THE CONCRETE HAND BOOK

CONCRETE FOR PERMANENCE

The Brand with a Reputation

VULCANITE Portland CEMENT CO.

PHILADELPHIA, NEW YORK, BOSTON.

VULCANITE PORTLAND CEMENT CO.

Incorporated 1893

Capacity **2,230,400** Barrels Per Annum

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Land Title Bldg., Philadelphia

Main Sales Office
8 West Fortieth St., New York

New England Office, 161 Devonshire St., Boston
Works, Vulcanite (Warren Co.), N. J.

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Compiled by Albert Moyer, Assoc. Am. Soc. C. E.
New York, October 1, 1917.

The Economy of Concrete

THE fact that concrete is a plastic material and is easily cast in any required shape makes it especially adapted to farm structures. If properly made it will last forever. Its durable qualities are such that it means the elimination of cost for repairs and renewals. It is a dense and impervious substance, affording no harbor for rats, vermin and other destructive agencies. With the exception of Portland cement, the necessary materials are usually found upon the farm. For the reason stated, concrete makes strong appeal to the farmer.

The actual money saved in repairs and reconstruction will soon offset any excess cost over other materials. It is often the case, however, that concrete structures cost no more than buildings of other materials, and often less.

The farmer can ordinarily do the work with the assistance of his farm hands, making it unnecessary to hire an expert carpenter or mason. Great economy is achieved in this way.

Perhaps the greatest benefit to be derived from concrete construction is the elimination of fire risk. This is of vital importance to the farmer, who is usually too far from a town to permit of any real protection from fire.

Aggregates to be Used in Concrete Construction

(Aggregates are particles of Stone or Sand.)

The sand, stone and gravel usually found upon the farms of the United States are generally suitable for concrete construction, provided the following precautions are taken:

1. These aggregates must be free from vegetable matter, dirt, or other foreign substances.
2. When using bank-run gravel, the sand must be separated from the stone or pebbles by screening through a ¼-inch screen.
3. In small concrete structures, such as drain tile, fence posts, etc., the coarse aggregate (crushed rock or gravel) should range in size from ½ inch to ¼ inch. For larger work, such as silos, barn floors, ordinary foundation, etc., coarse aggregate should range from 1½ inches to ¼ inch.
4. The sand used should be coarse, hard and clean, and graded from ¼ inch to fine, with the larger size predominating.

Use great care in hand mixing. It is economical to buy a small machine mixer if the farmer intends to use concrete in large quantities.

Hand Mixing

The process to be followed when concrete is mixed by hand, using a two-bag batch of 1:2:4 proportions:

1. Size of measuring box for sand should be 2 feet square by 1 foot high, thus containing 4 cubic feet.

2. Load sand in wheelbarrows and wheel onto boards.
3. Fill sand-measuring box, lift box, and spread sand 4 inches thick over board.
4. Take two bags of cement, place contents as evenly as possible over sand.
5. Turn the sand and cement over until thoroughly mixed, so that no streaks of cement or sand appear.
6. Spread the mixture of sand and cement out carefully, place measuring box beside it, and fill twice with stone or gravel, then empty onto sand and cement mixture and mix thoroughly.
7. Add three-quarters of required amount of water slowly and evenly, at the same time mixing the mass.
8. Continue mixing, adding balance of water when dry spots appear, until whole mass has been turned over three or four times; this should be sufficient. After final turning, shovel into compact mass ready for wheeling away to place.
9. The placing of properly mixed concrete is of the utmost importance. The object to be attained is compactness of the mass or maximum density. The amount of water used to bring about the right consistency is therefore of the utmost importance.

   For plain concrete, that is concrete which is not reinforced by wire mesh or steel bars, the consistency should be so that when placed the concrete will not flow and yet be sufficiently wet so it will quake and water will rise to the surface when tamped with a wooden tamp or tamping iron.

   For reinforced concrete, where it is necessary for the concrete mixture to enter into and around the reinforcing, such as wire mesh or bars, the concrete should be of such consistency that it will pour but not contain so much water as to carry off the cement particles. The consistency must be such that when poured into the forms, there will be very little, if any water, on the surface of the concrete. It must be of such consistency as will not be so thick as will not pour out of the bucket, but just a sufficient amount of water so it will run into the forms and all around the reinforcing.

Bank-run Gravel

Bank-run gravel is sometimes used as it comes from the bank. This is wrong, as *no two places* in a bank will have the same proportions of sand and pebbles. It is, therefore, always essential when using bank-run material to screen the sand from the gravel and remix in the proper proportions.

Average Proportions

As many users of concrete do not wish to take the trouble to test their own materials, it is customary for them to use the proportions which have been found to produce satisfactory results under average conditions. These are 1 part of cement, 2 parts of sand, and 4 parts of coarse aggregate (expressed 1:2:4) for most classes of construction. In the manufacture of products large enough to use aggregate exceeding one inch in greatest dimension the proportion of coarse aggregate may be increased accordingly. Conversely, where a fine texture is desired for ornamental purposes, the proportion of cement must be increased, reaching its maximum in 1:1½ troweled surfaces. The follow-

ing table gives the proportions recommended for various classes of work:

Concrete

A 1:2:3 mixture for:

One-course concrete highway, street, and barnyard pavements.
One-course floors and walks.
Roofs.
Fence posts and for sills and lintels without mortar surface.
Water-troughs and tanks.

A 1:2:4 mixture for:

Reinforced concrete floors, beams and columns.
Large engine foundations.
Work subject to vibration.
Building walls above foundation.
Silo walls.

A 1:2½:4 mixture for:

Base for two-course street and highway pavements.
Backing of concrete block and similar cement products.

A 1:2½:5 mixture for:

Supporting walls and foundations.
Small engine Foundations.
Base of sidewalks and two-course floors.
Mass concrete footings, etc.

Mortar

1:1½ mixture for:

Wearing course of two-course floors.

1:2 mixture for:

Scratch coat of exterior plaster.
Facing blocks and similar cement products.
Wearing course of two-course walks, street and highway pavements.

QUANTITIES OF MATERIAL FOR ONE CUBIC YARD OF RAMMED CONCRETE

(Table from Taylor and Thompson, "Reinforced Concrete.")

Proportions by Parts			Percentage of Voids in Broken Stone or Gravel (Air Spaces Between the Particles)								
			50 Per Cent.*			45 Per Cent.†			40 Per Cent.‡		
Cement	Sand	Stone	Cement, Bbls.	Sand Cu. yd.	Stone Cu. yd.	Cement, Bbls.	Sand Cu. yd.	Stone Cu. yd.	Cement, Bbls.	Sand Cu. yd.	Stone Cu. yd.
1	.....	2	3.57	.....	1.06	3.37	.....	1.00	3.20	.....	0.95
1	.....	3	.....	.....	.....	2.60	.....	1.16	2.45	.....	1.09
1	,2	3	1.81	0.54	0.80	1.74	0.52	0.77	1.67	0.50	0.74
1	2	4	1'58	0.47	0.94	1.51	0.45	0.89	1.44	0.43	0.85
1	2½	5	1.31	0.48	0.97	1.24	0.46	0.92	1.18	0.44	0.87

*Use 50 per cent. columns for broken stone screened to unform size.
‡Use 45 per cent. columns for average conditions and forbroken stone with dust screened out.
†Use 40 per cent. columns for gravel or mixed stone andgravel.

