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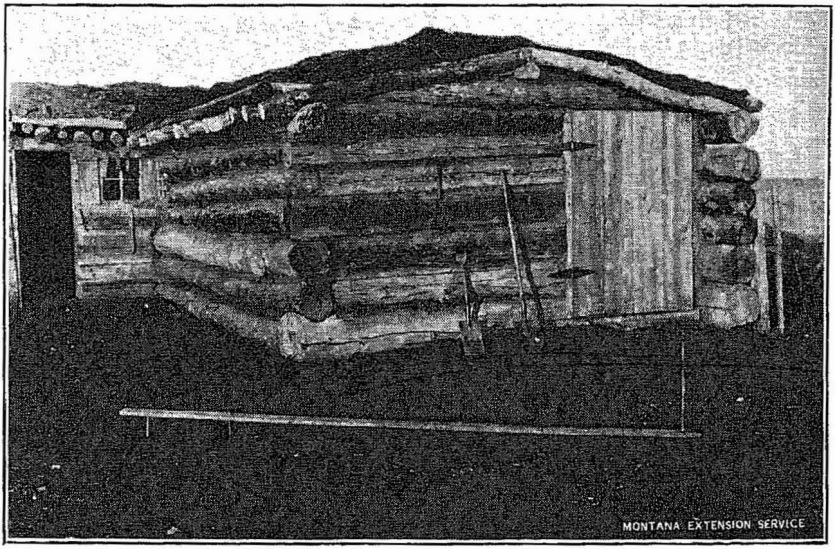
Homemade Silos



Laying off a pit silo.

By
F. M. HILLMAN, Field Agent in Dairying

SILOS

The first silo in America of which we have any record was built by Professor Manly Miles of Lansing, Michigan, in 1875; the first silo in Montana was erected by Dr. W. P. Mills at Lo Lo, in 1907. There are now (1916) seventy-eight above-ground silos and sixty-eight pit silos in this State, on record, and there may be others of which we have no knowledge.

GENERAL CONSIDERATION

Silage requires a receptacle built tightly to exclude the air. If air gains admission through cracks or apertures in the silo, the silage will spoil around the leak. The interior of the silo should be smooth and plumb, so that the silage can settle without leaving air pockets.

In filling, the forage around the sides should be packed very firmly by constant treading to exclude the air; otherwise, it will spoil on the outer edges. It is a good plan to seal the top of the silo by treading twice daily for a few days after filling.

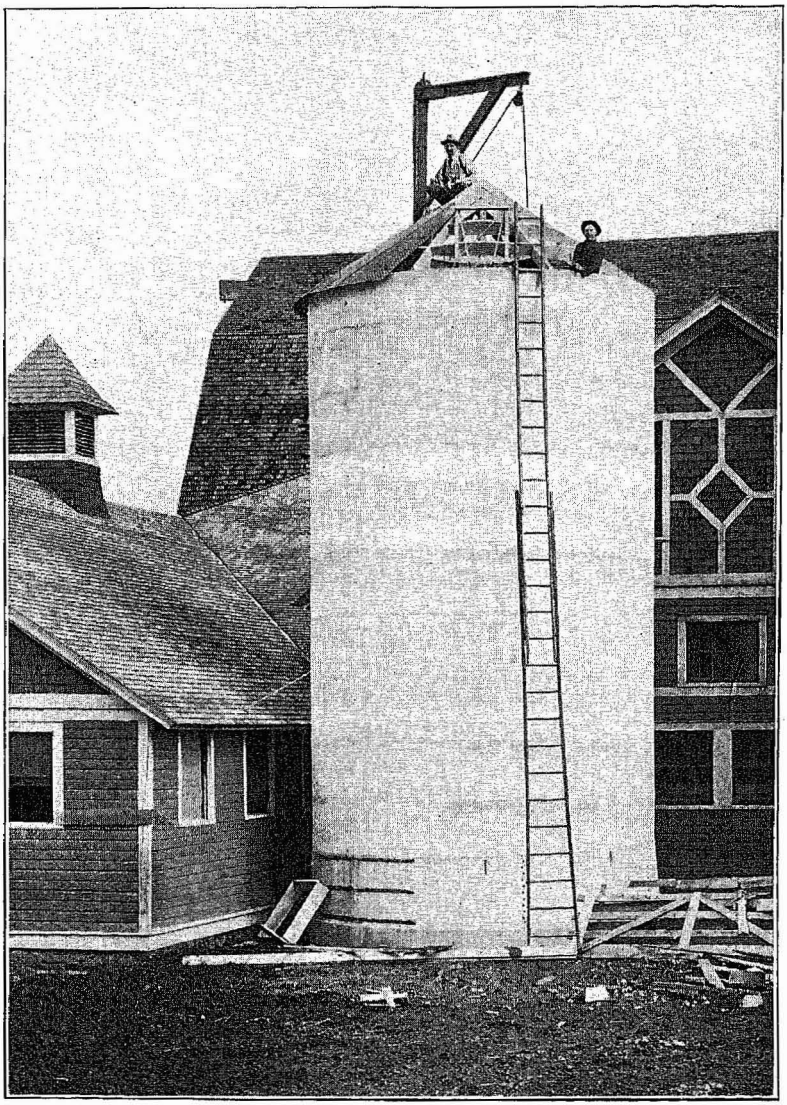
The cost of filling silos in the United States is from forty-six cents to eighty-six cents, with an average of sixty-seven cents per ton according to Farmers' Bulletin No. 292. In Montana, the cost will range higher owing to the smaller growth of corn, and may come as high as $1.00 or $1.50 a ton. Montana Experiment Station figures average $1.25 a ton.

Silage is not damaged much by freezing. Where silage freezes around the edges, it will generally thaw out if thrown in a pile in the center and left for a day before feeding. Freezing is less where the top of the silo is covered. Freezing is also reduced if, in removing the silage, it is kept the lowest at the edge of the silo.

There are several types of silos, all of which prove to be satisfactory when properly constructed. The kind to build depends upon local conditions, the material available, and the means of the builder. Many companies are selling ready-made silos that prove to be entirely satisfactory. There is a selling commission for these and a heavy transportation cost. In Montana, silos can generally be constructed for less money by the farmer himself.

ADVANTAGES OF ENSILAGE

The prime advantage of ensilage is that it preserves feed in its natural succulent condition. It gives a higher nutritive effect with corn than the same feed will produce when field cured. It



Monolithic concrete silo.

saves waste in coarse fodder, where a considerable portion is uneaten when fed dry. All of the plant is conserved when ensiled. Repeated trials of equal areas and yields of fodder, fed dry, and fed in the form of silage, have given increased production of meat and milk from the ensiled fodder. Ensilage makes farmers independent of weather conditions. The crop can be put up in rainy weather without damage. Corn can be cut after early fall frosts, and make first-class feed. Ensilage adds nothing to the feed, but it often reduces the loss in curing and in feeding, and it provides succulence at a season when it is greatly needed. Ensilage is also very valuable to supplement pasture during the dry weather in the summer.

SIZE OF SILOS

The capacity of a silo depends on the diameter and the depth. Silage keeps better in deep silos than in those which are shallow. It is doubtful whether it is wise to build a silo less than twenty feet deep. From twenty to forty feet is the usual range in depth. As the depth increases, the pressure increases, and the capacity of each vertical foot increases. A very deep silo must be strongly made to withstand the pressure near the bottom. According to depth, each cubic foot holds from twenty-five to fifty pounds of silage—the former, near the top, and the latter, near the bottom of very deep silos. Mature cattle readily consume thirty to forty pounds of silage daily, which makes about one-third to one-half of their daily ration. Three to five tons may be allowed for each cow for the season. Forty tons would be a good allowance for a herd of ten cows. One hundred tons would be ample for twenty-five cows.

