meal (3:3:1), 10 lbs.

Fattening sheep:

Silage, 2 lbs. per head daily.
Hay, 1 lb.
Oats and barley, 1 lb. each, or 1 to 1½ lbs. of other grain feeds.

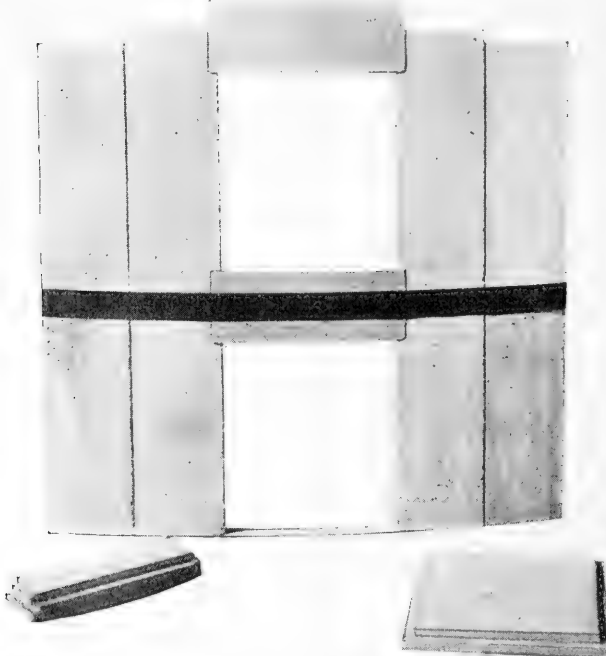
Breeding ewes:

Indian corn or sorghum silage, 3 to 4 lbs.
Alfalfa hay, 1 lb.

If alfalfa silage is available, grain hay or wild hay may be substituted for alfalfa hay.

What is the Best Silo?

A great deal has been written and many booklets printed dealing with the relative merits of silos made from different kinds of materials. Many a farmer has been bewildered on account of the conflicting arguments presented when trying to decide what kind of a silo to buy. In many cases this is the reason why a silo has not been built. Every farmer is familiar with the use of concrete and he knows when it is properly made it is a material that is everlasting. Thousands of concrete stave silos are used by farmers in all parts of the United



This Is a View of the Brooks Patent Silo Door Frame, Showing How An Almost Continuous Doorway Is Provided. This Is a Valuable Feature.

States. They are beginning to be extensively used in Canada. The old arguments about freezing and acid destroying concrete have been disproven by actual experience. The experiments conducted by the leading agricultural colleges of the United States prove that acid and freezing are not detrimental to concrete silos. The first attempts in using concrete for building silos was in the form of what is known as solid concrete silos. The great expense involved in securing material in the various localities, the cost of the forms required to build them and the length of time required for the construction work, made the total cost of the solid concrete silo almost prohibitive except in favored localities where there was easy access to sand and pebbles. Moreover, few localities have the proper gravel for manufacturing concrete. To make good concrete clean sand and pebbles are necessary.

Brooks Patent Concrete Stave Silo should not be confused with the solid concrete silo. The latter sometimes cracks because no provision is made for contraction and expansion. You will recall that in concrete sidewalks and in the new concrete roads of the State Highway joints are made to allow for contraction and expansion—and the Brooks Patent Silo is constructed on precisely the same principle.