Coloring Matter

Do not use coloring matter unless absolutely necessary. Nearly all coloring matter reduces the strength of the mortar. For coloring cement work, the following quantities will be found the least objectionable:

QUANTITIES PER 94 POUNDS OF PORTLAND CEMENT

For a 1 : 2 mortar

Excelsior Carbon Black	2 lbs.	Black	
Manganese Dioxide	10 lbs.	"	
Yellow Ochre	4 lbs.	Buff	
Ultramarine or Azure Blue	4 lbs.	Blue	
Lamp Black (Bone Black)	½ lb.	Gray	
Ultramarine	5 lbs.	Green	
Oxide of Chromium	7 lbs.	"	
Roasted Iron Oxide	6 lbs.	Brown	
Red Iron Oxide	6 to 10 lbs.	Red	
Pompeiian Red	6 lbs.	Bright Red	
Ochre	6 lbs.	Yellow	

Mix the coloring matter thoroughly with the sand and screenings in proportions as above.

Stucco

The use of stucco dates back to almost prehistoric ages. In its earliest application, it was made use of as a plaster of mud to cover a framework of reeds or rough-hewn timbers, as a means of keeping the house warm. The modern use of Portland Cement Stucco has grown with great rapidity, both for the purpose of renovating old buildings and also for exteriors of brick and frame structures.

Stucco is a mixture of Portland Cement and sand with the addition of about 1 part of lime to 10 parts of cement. The lime may be either hydrated lime or slaked lump lime. Hydrated lime is lump lime slaked with water by a mechanical process, the moisture then driven off, leaving the lime dry, in the form of an impalpable powder. The advantage of using hydrated lime lies in the fact that the work of slaking or hydrating is done mechanically, with the result that the lime is all thoroughly slaked. There is then no danger of placing any unslaked material in the plaster, or stucco, and the hydrated lime never air slakes. It comes in convenient sized packages and can be obtained from your dealer in building materials.

The lath to be used for stucco work are generally of three types—expanded metal lath, close meshed wire lath and wooden lath. In addition, there are on the market a number of patented stucco or plaster boards designed to take the place of ordinary lath. Wooden lath practically every one is familiar with. Expanded metal lath consists of metal sheets of about 1/40 inch thick, which are slotted and expanded to form meshes of various shapes. Woven wire lath is a close mesh wire cloth provided with wire stiffeners.

Since it is essential that metal lath should be protected against corrosion or rusting, two methods are used to completely imbed the lath in the stucco. Portland Cement is a preservative of iron or steel.

One method is to plaster the back of the lath, thus completely imbedding same. The other method is to use a sheath board on which to fasten the lath. When using the latter method, in order that the first coat will have a proper bond with the lath, it is absolutely essential that the stucco of the first coat is forced through the lath and into full contact with the sheathing boards, thus spreading the stucco back of the lath and completely imbedding same.

Manufactured stucco board is generally used to reduce the cost of wood or metal lath. In deciding upon the use of stucco board, great care must be exercised in order that a rigid, strong product is secured. There are on the market stucco boards which have nothing to recommend them but their cheapness. You are building for permanency when you use stucco; therefore avoid cheap stucco board or, in fact, cheap anything.

Hollow clay tile keyed to hold the stucco is also much used.

Specifications for Stucco

on Stucco Boards, Wooden Lath, Brick or Hollow Tile

Plaster—Mix 10 parts of Portland Cement and 1 part dry, pulverized, hydrated lime, measured by volume; add dry, clean sand, in proportion of 1 part cement-lime mixture, 2 parts sand. Turn with shovels, raking with a garden rake while shoveling, until the mixture is of a uniform color. Add necessary water to make a stiff plaster and turn several times with shovel, raking while shoveling.

Plaster or Stucco Made With Lime Putty—Make a lime-sand paste by slaking double strength lime for one week, strain and mix 1 part lime putty with 9 parts sand. Make up a stucco of 1 part Portland Cement, 1 part sand, dry mix. With this mix 1 part lime-sand paste and add sufficient water to bring to proper consistency.

Quantity—There shall not be mixed at any one time more mortar than will be used within one hour. Mortar or stucco which has begun to stiffen or take on its so-called initial set shall not be used.

First Coat—Start plastering at top of wall and make surface continuous from corner of offset to corner or other convenient stopping place. One day's work to be completed from top to bottom of wall. Scratch deeply over entire surface of plaster while it is wet.

Second Coat—Mix second coat in same proportions as first coat. Apply second coat as soon as first coat will bear pressure of trowel. Second coat must not be applied to any part of first coat which shows any drying of the surface. Make second coat from ½ inch to ¾ inch thick.

Third or Finishing Coat—Mix third coat same as second coat. Apply third coat as soon as second coat is strong enough to support it. Third coat must not be applied to any part of the wall where the second coat shows any signs of drying on the surface and must be continuous from corner to corner or other convenient stopping place, and from top to bottom of wall in one day's work. Finish third coat in accordance with specifications for finishing.

Hollow Tile—Soak thoroughly with water before applying stucco.

Portland Cement—"Vulcanite" Brand.

Sand—Well washed, coarse and well graded. All sand must pass through a ¼-inch mesh screen.

Curing or Seasoning—Keep entire surface continuously damp for one week. If the weather is dry and windy, hang tarpaulins or some form of cloth over surface and keep the cloths wet.

Finishing Stucco Surfaces

Oakum Finish—Take a handful of oakum about the size of your two hands bundled up and work in a circular movement over the surface of the stucco, not pressing too hard. This should be done after the stucco is fairly hard but still soft enough to receive the impression of the thumbnail. Dampen the oakum from time to time and a smooth and interesting surface will result.

To brighten up the surface, make a solution of 1 part commercial muriatic acid, 5 parts water. Use large whitewash brush and paint the surface with this mixture. As soon as the effervescence stops, wash with hose and clear water.

Bristle Brush—Another effect can be produced by following the above methods and using an ordinary house scrubbing brush instead of a piece of oakum.

Wire Brush—Still another effect can be produced by allowing the stucco to get a little bit harder and using a wire brush. The cement finisher will soon learn the consistency to bring about the effect desired.

Tile Inserts—If it is desirable to insert colored clay tile in design or panels to form a spot of color, this should be provided for by nailing lightly a wooden block or slab ¼ inch

larger than the exact size of the tile or panel that is to be inserted. After the stucco has been applied and is hard, remove the wooden block or slab and set tile in much the same manner as you would set floor tile.

Broom Dash Finish—While the last coat of the stucco is still thoroughly damp, apply a Portland Cement mixture composed of 1 part Portland Cement, 12% of the volume of the cement of well hydrated lime in pulverized form, and 1 part of the volume of the cement of fine white sand. Mix with water to the consistency of cream or the ordinary cold-water paint. Stir constantly and apply by using a whisk broom, throwing this paint on the surface of the stucco with some force. This will give a very pleasant effect. Keep this finish surface damp for at least six days, and longer if economy will permit. Do not allow it to dry out in any one place during the week. If the weather is hot and windy, hang tarpaulins or cloths as previously described.

Other finishes, such as floating with a wooden float and troweling, smooth surface, pebble dash, splatter dash, etc., are so well known as to need no further description.

If coloring matter is to be used, please bear in mind that the only lasting green is what is known as cromium oxide. This is quite expensive, but any sort of a substitute is worthless and will fade out within four or five months, making a refinish of the stucco necessary. In using coloring matter, mix coloring matter with the cement in proportions as described below.

Mix thoroughly until of an even color and mix the cement with the sand. Continue turning and raking until of an even color. Proportions of coloring matter to cement are as follows:

Gray, Lampblack or Boneblack—½ lb. to 1 bag of Portland Cement.

Buff—4 lbs. of yellow Ochre to 1 bag of Cement.

Reddish Brown—6 lbs. of Red Iron Oxide to 1 bag of Cement.

Red—6 lbs. of Pompeian Red to 1 bag of Cement.

Green—7 lbs. of Cromium Oxide to 1 bag of Cement.