A fifty-ton silo would be about ten feet in diameter and thirty deep, or twelve and one-half feet in diameter and twenty feet . The former dimensions would be preferable. A one-hundred silo would be fifteen feet in diameter and thirty feet deep, or venteen feet in diameter and twenty-five feet deep.

FEEDING SILAGE

In feeding silage, it is desirable to take enough off the top daily to avoid heating and spoiling through fermentation. In cold weather there is little danger of spoiling even though less than an inch is removed daily. In warm weather about two inches ought to be removed from the top of the silo daily to keep the silage from spoiling. The silo diameter should be small enough to permit this

with the number of animals fed. Silage is generally used as a feed for dairy cows, but it is fed profitably to other classes of live stock, especially beef cattle and sheep. Silage should not be fed alone, but should be used with hay, straw or other feeds. Beef cattle will winter in good condition on silage and straw. Along with silage, dairy cows should receive hay and grain in proportion to the amount of milk they are producing. Ordinarily, silage is used as a winter feed, but when pastures dry up in midsummer, silage feeding may be resumed to advantage. Some farmers have two silos, one of them of small diameter for summer feeding. The silo may be filled with green rye in early summer to be fed before corn matures, and then filled again with corn or other forage materials for fall and winter use.

Hay track and bucket for getting out dirt.

CROPS FOR SILOS

Corn is the crop generally used for silage, and where it can be grown to advantage, it is the most practical crop to use for this purpose. However, almost any crop that will make hay or fodder will make good silage. In this State, corn, alfalfa, clover, oats, peas,

and other crops have been used with good results. Next to corn, peas and oats have proven to be most satisfactory. During the fall of 1916, one of the silos at the Experiment Station was filled with sunflower. These give a large yield, and stand more frost and dry weather than other crops. (Later, we expect to have more information on sunflowers as a silage crop.

Ensilage adds nothing to alfalfa. With perfect weather it is better to make hay of it. The silo will prevent most of the loss of alfalfa due to bad weather at haying time. In bad weather the loss is less in the silo than in the field.

Corn should be allowed to get ripe before putting in the silo. Big, unripe corn appears better than it is, as it is mostly water. The large stalks do not contain as much dry food material, as the smaller mature corn. In Flathead County corn has averaged ten tons per acre and other crops seven tons of green forage.

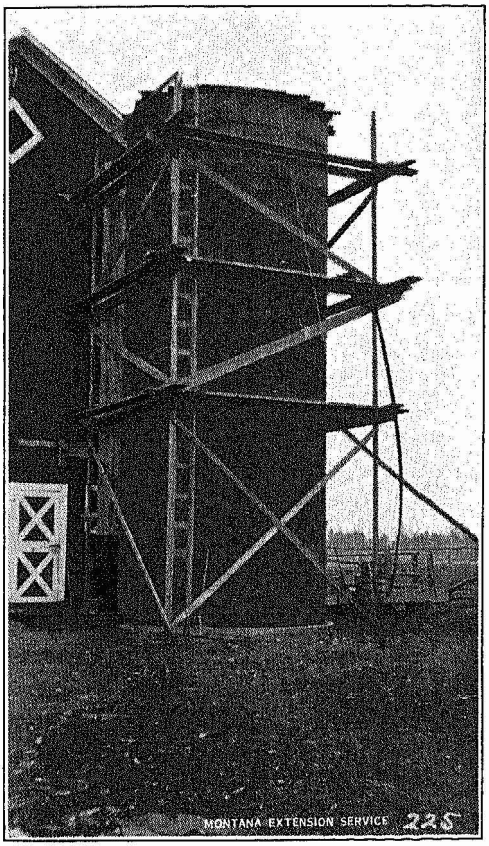
STAVE SILOS

There are probably more stave silos erected than any other type. This is because they are comparatively easy to build, and have been pushed by many commercial firms. This type is well adapted to western Montana, where lumber is not high-priced, and where there are local saw mills that can cut the staves. Any saw mill that has a planer, can cut staves on a proper bevel, and make a tongue, and groove almost as easy as they can plane it without cutting the bevel, tongue, and groove.

One objection to the stave silo is that it is not as substantial s some of the other silos, and if not looked after when the dry eason comes, may blow down. This difficulty can be overcome if the silo is properly anchored, and the hoops kept tight. The fact that the majority of silos are of the stave type shows that in most localities they have merits that more than offset any disadvantages.

It is necessary that the staves be straight and free from sapwood or loose knots. In Montana, fir, larch, or lodge pole pine are woods that will be used the most. Some satisfactory stave silos have been built of 2x4's or 2x6's, sawed square, but it is usually better to let the local saw mill cut them on a bevel to fit the circle, and at the same time make a tongue, and groove. Where full length staves are too expensive, shorter pieces may be spliced by ploughing the ends, and inserting a thin piece of wood or metal. See Fig. 1.

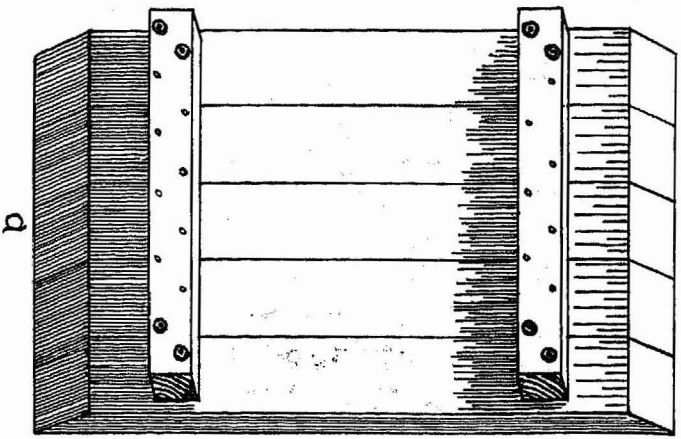
Before the staves are put up, one of them should be sawed at

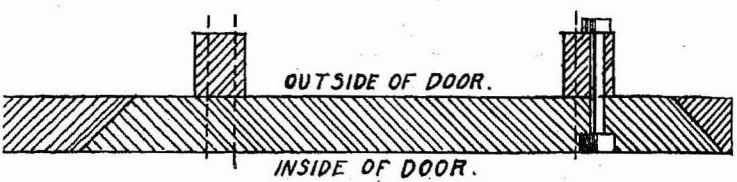


A stave silo.

intervals, corresponding to openings, so that one can get a saw in to cut out the doors. See Fig. 2.

As the staves are set up, they can be held in place by tacking barrel staves on the inside of the silo. Hoops are made of one-half, five-eighths, or three-fourths-inch rods. For silos, smaller than 14x30 feet, the lower hoops should be of five-eighths-inch rods and the upper of one-half-inch. The first hoop should be about six inches from the bottom of the silo. The second should be not over two feet from the first. The distance between hoops can be increased by three inches from the second to the top. After the hoops are on and tightened, the doors are cut out and the openings battened around.





Stave silo door and detail.