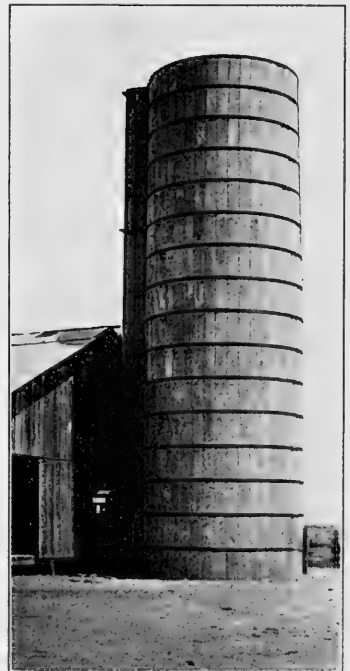
The Brooks Patent Concrete Stave Silos

Simplifying the building and lowering the cost of concrete silos has been the desire of those who know the value to the farmer of concrete stave silos. Various forms of piece construction in concrete have been invented and patented. The Brooks patent concrete stave silo is the latest improvement that has been offered to farmers. The Brooks patent concrete stave is 30 inches long, 10 inches wide and $2\frac{1}{2}$ inches thick. It is made of concrete mixed in the proportion of one part Portland cement and three parts clean sand, well graded. They are made in a modern factory by experienced workmen. The manufacture of the Brooks patent concrete stave is confined entirely to a completely equipped plant in order that the quality of the product can be guaranteed.

The disadvantages in making staves or other forms of piece construction, other than in a modern equipped plant, is the lack of facilities for properly hardening the cement. This is why the staves used in the Brooks Concrete Silo are not excelled.

Concrete Staves Are Curved

The Brooks Patent Concrete Stave is curved according to the diameter of the silo in which



This 12 x 40 Brooks Stave Silo Is On the Farm of F. Olarrea, Modesto, Calif.

it is to be used. The staves are joined together by tongue and groove. As each stave is cast in a steel mould, uniform, accurate joints are insured. The tongue and groove method of joining staves insures a more rigid wall construction than any other form of joint when the hoops surrounding the staves are tightened. The reason for this is that the square shoulders formed on each side of the tongue give perfect bearing surfaces for the square shoulders formed on each side of the groove of the adjoining stave.

Near the ends of the staves there is a slight offset or increase in the width on both the tongued and grooved sides for that part of the staves covered by the hoops. This projection can be detected by running your fingers along the edges of the stave near the ends. This projection eliminates all hoop strain on that part of the staves not covered by the hoops and prevents the cracking of the staves when the hoops are tightened. This has been the defect common with stave construction heretofore.

Hoops

Wide, flat bands, made of mild steel, are used for hoops. Lugs of refined steel, especially designed, are welded or riveted to the ends of the hoops for fastening around the silo. The lugs are bolted together with $\frac{5}{8}$ -inch bolts. These hoops can be furnished either galvanized or plain, dipped in asphalt.

Foundation for the Silo

A substantial foundation of concrete is necessary and the size will depend upon local conditions.

Inside Finish of Silo

As before explained, the inside of a silo should be as smooth as possible, to permit the silage to settle evenly.

The Brooks Patent Concrete Stave Silos are finished on the inside with a cement waterproofing mixture which makes a permanent finish. This treatment makes a smooth wall which is both air-tight and water-tight.



*C. Stout, Jr., Empire, Calif., Owns This
12 x 40 Brooks Stave Silo.*

Wall Construction

In beginning the construction of the silo, every other stave in the first course is two inches shorter than the adjoining stave, thereby breaking joints horizontally. When the next course is added, it will be noted that each stave interlocks with two adjacent staves. This insures a very rigid construction because the steel bands completely cover the joints and when tightened give full support to the meeting ends of all the staves.

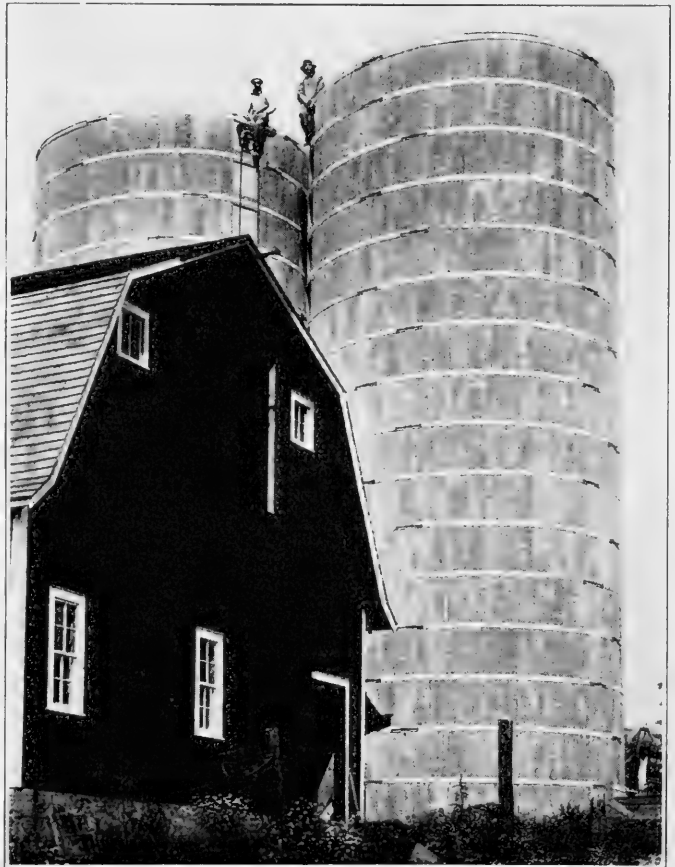
After the silo has been erected and the hoops properly tightened, the inside surface is worked over with a cement wash containing waterproof chemicals. This smoothens and hardens the interior surface of the staves and fills all joints, thereby making the wall air-tight and waterproof.