Blue—4 lbs. of Ultra Marine to 1 bag of Cement.

For further detailed information, apply for Vulcanite pamphlet No. 14, entitled "Cement Stucco."

Drain Tile

The farmer can readily make up drain tile at odd times, storing same for future use. It is well to purchase metal moulds and machine for making these tile, following the directions given in the catalogs of manufacturers of moulds for drain tile. The following is a list of manufacturers of equipment for the making of concrete drain tile:

W. E. Dunn Manufacturing Co., Holland, Mich.
St. John Miller, Pioneer, Ohio.
Quinn Wire and Iron Works, Boone, Iowa.
Farmers' Cement Tile Machinery Co., Box 200, St. Johns, Mich.
Pioneer Manufacturing Co., Waterloo, Iowa.

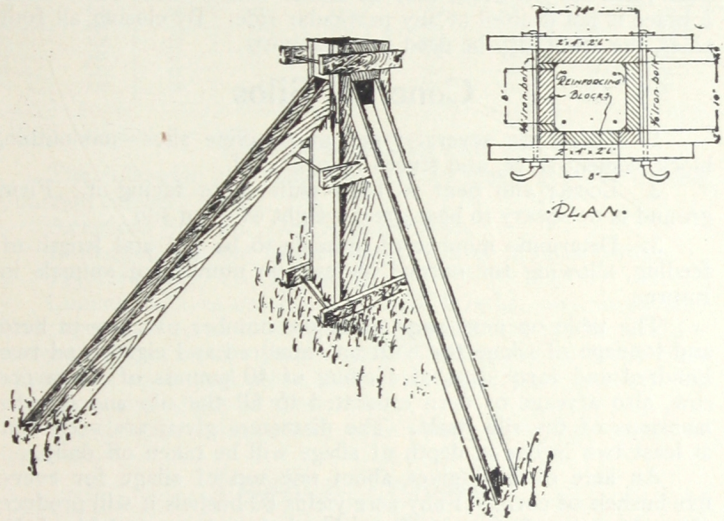

Fig. 1. Corner Post with Braces.

Fence Posts

Concrete fence posts can be made for approximately 25 cents a post, including material and labor. The usual size is 7 feet long, 3 inches square at top, and 5 inches at bottom, or 4 inches square at top and 4 inches by 6 inches at bottom. Do not make holes through posts to attach wire, if possible to avoid, as it tends to weaken the post.

If the farmer contemplates constructing a large number of posts, it would be economical to buy steel molds manufactured by one of the several companies in this line—see list given below:

MANUFACTURERS OF POST MOLDS

Ideal Concrete Machinery Company, Cincinnati, Ohio.
Staple Post Mold Company, 27 W. Home Street, Westerville, Ohio.
Ohio Post Mold Company, 1341 Nicholas Building, Toledo, Ohio.
Cement Machine Company, Guthrie Center, Iowa.

Cement Tile Machinery Company, Waterloo, Iowa.
American Cement Machine Company, Keokuk, Iowa.
D. & A. Post Mold Company, Three Rivers, Mich.
Cement Machinery Company, Jackson, Mich.
Milwaukee Post Mold Company, Milwaukee, Wis.
National Concrete Machinery Company, Madison, Wis.
Northwestern Steel and Iron Works, Eau Claire, Wis.
Hotchkiss Lock Metal Form Company, Binghamton, N. Y.
Indiana Concrete Mold Company, Peru, Ind.

Government Farm Bulletin No. 403 gives complete information on concrete fence posts.

Fig. 1.—This form can be used to build corner and end posts with from one to four braces. The opening left in the post form for the brace may be closed with a small block when a brace is not desired at any particular side. By closing all four sides, the form may be used for gate-posts.

Concrete Silos

1. There are several types of concrete silos—monolithic, block, cement-stave, and stucco or plastered.

2. Locate silo next to barn with chute facing it. Firm ground is necessary to bear great weight of filled silo.

3. Determine number of animals to be fed and length of feeding, allowing for normal increase in number of animals in future.

The table on next page 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 40 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 80 bushels it will produce about 16 tons of silage. The table is based on a yield of 50 bushels, or 10 tons of silage per acre.

(Description in Silo Bulletin.) Will be sent free on application. Silo Bulletin Vulcanite Pamphlet No. 12.

List of Silo Form Manufacturers

Monolithic Silo Forms:

W. H. Limberg, Plymouth, Wis.
McCoy Silo Form Co., Inc., Berger Building, Pittsburgh, Pa.
Monolithic Silo and Construction Co., Chicago, Ill.
New Enterprise Concrete Machinery Co., Chicago, Ill.
Polk-Genung Co., Fort Branch, Ind.
Reichert Manufacturing Co., Milwaukee, Wis.
Van Guilder Hollow Wall Co., Rochester, N. Y. (hand machine).

Cement Stave Molds:

American Silo Co., Des Moines, Iowa.
Playford Manufacturing Co., Elgin, Ill.
Perfection Cement Stave Silo Co., Des Moines, Iowa.

Size of Silos

Number of Cows in Herd	Feed for 180 Days				Feed for 240 Days			
	Estimated Tonnage of Silage Consumed	Size of Silo		Corn Acreage Required at 10 Tons to Acre	Estimated Tonnage of Silage Consumed	Size of Silo		Corn Acreage Required 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	39	10
25.....	90	13	33	9	120	13	40	12
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

Concrete Staves

The following are manufacturers of machinery for making Concrete Staves:

American Silo Co., Des Moines, Iowa.

Perfection Cement Stave Silo Co., Des Moines, Iowa.

Playford Mfg. Co., Elgin, Ill.

Concrete Staves are made in small lengths, very easily handled; are made so as to tongue and groove, and can be used for various purposes other than silos. The farmer can make them up at odd times and store them for future use. Almost any structure can be built of these staves.

For detailed information, write to any of the above manufacturers.

Feeding Troughs

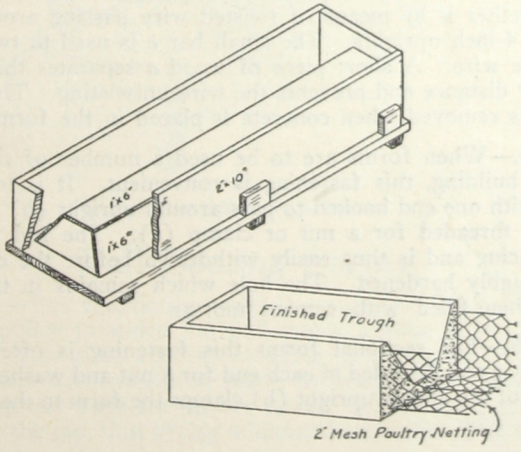

Fig. 2. Hog and Chicken Troughs.

These troughs can be made any size—from small troughs for chickens to large cattle troughs.

Mix concrete 1:2:4, making the concrete a mushy wet consistence, and place thoroughly in forms.

These troughs can be built anywhere for from 75 cents to $1.00. Use chicken wire for reinforcing.

Feeding Troughs for Hogs

Feeding troughs for hogs are usually built as a part of the feeding floor.

Wall Forms

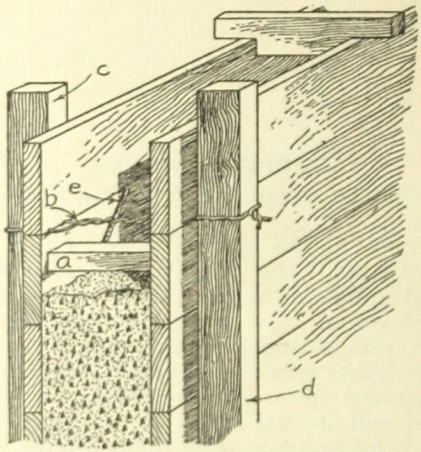

Fig. 3. Wall Forms Using Twisted Wire.