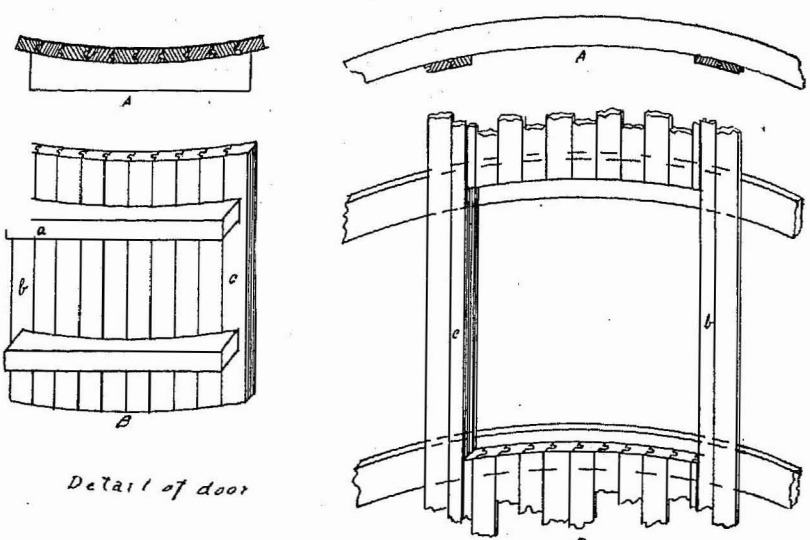


FIG. I. Section of door and staves cut on bevel.

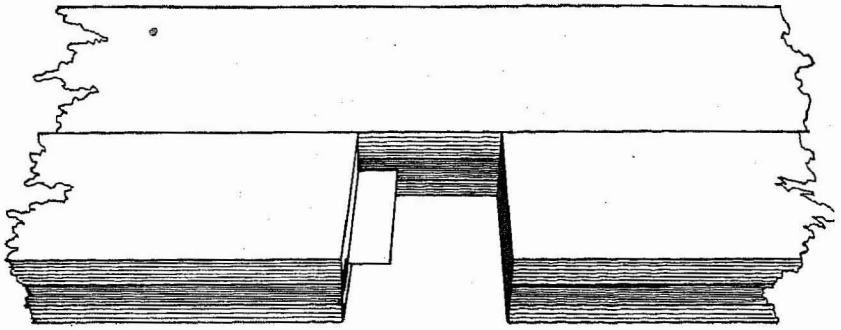


FIG. II. Joining stave ends.

WOODEN HOOP SILO

The wooden hoop silo is made of standard materials, which are carried in any lumber yard, and can be erected by any farmer who is handy with carpenters' tools. It costs less than other silos, and has proven to be very satisfactory in some of the Eastern states.

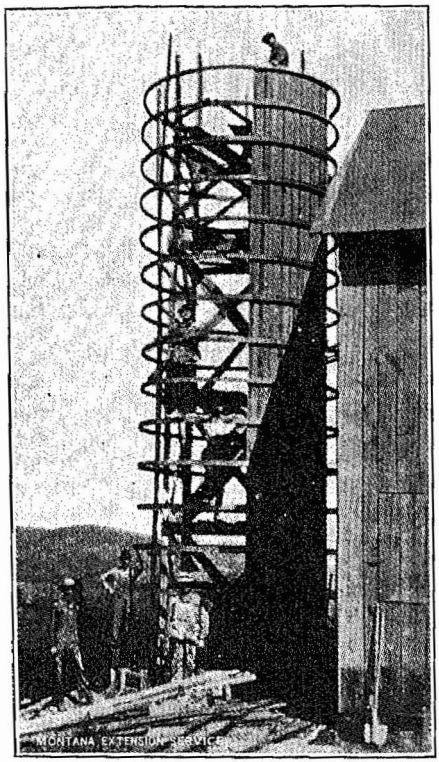
The hoops are made up of four or five layers of one-half-inch lumber that will bend to the required circle. Boards 4 inches wide are generally used for the hoops. A good grade of flooring is used for the staves.

Making the Hoops

To make the hoops, first construct a form over which to build them. This is done by marking off a circle the same diameter that the inside of the hoop is to be. If the barn floor is large enough, it is a good place to make the hoops. Blocks are nailed firmly on the inside of the circle about eighteen inches apart and even with the circle mark. This makes a form around which the hoops can be made. If a floor of sufficient size is not available, the circle may be drawn on a piece of level ground and pegs driven firmly every eighteen inches.

As the hoops are made, care should be taken that the different layers break joints. Use nails that will go through and clinch on the inside.

After the hoops are completed, the next thing is to raise them into place. There are different ways of doing this. Scaffolding may be used, or one may set up three poles just outside of the silo to be used as a derrick for raising the hoops. The hoops are held in place by resting on pegs which are driven through holes that have

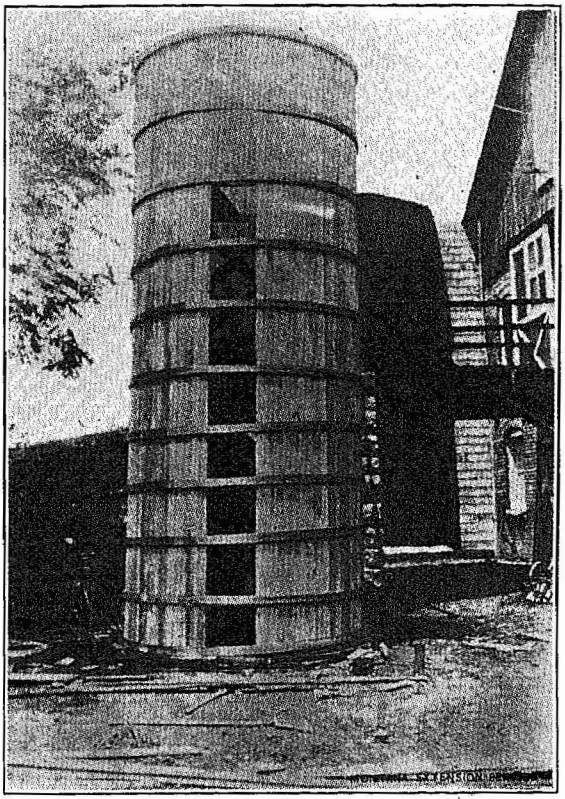


Constructing a wooden hoop silo.

been bored in the poles. If poles are not available, they may be made up by nailing two pieces of 2x6's together.

The flooring is now nailed on the inside of the hoops. First, pick out a good straight board, and nail it at the side or edge, where the door is to be. This board should stand perfectly plumb. Continue to nail on the boards until only enough space is left for the doors. This should be about two feet wide. For nailing the staves, eight penny nails are used, and placed in the center of the board so as to draw it down to the contour of the silo. A door is made to fit each of the spaces between the hoops. These doors should be numbered so they will always be put in the spaces for which they were made.

This silo can be boarded up, outside of the hoops, to give it a finished appearance and to make a dead air space. The roof is made the same as for any other silo. However, the silo can be used without a roof or outside boarding, and these can be added when time and



Wooden hoop silo.

means permit.

The silo should be painted on the outside and oiled on the inside. As it is light, a good set of guy wires must be put on to protect it from the wind. It should be anchored at the bottom by imbedding bolts in the foundation.