Roof and Chute

Metal roofs and chutes can be furnished. We recommend that metal be used. The chief fault of the wooden devices is the danger of destruction by fire, which might ruin the silage.

Size of Silo

The size of the silo to be built must be determined by the number of animals to which silage will be fed, and the length of the feeding season. As there is danger of silage spoiling if the silo is emptied too slowly, it is necessary to remove a layer of about two inches daily from the entire surface of silage during the summer months, and from one to one and one-half inches in cold weather. About five square feet of such a layer will furnish sufficient silage for a cow or a steer per day, hence the diameter of silos to be built should be approximately as fol-



Twin Brooks Stave Silos on the Dairy Farm of Lanners & Dixon, Bay City, Wis.

lows, if silage is to be fed during a period of six months: For a herd of sixteen cows, ten feet; twenty-four cows, about twelve feet; thirty cows, fourteen feet; forty cows, sixteen feet; fifty cows, eighteen feet; sixty cows, twenty feet; one hundred cows, twenty-five feet.

The following table shows the capacities of cylindrical silos of a diameter from ten to twenty feet and a height of twenty to forty feet:

Capacities of Brooks Patent Concrete Stave Silos

Size	Approximate Capacity Tons	Number of Cows	No. acres of corn 11-12 ton per acre	Size	Approximate Capacity Tons	Number of Cows	No. acres of corn 11-12 ton per acre
10 x 20	30	8	2.5	16 x 30	120	34	10.0
10 x 22½	34	9	2.7	16 x 32½	146	38	11.0
10 x 25	38	10	3.0	16 x 35	158	43	13.0
10 x 27½	42	12	3.5	16 x 37½	170	49	14.0
10 x 30	48	13	4.0	16 x 40	185	53	15.0
10 x 32½	55	14	4.3	16 x 42½	200	56	17.0
10 x 35	60	16	4.7	16 x 45	215	60	18.0
10 x 40	75	20	5.0	16 x 47½	230	64	19.0
				16 x 50	245	70	20.0
12 x 20	45	10	3.0	18 x 30	150	43	13.0
12 x 22½	53	12	3.5	18 x 32½	170	49	14.0
12 x 25	58	14	4.3	18 x 35	187	53	16.0
12 x 27½	71	17	5.0	18 x 37½	200	57	17.0
12 x 30	75	19	5.7	18 x 40	228	65	19.0
12 x 32½	80	21	6.3	18 x 42½	248	71	21.0
12 x 35	99	24	7.0	18 x 45	273	78	23.0
12 x 37½	110	26	8.0	18 x 47½	295	84	25.0
12 x 40	121	29	9.0	18 x 50	320	91	27.0
				18 x 55	375	107	31.0
				18 x 60	435	124	36.0
14 x 25	78	21	6.3	20 x 35	225	64	19.0
14 x 27½	88	25	7.3	20 x 40	275	78	23.0
14 x 30	100	28	8.0	20 x 45	340	97	28.0
14 x 32½	113	32	9.0	20 x 50	400	114	33.0
14 x 35	125	35	10.0	20 x 55	470	134	39.0
14 x 37½	139	38	11.0	20 x 60	550	157	46.0
14 x 40	150	41	12.0				
14 x 42½	163	45	13.0				
14 x 45	182	49	14.0				

Based on 180 Days' Feeding.