Fig. 3.—The most simple and inexpensive method of tying forms together is by means of twisted wire passing around the 2-inch by 4-inch uprights. The small bar *e* is used to twist and tighten the wire. A short piece of wood *a* separates the forms the proper distance and prevents the wire untwisting. This piece of wood is removed when concrete is placed in the forms.

Fig 4.—When forms are to be used a number of times on the same building, this fastening is convenient. It is merely a rod (a) with one end hooked to pass around upright (b) and the other end threaded for a nut or clamp (c). The rod is oiled before placing and is thus easily withdrawn before the concrete has thoroughly hardened. The hole which remains in the concrete is then filled with cement mortar.

Fig. 5.—For sectional forms this fastening is often used. It is merely a rod threaded at each end for a nut and washer. The lower end of the double upright (b) clamps the form to the section beneath.

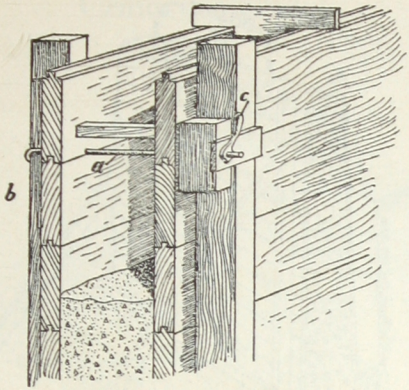

Fig. 4. Wall Forms, Rod Fastening.

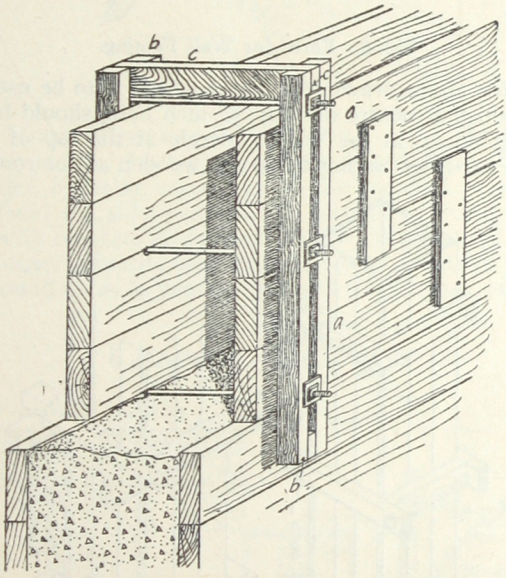

Fig. 5. Sectional Wall Forms.

Wall Footing Forms

Fig. 6.—For foundation walls in ground which is not firm it is good policy to widen the wall into a footing at the bottom as shown. This gives a greater bearing on the earth. Walls of this character are sometimes made by setting the forms at a slant so that the walls are thicker where the wall joins the footing than at the top, thus giving additional strength. This is illus-

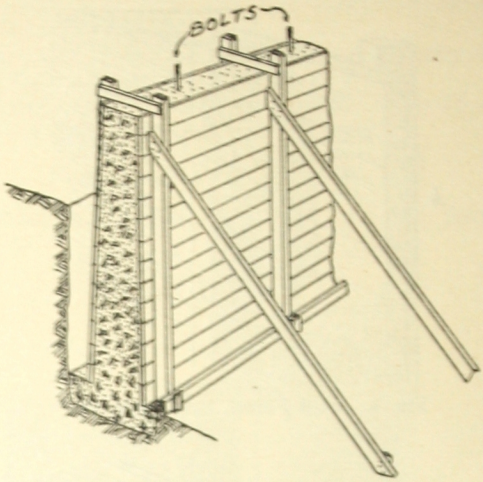

Fig. 6. Form for Wall Footing.

trated in the above drawing. Where a wall is to be used to support a wooden structure or roof, ¾-inch bolts should be embedded, heads down, in the fresh concrete at the top of the wall. These are used for bolting down the wooden sill or roof plate.

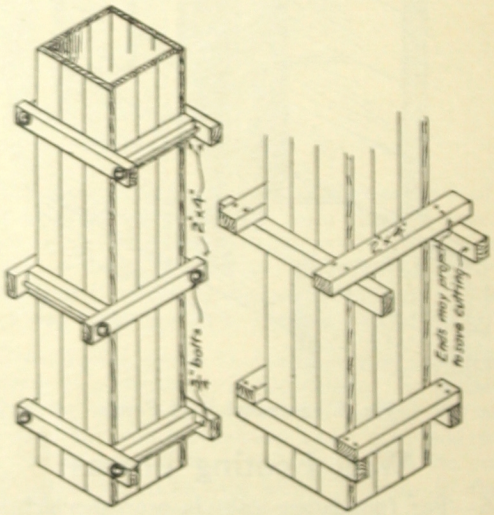

Fig. 7. Column Forms.

Fig. 7.—Two methods of fastening column forms. The form at the left is best where it is to be used many times and the other cheaper for using once or twice.

Concrete Steps

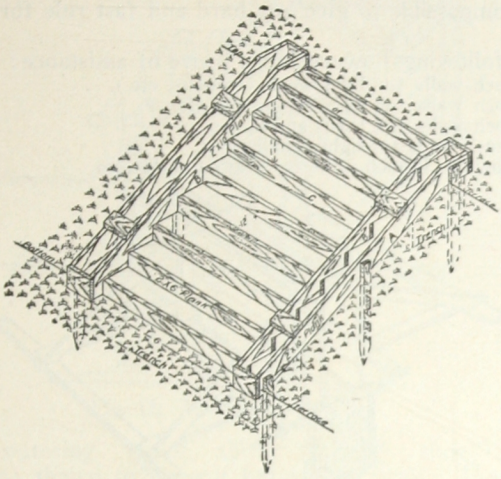

Fig. 8. Step Forms.

The form illustrated is for steps on a terrace. The same form is used for steps in a cellar hatchway. The boards at the sides, by being carried up to the required height, can be used to build the side walls of the hatchway. Note trench—to be filled with concrete at top and bottom. Where steps lead up to poultry house, corncrib, etc., the side forms should extend down to the ground so as to provide for wall at each side of the steps.

Concrete Culverts

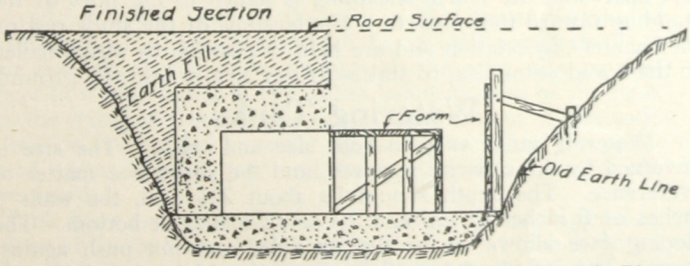

Fig. 9. Culvert Shown Half Finished and Half With Form in Place.

A concrete culvert not only will be suitable for use along roads, but when installed in the field provides an easy crossing for wagons and implements over the ditch or gulley. The drawing shows the lines of the ditch and the form in place and one-half of the finished culvert and earth fill.

Thickness of Walls for Various Structures

It is impossible to give any hard and fast rule for thickness of walls.

The following, however, may prove of assistance:

1. 4-inch walls for light work (troughs, etc.).
2. 6-inch walls for silos, windwalls, etc.
3. 8-inch walls for barns and houses.
4. 12-inch walls for light foundations.
5. 15-inch to 18-inch walls for heavy foundations.