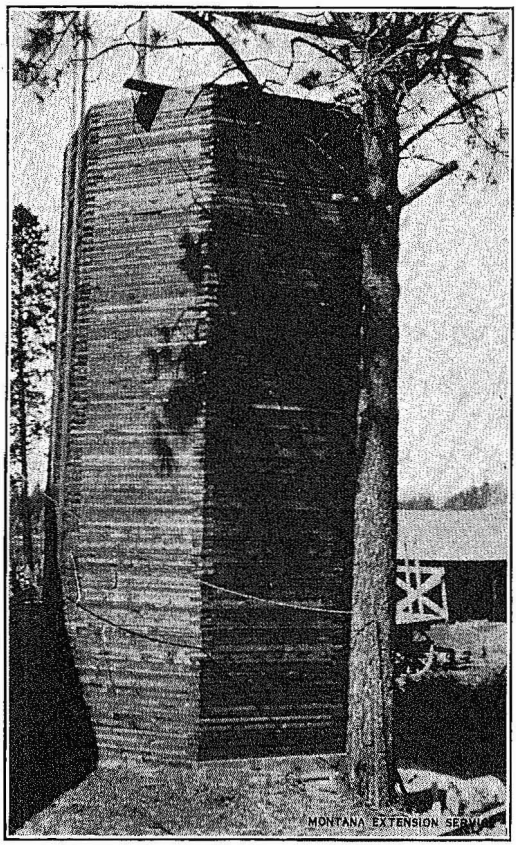
CRIB SILO

The illustration shows a crib silo built near Creston in Flathead County. This silo is built of 2x4's, and practically the same construction is used as in a grain elevator. Roofing paper is used as a lining, but this is not very durable. A better plan would be to paint the inside with asphalt thinned with gasoline. This would be cheaper and more permanent.

This silo cannot blow down, there are no hoops to tighten, and it can be built out of a cheap grade of lumber. In parts of Montana, such lumber can sometimes be obtained for less than $10.00 per thousand, and in those localities this silo is well worth considering.

It is desirable to get the exact pattern for the 2x4's; have them surfaced top, bottom, and inside, and cut on the exact mitre. They should be well nailed with 12-penny nails—at least four nails to each strip and one nail driven obliquely at each end joint to draw it tight.

Each door should be cut out after nailing the strips that come as high as the top of that door. Twenty inches wide and twenty-four inches high, with at least four strips between, make good openings



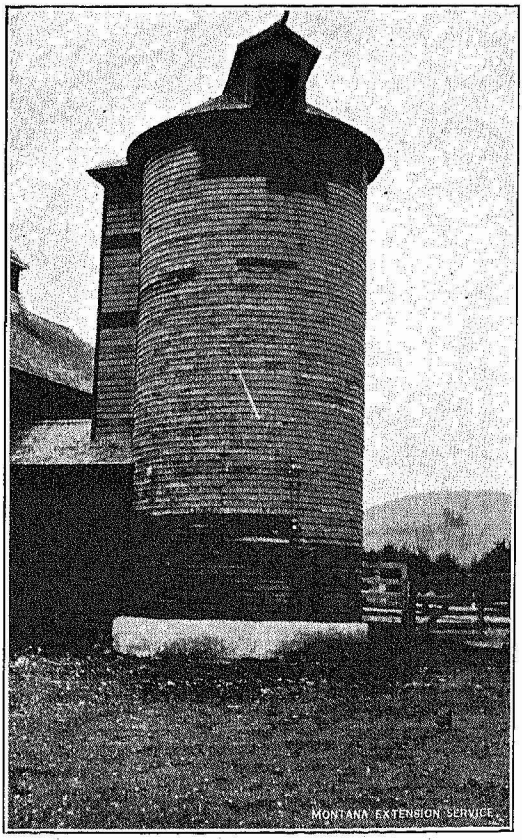
Crib silo in Flathead County.

for doors. Rabbeted door jambs may be spiked on the sawed ends of the 2x4's on either side of the opening.

It may be worth while to pour a thin ribbon of hot asphalt on top of each layer, just before nailing the next, to make the joints tight, and to preserve the wood. If this is done, it will be important to have the asphalt hot. Warm days would make such work surer.

WISCONSIN SILO

Another practical wooden silo is the Wisconsin silo. For this 2x4's are used as studdings, set twelve inches apart, and half-inch



Wisconsin silo.

or resaw boards are bent around on the inside. Two layers of the half-inch lumber are used with paper between. Care should be taken to have the boards break joints. The outside can be boarded

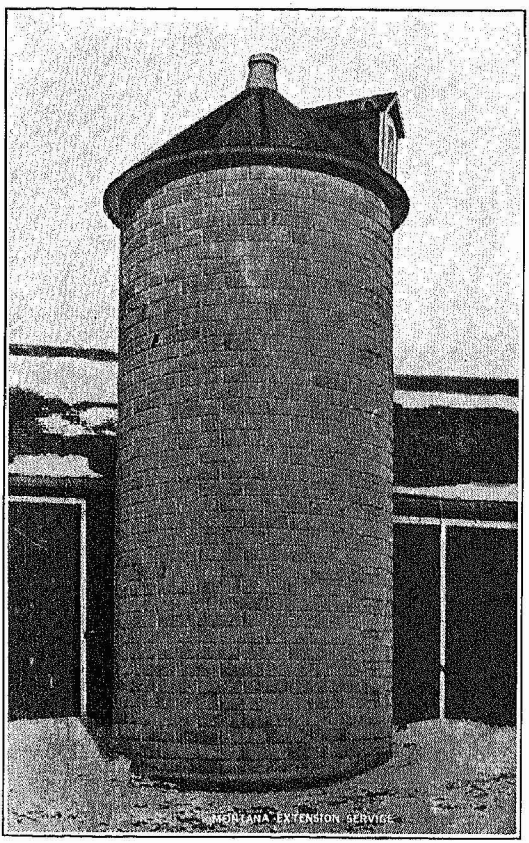
up in the same manner. In some cases, 1x12's with battens are run up and down for the outside. If the silo is too small, or the resaw material is not first-class, some difficulty may be experienced in bending it to the circle.

GURLER SILO

The Gurler silo is similar to the Wisconsin, except it is lathed and plastered on the inside. Sometimes, an old Wisconsin silo is fixed up in this manner.

CONCRETE SILOS

The chief advantage of the solid concrete or monolithic silo is that it is a permanent structure. Concrete becomes stronger and



Concrete block silo.

tougher with age. A concrete silo is fire proof, cannot blow down, will not shrink and swell with dry and wet weather, so there is practically no depreciation. Considered for a long term of years, this is the cheapest silo that can be built. For these reasons, concrete silos are growing in favor in the localities where silos have come into common use.

About the only objection to concrete silos is the first cost, but in many cases, this is no higher than the cost of less permanent silos. Where sand and gravel can be obtained for the hauling, the only expense will be for the forms, cement, reinforcing, and labor. The walls of a 12x30 silo will require approximately 28.8 barrels cement, 10.5 cubic yards of sand and 17 cubic yards of gravel. Four or five men, working four or five hours per day, can usually complete one of these silos in a little less than two weeks.

The most convenient material for reinforcement is the common woven steel hog fencing, thirty-two or thirty-four inches wide with horizontal strands of Number 9 wire. A 12x30 silo will require nearly 500 feet of this wire. Homemade forms can be constructed for $30.00 to $60.00; forms made in a machine shop may cost $125.00. This expense can be reduced by several farmers cooperating, and using the same forms.

On account of the limited space in this circular, directions for making forms cannot be given, but those interested can obtain this information from the Agricultural College at Bozeman. United States Farmers' Bulletin Number 292 on Homemade Silos gives this information. (If demand justifies it, a circular on concrete silos will be issued later.

MATERIAL FOR STAVE SILO

12x30

Staves—98 2x6–18 tongued and grooved
Staves—98 2x6–12 tongued and grooved
Rods—18 14 feet long, 5/8-inch iron
Rods—18 14 feet long, 1/2-inch iron
Lugs—36
Paint—5 gallons
Oil—5 gallons

MATERIAL FOR WOODEN HOOP SILO

12x30

1500 board feet flooring

715 board feet 4-inch resaw
Nails—40 pounds 8-penny
Paint—5 gallons
Oil—5 gallons

MATERIAL FOR WISCONSIN SILO

12x30

Studs—50 pieces 2x4, 16 feet long
Studs—50 pieces 2x4, 14 feet long
Flooring for doors, 32 feet 4-inch
Sheeting—3000 feet ½-inch for lining of two layers
Sheeting—1500 feet, same for outside
Tar building paper—200 yards, water and acid proof
Nails—100 pounds 6-penny, 50 pounds 8-penny
Paint—5 gallons for two coats.