On account of the difficulty of handling the silage from very wide silos it is not to be recommended to build silos of larger diameter than twenty feet; it is also difficult to feed out the silage rapidly enough from very wide silos to prevent considerable losses through decay of the surface layer, except in cases of very large herds.

The figures for the capacities of silos given refer to Indian corn cut when nearly mature. Somewhat larger quantities can be put in of immature corn or of sweet sorghum, and less of dry corn, alfalfa, grain sorghums and similar crops that do not pack well. If cut when nearly ripe the grain sorghums will occupy at least one-third more space than Indian corn cut at the usual time, and the capacity of a silo for these

crops would then be decreased in this ratio from the figures given in the table.

DIAMETER IN FEET.	APPROXIMATE MINI- MUM POUNDS TO BE FED DAILY.	NUMBER OF ANIMALS TO BE FED FROM EACH SIZE OF SILO.					
		Horses.	500-lb. Calves.	Stock Cattle.	Beef Cattle.	Dairy Cows.	Sheep.
10	525	48	44	26	21	13	175
12	755	69	63	38	30	19	252
14	1030	94	86	52	41	26	344
16	1340	122	112	67	54	34	446
18	1700	155	142	85	68	42	567
20	2100	191	175	105	84	53	700

The following table gives the number of cows in herd and tonnage of silage for both one hundred and eighty and two hundred and forty days of feeding of forty pounds of silage per cow, also acreage of corn estimated to fill the silo and the dimensions of the silo itself. The diameters given are such that at least two inches in depth of silage will be taken off daily.

An acre of land gives about one ton of silage for every five bushels of corn. If any acre yields eighty bushels, it will produce about sixteen tons of silage. This table is based on a yield of fifty bushels or ten tons of silage per acre.

NUMBER OF COWS IN HERD.	FEED FOR 180 DAYS.				FEED FOR 240 DAYS.			
	Estimated Ton- nage of Silage Consumed.	Size of Silo.		Corn Acreage Re- quired at 10 Tons to Acre.	Estimated Ton- nage of Silage Consumed.	Size of Silo.		Corn Acreage Re- quired at 10 Tons to Acre.
		Diameter	Height			Diameter	Height	
	Tons.	Feet.	Feet.	Acres.	Tons.	Feet.	Feet.	Acres.
10	36	10	25	3½	48	10	31	5
12	43	10	28	4½	57	10	35	6
15	54	11	29	5½	72	11	36	7½
20	72	12	32	7	96	12	36	10
25	90	13	33	9	123	14	37	12½
30	108	14	34	11	144	15	37	14½
35	126	15	34	13	168	16	38	17
40	144	16	35	14½	192	17	39	19½
45	162	16	37	16½	216	18	39	22
50	180	17	37	18	240	19	39	24
60	216	18	39	22	288	20	40	29
70	252	19	40	25½	336	20	46	34

A silo should be planned for a larger capacity than is needed for the present herd. Experience in feeding silage has proven that the farmer always finds it so profitable he immediately plans to increase his herd. In this case the Brooks Concrete Stave Silo can be enlarged by adding to the height.

Many times a farmer desires to double his herd after he has learned of the saving to be had in feeding silage. It is, therefore, well to consider the possible requirements for the future in locating the first silo in order that the second silo can be conveniently added later.