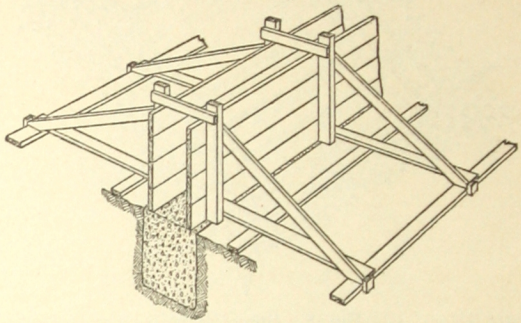

Fig. 10. Wall Form on Top of Ground.

For small buildings, such as milk-houses, hydraulic ram houses, spring-houses and poultry sheds, where no cellar is necessary, this form is used. By increasing the height of the form it can be employed for building windwalls to protect cattle from cold winds in winter.

When foundations are built in soft ground, widen at base to allow for footing.

Simple Wall Construction

Walls for small buildings, etc., should be made 6 inches thick and the concrete mixed 1:2:4. The forms should consist of 1-inch sheathing nailed to 2 x 4 inch studding. Space studs 2 feet apart and the 1-inch sheathing is nailed to the sides of the studding toward the concrete. The bottoms of the studs rest on the concrete foundation and are held in position by strips nailed to them and extending to stakes driven firmly into the ground.

Watering Tanks

Watering tanks vary in both size and shape. The size is governed by the capacity required, and the shape is a matter of preference. The depth should be about 2½ feet, the walls 5 inches or 6 inches at top and 10 or 12 inches at bottom. The sloping face allows ice to slip up sides and not push against them. The inflow and outflow pipes should be 1½ inches in diameter. Lay ½-inch iron rods entirely around the tank 2 inches from the top and 1 inch from both inner and outer edges. Lay woven wire in bottom of troughs as shown in drawing on next page.

The above description relates to an oblong tank, the dimensions being 5 feet x 16 feet x 2½ feet.

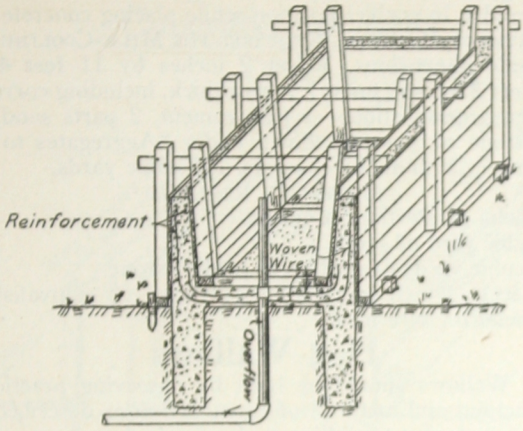

Fig. 11. Watering Tank.

Small watering tanks above ground should have foundations as shown to prevent heaving by frost. Note how uprights are tied together at top across tank. Inlet and overflow pipes must be installed before placing concrete. Proper proportions for tanks are 1 part Portland cement to 2 parts sand to 3 parts clean gravel or crushed stone.

Concrete Milk Cooling Tank

Make forms the same or similar to tanks described elsewhere in this book. The width is usually 2 feet 6 inches, which is sufficiently wide to accommodate two rows of the standard 14-inch milk cans. Any capacity may be secured by varying the length of the tank. The bottom of the tank is 8 inches below the milk room floor level, making it easy to lift cans from the tank. The available inside depth of the tank is 17½ inches because of the construction of the floor, which has 1-inch corrugations to permit free circulation of water beneath the cans, also because the over-flow pipe outlet is 1½ inches below the top of the tank. When the standard size milk cans rest on the bottom of this tank, they will be surrounded by water up to the neck, and the possibility of water entering them and thus getting into the milk will be prevented.

Tank floor and walls should be concreted at one operation. The floor of the tank should be 6 inches thick plus 1 inch provided for forming corrugations. The tank walls should be 4 inches thick, reinforced throughout with expanded metal, wire mesh, or ¼-inch round rods. Reinforcing rods for the floor are bent U-shape and spaced 12 inches apart. This makes the reinforcing of tank floor and sidewalls continuous. Horizontal rods in the wall should extend around the tank as continuous bands. In making splices of these rods, lap the ends at least 12 inches. All

reinforcing should be firmly wired together at the intersections so as to hold it in correct position while placing concrete.

ESTIMATES OF MATERIAL REQUIRED FOR MILK-COOLING TANK

Outside dimensions, 3 feet 2 inches by 11 feet 4 inches; walls, 2 feet 2 inches; floor, 7 inches thick, including corrugations.

Concrete proportions—1 part cement, 2 parts sand, 3 parts crushed stone of sizes as shown under "Aggregates to be used in Concrete." Volume of concrete, 1½ cubic yards.

MATERIALS REQUIRED

11 sacks of Portland Cement.

¾ cubic yard of sand.

1¼ cubic yards of pebbles or broken stone.

230 feet ¼-inch round rods (38 lbs.) or equivalent in expanded metal or wire mesh.

Hog Wallows

Hog Wallows should be built by observing practically the same principles and methods of construction as described in constructing a watering trough or tank.

This is simply a concrete basin formed by making an excavation of the required depth and building a 6-inch wall all around inside, then laying a concrete floor on the bottom of the excavation. If the site where the hog wallow is to be built is well drained, the soil on which the floor is laid need have no special preparation other than being well compacted before the concrete is placed. At one end of the wall a pavement slab is provided so that when the animals leave the wallow the immediate vicinity will not become a mud hole.

The corners inside the wallow should be slightly rounded. The wallow should be about 18 inches deep and located convenient to water supply so that it can easily be refilled. Drain outlet should be provided for emptying the pool when necessary. The sidewalls should extend below ground to the extent of possibly 3 feet to prevent possible disturbance from upheaval by frost.

DIMENSIONS AND MATERIALS REQUIRED

Outside dimensions, 8 by 12 feet. Walls, 2 feet deep. Floor and pavement, 6 inches thick.

Concrete proportions—1 part "Vulcanite" Portland Cement, 2½ parts sand, 4 parts crushed stone or pebbles in sizes as shown under "Aggregate to be used in Concrete Construction."

MATERIALS REQUIRED

25 sacks of Portland Cement.

2 1/3 cubic yards sand.

3¾ cubic yards of pebbles or broken stone.

84 feet ¼-inch round rods (14 lbs.).

Concrete Tanks for Storage of Water

Above-ground tanks for the storage of water and underground tanks for the same purpose may be built by various methods, the description of which is too lengthy to illustrate in this pamphlet.

If you intend to build a concrete tank, write to us for "VULCANITE" Pamphlet No. 13, entitled "Concrete Tanks."

Concrete Hot Beds

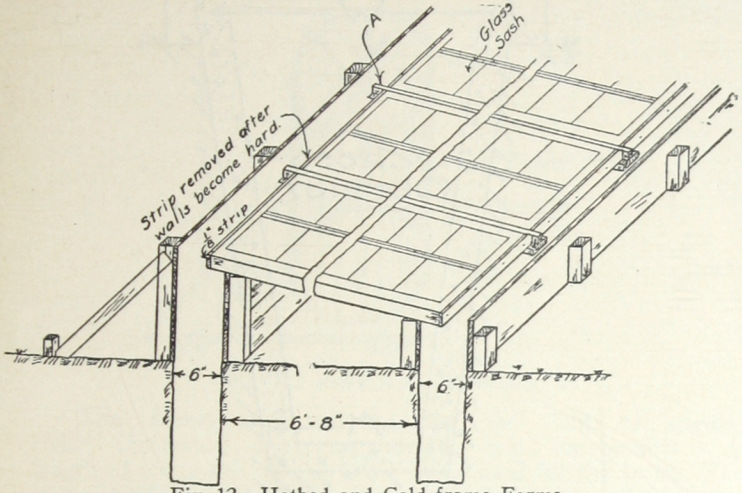

Fig. 12. Hotbed and Cold-frame Forms.