COST OF HOMEMADE STAVE SILO

This is the cost sheet in Flathead County of a 12x29-foot stave silo. The staves were cut at a local mill. Hoops were made of rods that had been used as reinforcement in the dam at Bigfork. The expense was as follows:

Staves	$45.00
Iron rods for hoops	10.00
Lugs	7.00
Burrs	1.50
10 sacks cement	8.00
Cables for guy wires	3.50
2 men 2 days to straighten rods	10.00
2 men 2 days to put in foundation	10.00
5 men 1 day to erect	12.50
1 man 1 day to cut out doors	2.50
	$110.00

The people who cut the staves found they took the contract at too low a rate, and will have to charge more in the future.

COST OF PIT SILO

Capacity 100 tons

Guy Farnum in Custer County gives the following statement as to the cost of his pit silo:

35 sacks of cement at 85c per sack	$39.75	
Lumber for form and studding	17.25	
351 hours labor at $40.00 per month	45.00	
Total		$102.00

COST OF CRIB SILO

14x26

S. D. Isaacs of Creston erected a crib silo at the following expense:

5,000 feet of lumber	$48.20	
10 sacks of cement	6.50	
10 rolls of roofing	22.00	
10 days to cut and erect	25.00	
2 days hauling gravel for foundation	5.00	
1 day laying foundation	2.50	
Total		$109.20

COST OF SILAGE

F. F. Graves of Whitehall gives the following statement of the cost of pea and oat silage. This is for a twelve-acre field on which 100 tons of silage were produced:

Hauling manure	$10.00	
Plowing	34.70	
Harrowing (twice)	19.50	
Pea seed	45.00	
Seeding	11.00	
Oat seed	7.20	
Cleaning seed	4.80	
Irrigating	20.00	
Filling (team and labor)	136.80	
Engine rent	70.00	
Total		$359.00

For 100 tons this makes a cost of $3.59 per ton.

Capacity of Silos

Height of silo	Diameter of Silo									
	8 feet	10 feet	11 feet	12 feet	13 feet	14 feet	15 feet	16 feet	17 feet	18 feet
feet	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons
20	18	30	36	45	51	60	66			
22	20	33	41	50	57	66	76	87		
24	23	36	45	55	64	73	85	95	104	120
26	25	40	50	60	71	80	94	103	116	130
28	28	44	54	66	79	90	102	111	126	140
30	31	48	58	75	86	100	110	120	136	150
32	35	53	66	84	94	110	118	131	148	162
34	37	58	73	94	102	120	131	143	162	175
36	40	64	82	105	110	130	139	155	176	190
38	43	70	89	114	119	140	151	167	190	212
40	47	75	98	121	129	150	165	180	204	228
42		80	104	128	139	160	176	193	218	244
44				135	150	171	188	207	233	261
46						182	200	222	247	277
48								236	261	293

Relation of Size of Herd to Diameter of Silo

(On basis of 40 pounds of silage per cubic foot)

.side diameter of silo	Quantity of silage in depth of 2 inches	Number of animals that may be fed allowing:			
		40 lbs. per head	30 lbs. per head	20 lbs. per head	15 lbs. per head
't.	lbs.				
12	524	13	17	26	35
11	634	16	21	31	42
12	754	19	25	37	50
13	885	22	29	44	59
14	1026	25	34	51	68
15	1178	29	39	59	78
16	1340	33	44	67	89
17	1513	38	50	75	101
18	1696	42	56	85	113

PIT SILO

The following information in regard to pit silos is based largely on experience and observation in Montana by M. L. Wilson, county agent leader:

The pit silo is the equal of the above-ground silo in most respects, except that there is a little inconvenience in hoisting out silage for feeding. As a matter of fact, when Montana conditions are taken into consideration, it can be credited with several advantages.

1. They conform to the requirements of silos, being air tight, with smooth walls, and are permanent.
2. Small cash outlay. The only materials which necessarily need to be purchased are cement and tackle for hoisting the dirt.
3. Homemade. Any careful farmer can make pit silos. No high-priced mechanics are required.
4. These can be made during the slack times of the year, and not interfere with farm work.
5. Silage will not freeze in a pit silo.
6. Only a small outlay is required for cutter. No conveyor is needed.

Location

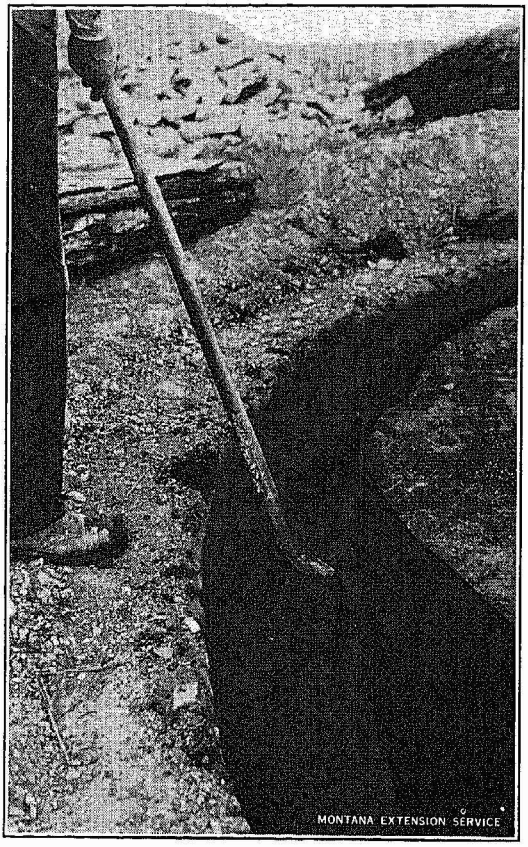
Pit silos can be dug in almost any soil, provided they do not extend below the water table. The cement plaster sticks better on clay, but pit silos have been successfully made in sandy ground. The silo should be located near the barn or shed in which the silage is to be fed. As it is a permanent improvement, care must be exercised that it conforms to future building plans.

Concrete Ring or Curb

The weakest part of the wall of a pit silo is from the surface of the ground to the frost line. Experience has taught that a concrete curb should form the upper part of the wall extending at least three feet into the ground. It pays to make a good-sized curb, one which will not settle, and strong enough to support a section of the silo, which might at some future time be placed upon the top of the pit.