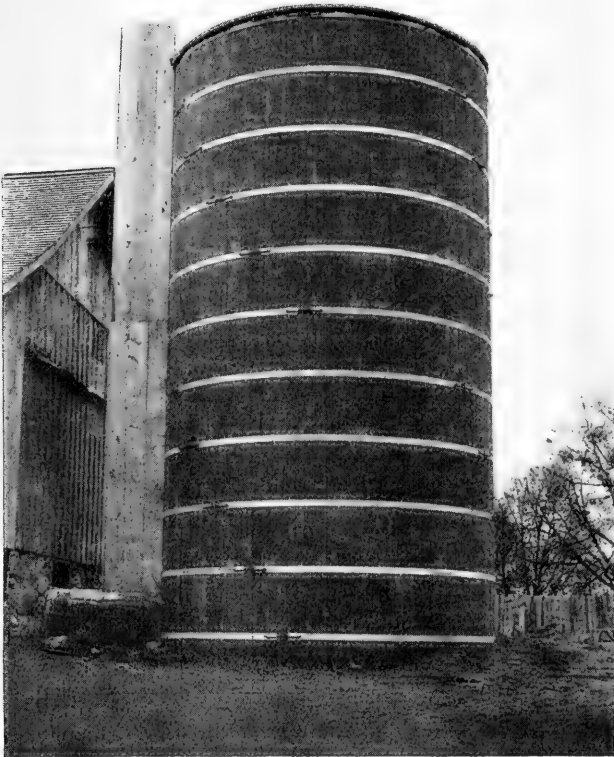
Acid in Silage

The supposed effect of silage acid on concrete has been one of the most widely discussed and at the same time the most absurd of the many common silo fallacies. Silage acid is one of the weakest acids known to science. It does not miraculously preserve wood nor destroy concrete. Silage juices will not eat away concrete nor injure it, which is proven by the fact that after years of service the concrete foundations of hundreds of silos built of other material still show, today, the trowel marks which were made at the time constructed.

Where it has been claimed acid affected concrete, investigation has proven that the concrete was made of dirty materials and a lean mixture. Concrete of such construction is highly absorbent. Where concrete is properly made, it is not affected by frost nor the acids in silage.

The Silo of Concrete Staves

The silo built of Brooks patent concrete staves is the ideal silo. It fulfills all the requirements. As stated on another page, the inside wall surface is covered with a cement waterproofing mixture which effectually renders it smooth, jointless, air-tight and water-tight.



A 14 x 30. Equipped With a Wood Chute. Owned by A. Kerkamp, Hazel Park, Minn.

The chief advantage of a Brooks patent concrete stave silo is its smooth, air-tight, water-tight, and non-absorbent walls. Probably next in importance is its safety from fire. This danger is perhaps the most serious one with which a farmer has to contend. When his buildings are once burning, there is little he can do other than to save the stock from destruction. If the silo and silage are destroyed, he must at once buy high-priced hay and grain for feeding.

Another point in favor of the silo of Brooks patent concrete staves is its resistance to windstorms. There is no other type of silo that is its equal in this respect. The weight of the concrete silo, even when empty, makes it so stable that no case is known where a concrete silo has been blown down by windstorms, even of the most severe nature.

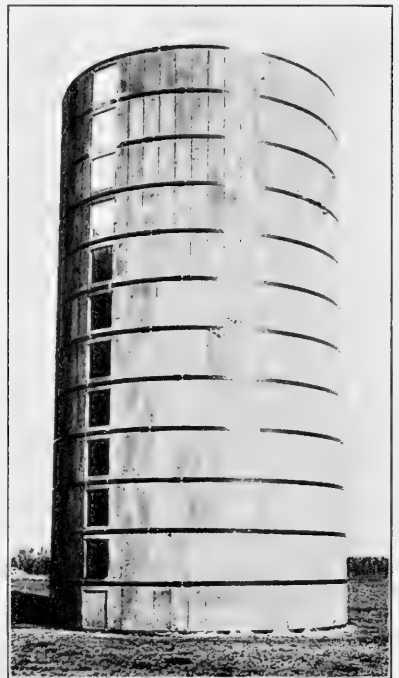
The fact that concrete excludes vermin is an added advantage to this kind of silo. Rats gnaw through the walls of wooden silos and build nests in the silage. The air thus allowed to enter causes moldy silage for a considerable distance around the opening.

The absence of maintenance costs and deterioration is one of the attractive points of the Brooks patent concrete stave silo. There is no rotting and replacing of staves, no alternate swelling and shrinking of wood, causing cracks to open, no hoops to need tightening.