A hotbed or cold-frame may be constructed easily by following the above drawing. The glass sash, which are generally 3 feet by 6 feet, are placed so as to extend 3 inches over the inside forms, as shown. The 1/8-inch strip nailed on each end is for clearance and is afterward removed. The ends of the sash are well oiled or soaped, and the concrete is deposited under and around them. The T-shaped strip "A" is formed by nailing two strips of wood together and should extend into the concrete wall as shown.

Dipping Vats

Four important points to be considered in building dipping vats:

1. An entering slide, steep enough to shoot the animal in, but not a direct drop.

2. Must be narrow enough not to allow turning around; long enough so as to keep the animal in for one or two minutes, and deep enough to cover him when taking the plunge.

DIMENSIONS FOR GROUND PIT FOR DIPPING TANKS

KIND	W	N	D	L	E	B	A	I	O	T	CEMENT	SAND	ROCK
											Barrels	Cu. Yds	Cu. Yds.
Horses ...	5' 10"	3' 4"	8' 8"	55' 0"	7' 6"	31' 0"	16' 6"	8' 8"	18' 7"	0' 8"	38	11	22
Cattle.....	5' 4"	3' 4"	7' 8"	51' 0"	6' 8"	31' 0"	13' 4"	7' 8"	15' 4"	0' 8"	36	10½	21
Sheep	3' 4"	2' 4"	5' 8"	46' 0"	5' 0"	31' 0"	10' 0"	5' 8"	11' 6"	0' 8"	22	6½	13
Hogs.....	3' 4"	2' 4"	5' 8"	36' 0"	5' 0"	21' 0"	10' 0"	5' 8"	11' 6"	0' 8"	19	5½	11

3. Slope at leaving end must be gentle and footing roughened so animal may easily scramble to dripping pen.

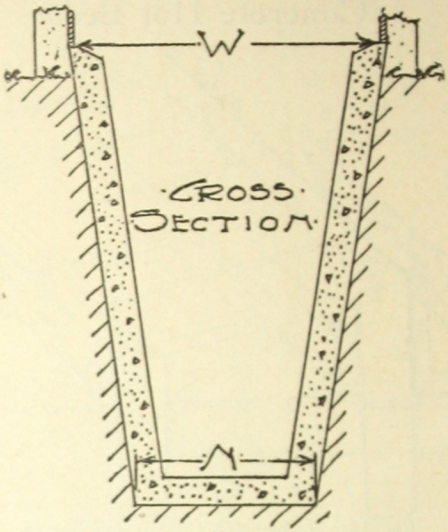

Fig. 13. Dipping Vat.

4. Provide two dripping pens draining back into vat. Mix walls 1 part Portland cement, 2 parts sand, 4 parts gravel or crushed stone. (U. S. Government Bulletin No. 481.)

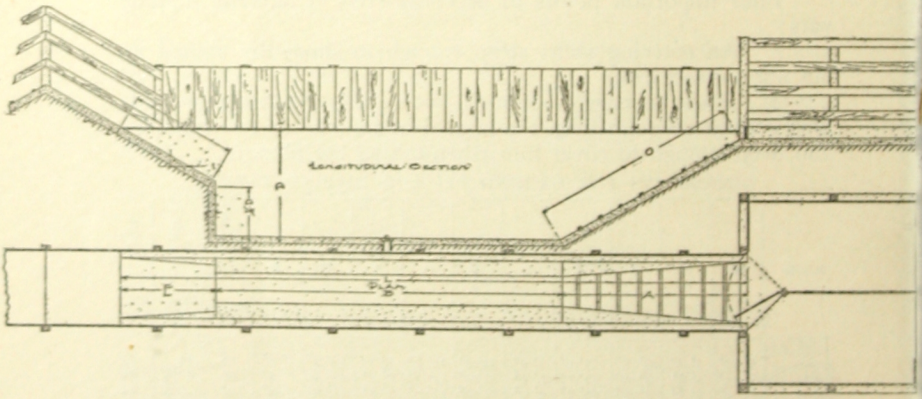

Fig. 14. Side Elevation and Plan Concrete Dipping Vat.

Concrete Roller

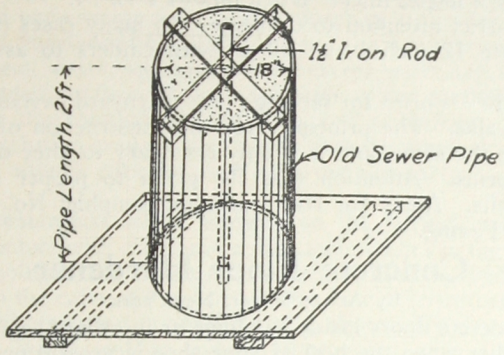

Fig. 15. Field or Garden Roller.

The forms and material for the field or garden roller illustrated are very simple and inexpensive. A length of old sewer pipe or drain tile is used for the form. The iron rod which serves for an axle is carefully centered by means of a hole in the platform and the wooden cross-arms at the top. The roller shown without yoke or shaft weighs about 550 pounds. By increasing the size of the roller and attaching shafts a horse-drawn roller may be made.

Feeding Floors and Barn Floors

These are built similar to sidewalks in essential parts, varying only in a few particulars.

All interior floors, such as cellars, dairy barn floors, etc., need no contraction joints. All outside floors, such as feeding floors, driveways, etc., should have contraction joints. All concrete

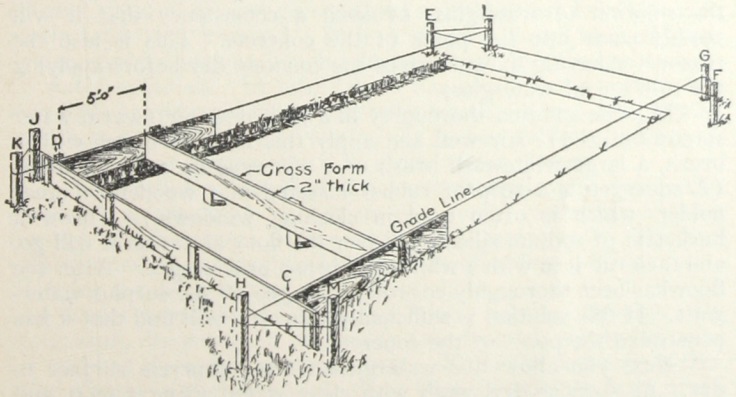

Fig. 16. Form for Feeding Floors and Barnyard Pavements.

floors subject to heavy loads should be made 6 inches thick; light loads, 4 inches thick. Use a mix of 1 : 2 : 4.

Pay strict attention to drainage. In many cases it is better to excavate 12 inches and fill in with cinders to assure good drainage.

Fig. 16.—Forms for feeding floors, barnyard pavement, floors and sidewalks. The principles for the construction of all these works are the same, and it is only necessary to alter dimensions of the forms. Attention must be given to proper slope and other details. Apply for free Vulcanite pamphlet No. 7 Cement Sidewalk Paving.

Concrete Floor Hardener

By Albert Moyer, New York.

If concrete floors inside buildings or in cellars begin to show wear so that when the heel of your shoe is ground on same the floor will dust, it is evident that such floor has not been properly laid, that it is either too porous or has been allowed to dry out too quickly before the cement, which forms the binder between the sand and the stones, has had an opportunity to reach its ultimate strength.