The first step, therefore, is to mark out the lines for digging a trench which will act as a form for the curb. Drive a pin in the center of the proposed silo, place a board with a hole in one end over the pin. Measure on the board from the center of the pin,

one-half of the diameter of the silo, and drive a large spike through the board at this point. Drive a second spike into the board a foot farther out from the first spike. Swing the board around, and two circles will be described. The inner one marks the circumference of the silo, and the outer one, the outside of the curb. A trench is dug between these circles with two perpendicular sides, which will be the form for the curb. After the trench is dug, the inside wall

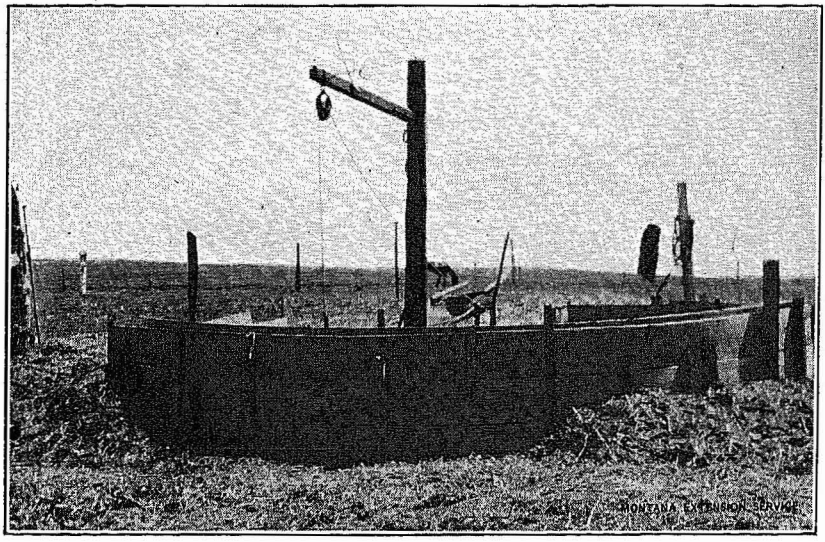


Trench for pit silo curb.

ɔuld be plumbed. It also pays to line the inner wall with building per which makes a much smoother surface. As there is not much rain on this curb, it does not need to be made of rich concrete—ɔne part cement to five or seven parts of clean gravel gives good

results. When filling, occasionally throw in some hoops or old wire for reinforcing. Rocks, from the size of a hen's egg to eight inches thick, may be used, which will decrease the amount of cement used. If this is done, the rocks should be crowded back from the inner side with a shovel to prevent their projecting into the face of the silo.

If possible, this concrete ring should extend from one foot to eighteen inches above the ground; this will require a wooden form for its construction. The most convenient method of doing this,



Form for curb of pit silo, above ground.

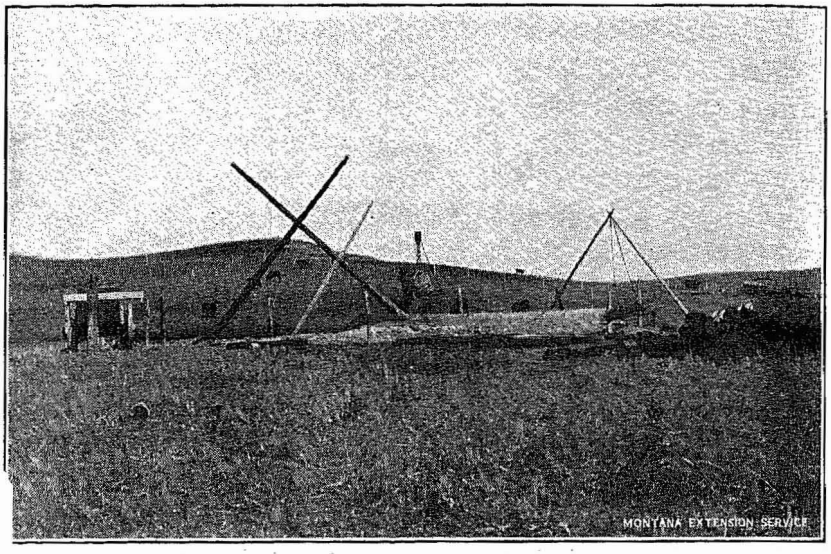
is to first fill the trench with concrete. After it has set, stakes can be driven around the cement ring about one foot apart, and a form made of one-half-inch resawed lumber.

Mixing Concrete

For the information of those who have not had the experience with concrete, the following rules are included: First, use sand and gravel free from clay; second, mix with the dry cement (one part cement to from five to seven of gravel), shovel over three or four times; third, add water, and shovel over several times until it is thoroughly moistened and mixed. Do not use alkali water.

Hoisting Dirt

There is no one best way of hoisting dirt from a pit silo. Each farmer who considers digging should study the different ways, and select the one which will meet his conditions, the cheapest and still be serviceable. All kinds of rigs have been used from expensive chain bucket elevators to pole hay stackers. The following have been used by Montana farmers with success:



Wire cable hay stacker for hoisting dirt.

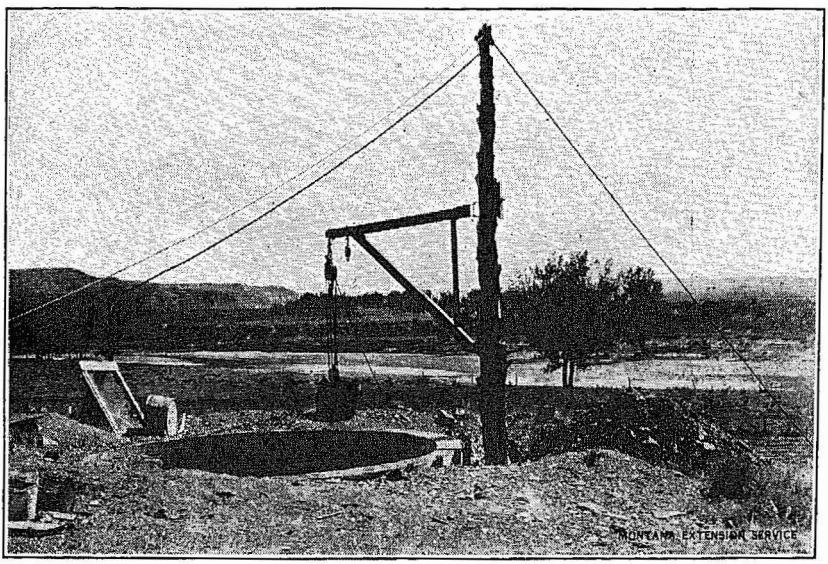
Wire Cable Hay Stacker. This is set up so as to hook the catch, which starts the carrier, and allows the pulley and rope to drop over the center of the silo. The buckets of dirt are pulled up like hay, and are tipped on the ground away from the silo.

The cable need not be more than six or eight feet above the ground unless the dirt is to be dumped into a wagon.

Hay Track and Carrier, such as is used in hauling hay into barns, may be set up on a scaffold, made of poles and cross bars of two by sixes, and operating similar to the wire stacking outfits.

A Swinging Derrick is sometimes made by selecting a straight, good-sized pole, and setting same into the ground to a depth of five feet, guying it by three or four ropes or wires which are attached to the top, and fastened to stakes firmly driven into the ground

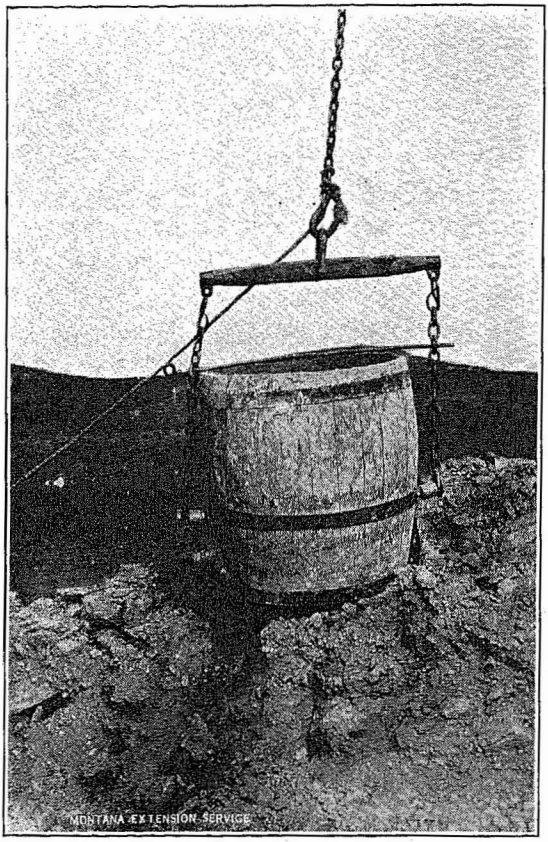
some distance away. A swinging arm, made of two 2x6's bolted together and extending two feet beyond the center of the silo, is hinged to the pole about eight or ten feet from the top of the curb. The arm may be supported by a chain or a wire cable, extending from the top of the pole to the end of the arm, or it may be braced to two 2x6's, bolted two feet from the swinging end of the arm and hinged to the pole above the curb of the silo. A pulley, at the bucket and on the derrick arm, and a snatch block at the base of the pole with tackle, complete the hoisting outfit which is operated by two men and a horse.