Building Silo is Good Business Management

In farming, as in any other business, adequate investment of capital is needed from time to time to keep the business modern and equipped with labor saving and profit sharing devices. The high cost of producing beef, milk, butter and cheese makes it necessary to lower the cost of production, to make possible greater profits. No construction on the farm is of greater importance to the farmer from the standpoint of profit than the silo. It makes it possible to keep two cows on the same acreage that kept one under the old management. A silo with the proper farm management and attention to feeding should be able to do this for every farmer.

In this booklet an effort has been made to give all the necessary information concerning silos in general. It has been shown that the Brooks Patent Concrete Stave Silo fulfills every requirement. You may have some peculiar silage problem not mentioned in this book-



Note the Continuous Doorway. This 16x30 Brooks Silo Is on the Farm of H. T. Crow, Modesto, Calif.

let, and if such is the case you are urged to write at once asking for any information you desire—use the coupon on the last page if you wish. Be assured that you incur no obligation whatever in asking for further details. All that is asked is that you investigate the merits of the Brooks Patent Concrete Stave Silo before you buy. What could be more fair?

You may think that you can not afford a silo. The fact is you can not afford to be without one. Your banker will be glad to help you finance one and you can obtain reasonable terms in the purchase of a Brooks Patent Concrete Stave Silo.



This Brooks Silo, at Osseo, Minn., is on the Farm Owned by Clifford Willis, Editor of Northwest Farmstead.

FILL IN THIS COUPON AND DROP IT IN THE MAIL.

Mr. John S. Copley,
Agent for Brooks Patent Concrete Stave Silo,
Modesto, Calif.

Dear Sir:—

I need a silo large enough for the following stock:—

Cows (dairy).....

Steers

Sheep

Swine

Horses

I operate.....acres at

I have
I have not had experience with silos.

Please advise what the approximate cost would be. I understand that this inquiry does not obligate me in any way whatever.

Name.....

Address.....

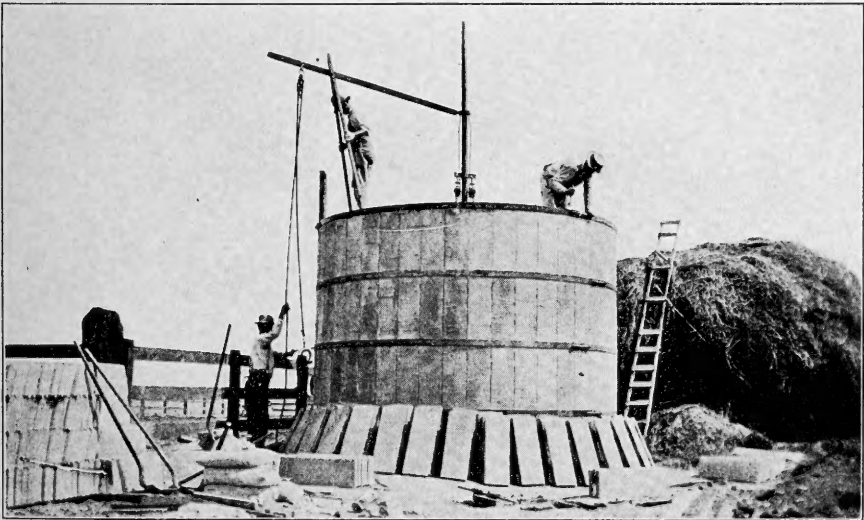


Illustration of a Brooks Stave Silo Which Has Just Been Started.







Buy a Brooks Patent Concrete Stave Silo

Because---

It is permanent.

It does not rot.

It does not burn.

It does not blow down.

It does not shrink, swell or warp.

It does not require tightening or loosening of hoops.

It does not require a variety of cables, braces and anchors to keep it standing.

It does not require painting, repairing and rebuilding.

It is air-tight, water-tight and sanitary.

It is rat-proof, germ-proof and wear-proof.

It has curved staves so the walls are perfectly smooth and circular, both inside and out.

It has tongued and grooved staves, insuring a perfect joint and greater strength than other forms of joints.

It has wide hoops which give full support to the staves.

It has a continuous doorway.

It is equipped with the best and most convenient door-hanger.

It has all the merits of a wood silo and none of its disadvantages.

The first cost is the only cost.