When this has occurred, the best remedy is to use a floor hardener. There are many patented floor hardeners on the market and a number sold under mysterious names. We therefore offer you the following suggestion:

That you purchase from your hardware dealer or paint dealer several gallons of waterglass (sodium silicate) of 40° baume. Wash the floor thoroughly with clean water, scrubbing with a stiff broom or scrubbing brush, removing all dirt and loose particles. Then allow the surface of the floor to dry, and after it is thoroughly dry, apply a mixture or solution of 1 part waterglass and 3 to 5 parts water. If the concrete is very porous, 3 parts water may do. If it is rather dense but still dusts, 5 parts water should be used. The idea to keep in mind is to make the solution of waterglass of such a consistency that it will readily enter into the pores of the concrete. This is also the reason for having the surface of the concrete dry before applying the solution of waterglass.

Mix the solution thoroughly in a pail of water (warm water should be used); stir well and apply this mixture either with a brush, a large whitewash brush or a squeegee on a long handle. (A squeegee is a strip of rubber inserted in a wooden or other holder, which is often used in cleaning windows.) Throw a bucketful of sodium silicate all over the floor as far as it will go, and then rub it in with a whitewash brush or squeegee. After the floor has been thoroughly covered, squeegee off the surplus waterglass. If this solution is sufficiently thin, you will find that it has penetrated the pores of the concrete.

Next you allow this waterglass-treated concrete surface to dry. As soon as dry, wash with clean water, using a mop, and squeegee off all the excess water. Again allow the surface to dry and again apply the solution of waterglass as before, only it

might be well to make this next application a thinner solution. If in the previous solutions you used 4 parts water to 1 part waterglass, use 5 parts water and 1 part waterglass in the second application. If this doesn't fill all the pores of the concrete, again wash off with clean water, squeegee off the excess water and allow this second treated surface to dry. As soon as the surface is again dry, apply the solution a third time and as before. You can make this solution even a little thinner than the previous one. This third coat should entirely flush all over the surface, filling all the pores.

The waterglass which remains on the surface, not having come in contact with the various salts and alkalies in the concrete, is readily soluble with water, and therefore easily washed off, thus evening up the color and texture of the floor. Therefore, as soon as the third treatment is applied and is thoroughly dry, flood the floor with water and go over it thoroughly with a mop and squeegee off all the excess water. This should also dissolve the excess waterglass remaining on the surface. That which has penetrated into the pores, having come in contact with the other alkalies in the concrete, has formed into an insoluble and very hard material, hardening the surface, preventing dusting and adding materially to the wearing value of the floor.

Waterglass is very cheap, and the amount of labor required for this sort of work will probably not cost more than ½c a square foot for the floor treated.

Concrete Septic Tanks

A New Sewage Disposal System for Country and Suburban Houses

The well-managed farm of today means many household conveniences as well as labor-saving farm machinery. Back-breaking drudgery has been largely eliminated from both house and fields. Running water and the kitchen sink and bathroom have supplanted the old-time pump and open, insanitary drainage. But the most efficient disposal of sewage remained a problem until the concrete septic tank was invented. It is a simple, cheap and effective device, rapidly supplanting the drywell, with its constant menace of water pollution. In brief, there has come to the farmer his own little sewerage plant in concrete; which answers his purpose even better than large city works, for he has neither the tax nor the repairs that always attach to a city sewer system.

The principle upon which the concrete septic tank operates is extremely interesting. It consists of a long, water-tight cistern, through which sewage passes very slowly and evenly. Located underground, it is warm and dark, thus affording perfect conditions for the development of the bacteria or germs which clarify and render harmless the sewage. After passing through the septic tank, the sewage is practically free from all suspended matter and has the appearance of water. From the septic tank this clear effluent is discharged into three lines of ordinary farm drain tile. For detailed plans write us for Free Septic Tank pamphlet.

Concrete Chimney

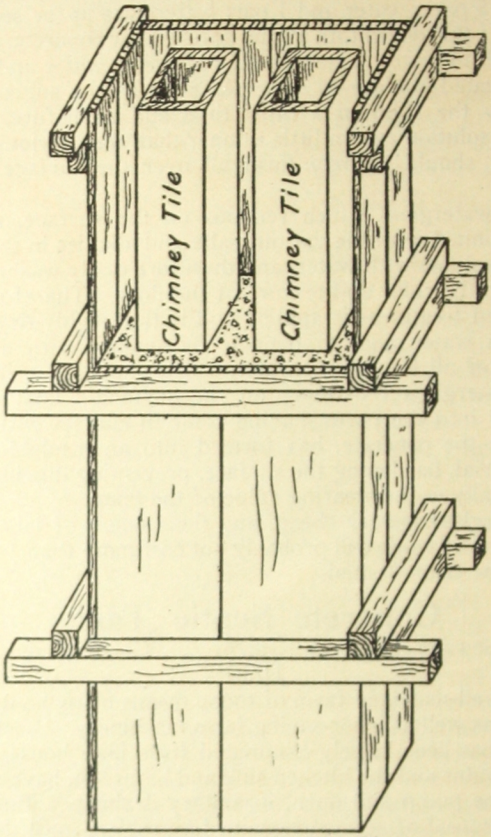

Fig. 17. Chimney with Two Flues.

Chimneys of concrete can be used with advantage for smoke-houses, feed cookers in barns, and for houses. The tile to form the flues are of clay or concrete, and should be round so as to give better draught. Provision for smoke-pipe connections must be made in the forms before concreting commences.

Manure Pits

Quoting from Government pamphlet, Farmers' Bulletin No. 481, entitled "Concrete Construction on the Live Stock Farm," the Agricultural Department states that one load of manure from a concrete pit is worth 1½ to 2 loads of manure as usually stored. Moreover, with concrete pits the supply of manure is increased by all the liquid manure, the richest part, from the barn gutters and feeding floor.

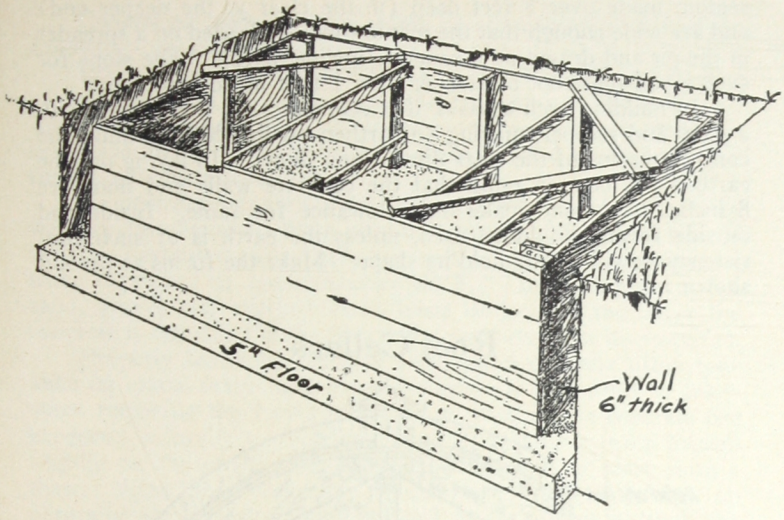

Fig. 18. Manure Pit Forms.