Derrick for hoisting dirt.

Buckets

Various types of buckets have been made, ranging from galvanized iron buckets and boxes with hinged bottoms to half barrels with iron links. About the most convenient one is made by sawing off the upper third of a stout barrel, and attaching two chains to opposite sides a little below the center. Small holes are bored near the top, in line with the chains, through which to run an end gate rod to prevent the barrel from tipping. The chain should be attached about two inches below the center of the barrel; otherwise, it will be hard to operate.



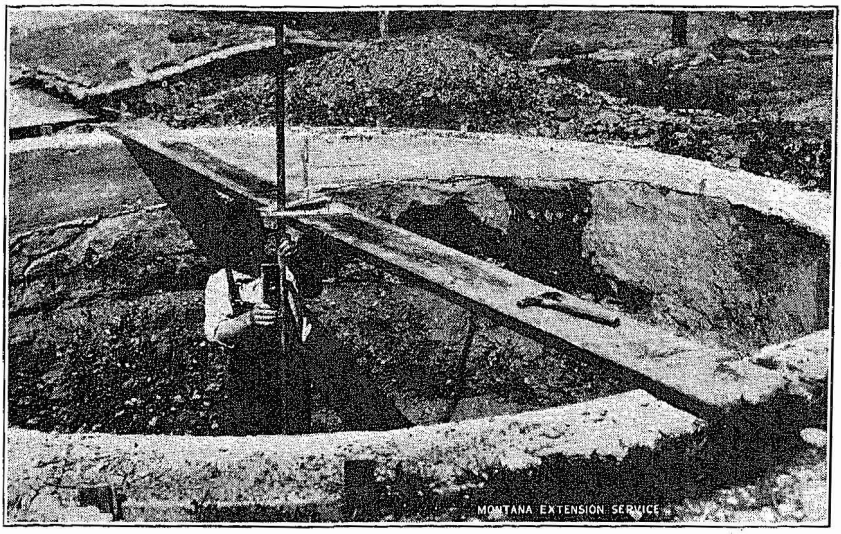
Bucket used in digging pit silo.

Digging the Silo

Ordinarily, the soil will be so dry that it will not spade easily, and it will have to be loosened by blasting, or with a pick. Low percent dynamite has been used in this State. However, the Kansas Station states that blasting powder is more satisfactory.

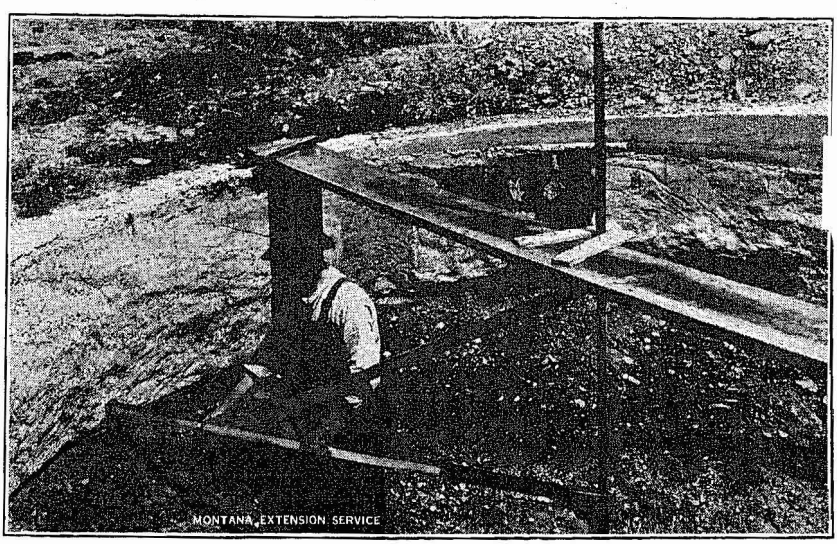
Preparation of Wall for Plastering

In case the wall is shale or rock, the wall may be plumbed with a line depending from the curb, but in ordinary dry dirt, a marking arm is most convenient. This arm is made as follows: A straight piece of lumber is laid across the curb of the silo, both ends being marked so that it can be returned exactly to its place every time it



Plumbing the pivot of the marking arm.

is removed. A one-inch hole is bored in the center of the board, and a piece of gas pipe is inserted through the hole. This gas pipe is plumbed by a spirit level, and the lower end slipped over a peg driven into the earth. The marking arm itself is made of a piece



Cutting the sides plumb and even.

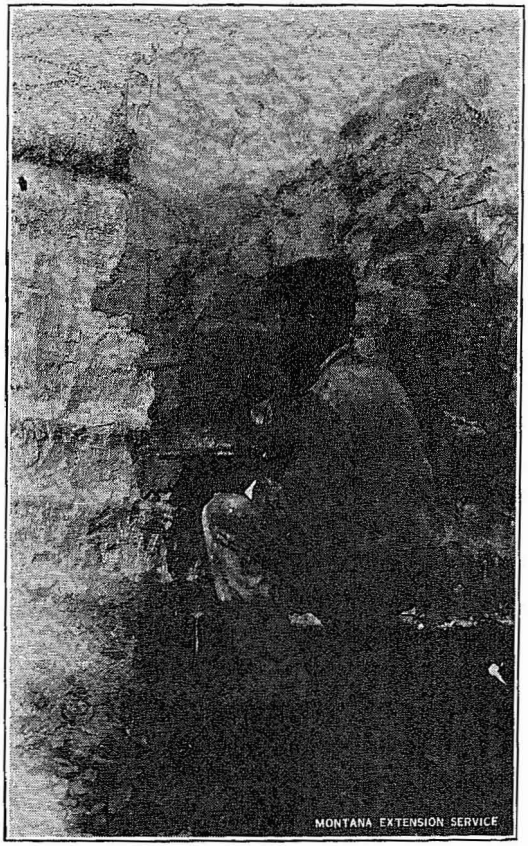
of 2x4. In one end, bore a hole that will just fit the gas pipe. The knife, which is made of a sharp-edged piece of steel bent at right angles, is bolted at the other end. This knife should extend one-half inch beyond the inside measure of the silo. This allows for the cement. In digging the silo, two or three inches of dirt is left near the outer edge of the silo to be removed by the marking arm.

Moistening the walls before plastering.

Plastering

It is most convenient to plaster the walls of the silo in sections, as each six or seven feet is dug. Ordinarily, the walls will be very dry. In such cases, they should be moistened by throwing a fine misty spray on with a compressed-air pump. If this is not done, the dry walls absorb the moisture from the plaster, which weakens it. Some pit silo walls have proven unsatisfactory because of this drying out. The walls should be plastered with a mixture of one part of cement to two parts of clean, sharp sand. If the wall is formed with occasional strata of shale rock, one coat of plaster from one-half to one inch thick will be sufficient. If, however, the walls show signs of crumbling, two inches would be better. In this case, the first coat may be of one part cement to three of sand, and the second, which should be put on as soon as the first sets, one to two. Pure

cement should be mixed with water to a creamy consistency, and applied with a whitewash brush to finish the job. After the cement is set, it should be moistened frequently until it becomes hard and tough.



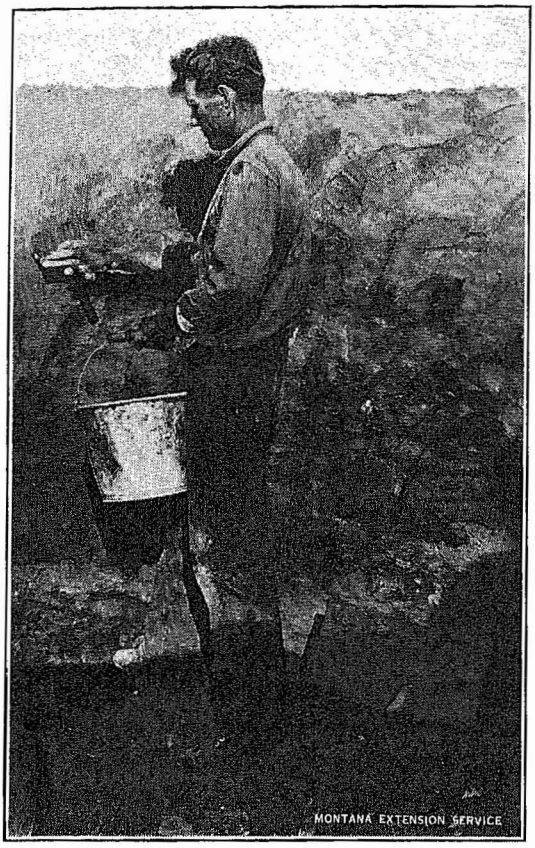
Plastering silo wall with rich concrete.

Digging in Sand and Gravel

A pit silo may be made in sand or gravel by thoroughly saturating the walls with water as the digging proceeds. Wet sand or gravel stands, when if it were dry, it would crumble badly. The walls should be plastered as soon as each foot or so of digging has been done.

Digging in Winter

Silos may be dug in winter by the same process as in summer,



Putting on the whitewash coat of clear cement.

if the work is done on warm days. The bottom may be covered at night with straw or fire kept in the silo so as to prevent the cement from freezing. Sometimes, a shoulder of a foot or so of earth is left until early summer. A scaffold is then made in the silo, the shoulder removed, and the walls plastered. A cement floor is unnecessary, but may be made if desired. In clay, no protection is needed.

Roofing

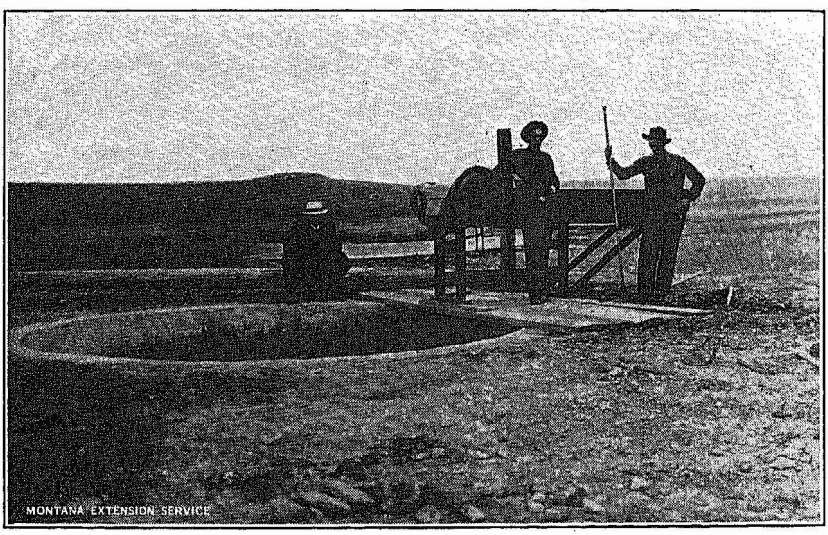
It is recommended that pit silos should not be built in a barn, but just outside. Outside silos are handier to fill. A cheap roof

with a rather flat pitch is easy to make. The cover keeps stock from falling in, and also keeps the silo warmer in winter.

Danger from Gas

Ardent advocates of commercial silos, especially agents whose commissions depend upon the number of silos sold, are continually knocking the pit silo on the ground that it is absolutely dangerous, due to suffocating poisonous gases, which are likely to be present in the silo at any time. Their alarming statements are based more upon "selling a silo" than upon facts. The facts are that danger from gas is slight, and as yet no fatalities have been reported over the semi-arid regions of the United States in which there are now probably one thousand pit silos.

Carbonic acid gas is given off during the first fermentation. This gas is heavier than air. The gas is formed principally just after filling the silo. On this point, Professor Larson of South Dakota, says: "If the silo is left for any length of time partially filled, the owner should take the precaution of lowering a lighted lantern before entering. If the lantern goes out, the air of the silo should be agitated with a blanket or some contrivance which will cause the air in the pit to move and mix. When the silo is nearly

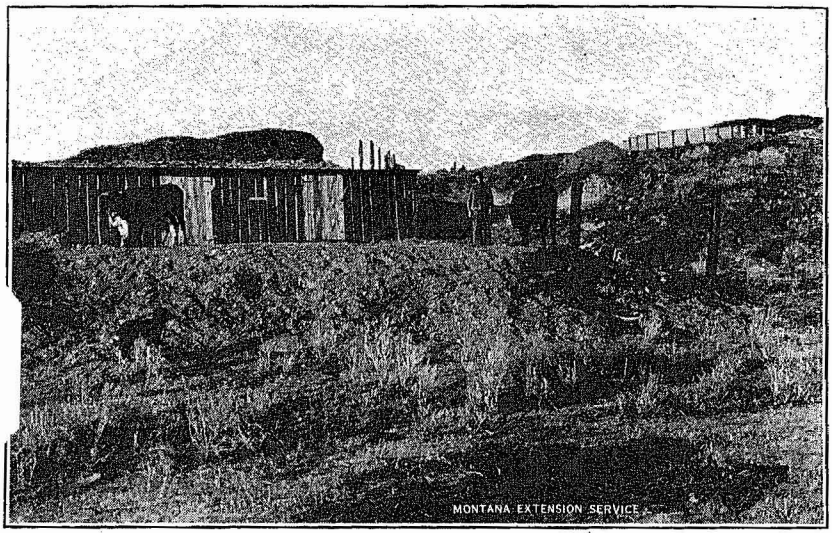


Ready to fill with forage.

full of silage, or after the silage has been in the silo a month, there is little danger from poisonous gases in pit silos."

BANK SILOS

There are many ranches in Montana which have the barn and sheds located in the shelter of a cut bank. Such locations are ideal for a bank silo, provided the bank is solid. This silo is like a pit silo, except it has doors along one side, or it is more nearly like the ordinary above-ground silo set in the ground. A tunnel is made at the bottom of the bank which intersects with the chute of the silo. They should be dug and plastered in the same manner as pit silos, with the exception of the doors and the chute. Different ways have been suggested. Some require a good mechanic to make forms. Cement workers should be employed who have had experience with reinforcing and form work. Wooden jambs and doors may be made as for other silos.



A pit silo in a bank.

"Johnny Wise dug a pit;
Tramped his cow feed into it.

When the winter winds blew keen,
His cow feed was fresh and green.

Soon his cream checks extra size
Made the neighbors ope their eyes.

Johnny Wise sure made a hit;
Now each neighbor has a pit."

—J. R. Campbell.