Shallow manure pits do very well where the manure can be frequently hauled to the fields. In figure 18 is shown plans for such a pit adjoining a feeding floor. The walls and floor are 5 inches thick. The clear dimensions of the pit are: Depth, 3 feet; width, 6 feet; length, 12 feet. Dig the trench 3 ft. 5 inches by 6 ft. 10 inches by 12 feet 10 inches. By keeping the sides vertical, provided the ground is sufficiently rigid to hold its shape, only an inside form will be needed. If the ground is too lose, so it would be likely to fall in when the concrete is placed, both an inside and outside form must be used. Frame the sides and ends separately. For the sides, cut the 1-inch siding 12 ft. long and nail it to four 2 by 4-inch uprights 3 ft. long and equally spaced. The end uprights for the sides are 2 by 4-inch pieces nailed flat to the siding; the others are also 2 by 4, but are nailed on edge. It is not necessary to cut these uprights to exact lengths; they may be allowed to extend above the siding. Make the siding for the end sections of the form 5 ft. 2 inches long, and at the ends nail it to the edge of two 2 by 4-inch uprights. Place a single 2 by 4 upright between each end pair. Cut four cross braces, 5 ft. 10 inches long, from 2 by 4-inch timbers. Provide enough sections of woven-wire fencing, 7½ ft. long, to cover the bottom of the pit and to act as reinforcing to the concrete. The concrete should be mixed as per instructions under the head of mixing and placing concrete; the proportions used should be no leaner than 1 part Portland cement, 2 parts sand and 4 parts crushed stone of sizes as previously described in this pamphlet.

Where manure must be stored for a considerable length of time, larger pits or basins are required. Such pits, however, are

seldom made over 5 feet deep (in the clear at the deeper end) and are wide enough that the manure may be loaded on a spreader in the pit and drawn up a concrete incline or run. The slope for such a run must not be steeper than 1 foot up to 4 feet out.

In building such a basin, it is economical to use a team with a plow and scraper, making an earthen pit in which to build the concrete basins of the clear dimensions shown. In laying out the earthen pit, bear in mind that the concrete walls and floor are 8 inches thick, and make due allowance for same. Inside and outside forms should be used, unless the earth is of such consistency as will rigidly hold its shape. Make the forms as per cut shown in figure 18.

Root Cellars

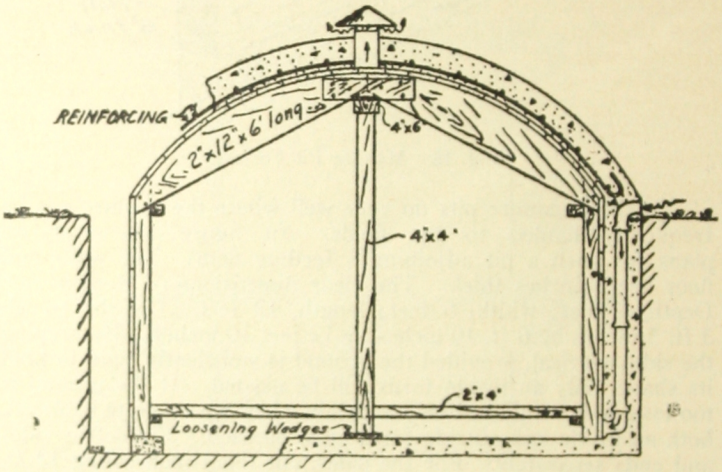

Fig. 19. Root Cellar Form.

Root or storage cellars are usually built all or part way under ground. The form in the illustration is for a cellar with arched roof, but a flat roof can be substituted. An underground cellar can be used for the storage of potatoes, other vegetables and fruit.

Concreting in Winter

Concreting may be done safely in wintertime provided the following precautions are observed.

Precautions against too slow setting and consequent danger of freezing must be taken when the temperature drops to 40°. The greatest danger of course is when the temperature drops to below freezing. You must always keep in mind the danger of a sudden drop in temperature.

To insure permanent work with concrete placed in freezing weather, the deposited fresh concrete must have sufficient heat to assist in hastening early hardening and must have a temperature when deposited of approximately 80°F. Therefore, the water, sand, gravel and crushed stone must be heated, and after the concrete is deposited in the forms, the concrete must be protected.

Properly hardened concrete and frozen concrete often look alike on casual inspection, therefore extreme care must be taken when removing the forms to ascertain whether the concrete has hardened naturally or is simply frozen. If frozen, even though slightly on the outside, the forms must be left in place until a thaw. After the thaw, this frozen concrete will harden up naturally and when sufficiently hard to be self-supporting, the forms may be removed. Frozen concrete may be detected by pouring hot water on the surface or applying heat from a painter's or plumber's blow-torch. If the surface becomes soft after application of hot water or upon exposure to other heat, this is evidence that the concrete is frozen and the forms should not be removed.

Heating Materials

Water—A temperature averaging 150° can easily be secured and maintained. One of the methods is by using live or exhaust steam from a boiler plant on the job. The other is to heat the water in tanks or kettles over a fire. To heat the water by means of exhaust steam, install in a water barrel or tank a steam pipe or short coil connected with the boiler plant. To heat water over a fire, use a large kettle supported above the fire.

Heating Sand, Gravel and Stone—In freezing weather, these aggregates often contain considerable frost and sometimes lumps of snow and ice. Therefore sand and gravel must be thoroughly thawed out by heating. Sometimes, the sand and stone are heated by running exhaust pipes thru the pile of sand and stone and covering the pile with tarpaulins. Another method consists of piling the material around the top of an improvised sheet iron cylinder, such as an old smoke stack, section of old iron sewer pipe, etc. The fire is built within. The material in this pile must be constantly raked or turned over so that the entire pile is completely thawed out and heated, although the temperature need not be as high as that of the hot water which will be used in mixing.

Protection of Concrete After Depositing

Particular attention must be given to protecting floor slabs, sidewalks, or similar construction having large surface areas in comparison to their volume. Floors are usually protected by a 12″ layer of hay or straw. The concrete should first be covered with building paper or canvas before placing the hay and straw. This should be weighted down so that the wind will not blow it away.

For walls, a covering of hay and straw over the exposed upper surface of the concrete is necessary. The board forms on the sides, excepting in very low temperatures, will be found sufficient. Where temperatures are very low, the walls should be housed in, making a frame of lumber and covering same with canvas or building paper, and under that light fires in salamanders. Salamanders are open sheet-iron coke burning pots, used as stoves and give off no smoke. Under ordinary conditions, one salamander is provided for each 500 square feet of surface.

FREE PAMPHLETS

The following pamphlets giving full directions and description for permanent concrete work will be sent you without any charge, postpaid, if you will write us mentioning which pamphlets you wish.

Simple Forms for Concrete.
Concrete Septic Tanks.
Shipments of Cement in Bulk.
Cost of Concrete Compared with Other Materials.
Concrete Tanks.
Concreting in Winter.
Cement Sidewalk Paving.
Proportioning Aggregates for Concrete.
Cement Stucco.
Concrete Silos.
Concrete Roads.
Concrete on the Farm.
Tennis Courts of Concrete.
Concrete School Houses.

"VULCANITE" was used in the following important work:

Broadway Subway, Union Square to 26th Street, New York.
All stations and platforms of old subways.
U. S. Postoffice, 33d Street and 8th Avenue, New York.
Paving Grand Central Station, New York.
Gould Residence, New York.
Florida East Coast Railway Viaducts, Long Key.
East Boston Tunnel.
Edison Electric Power House, Boston.
Lovejoy Wharves, Boston.
Naumkeag Mills, Salem, Mass.
Paving Cantonment, Ayer, Mass.
Brooklyn Navy Yard Reinforced Warehouses.

"CONCRETE FOR PERMANENCE"

The Vulcanite Portland Cement Co.

PHILADELPHIA *BOSTON* *NEW YORK*

Works: P. O. Easton, Pa.

SLOW-SETTING RAPID-HARDENING

¶ The exceptional *qualities* which make "VULCANITE" Portland Cement *superior* to other brands are its persistent characteristics of SLOW-SETTING and RAPID-HARDENING, enabling the contractor to place the concrete *before* it has begun to set and permit of its *use* at an earlier date.

¶ At the 1912 meeting of the International Association for Testing Materials, the statement was made and concurred in by the representatives of the various Nations present that the *value* of a Portland Cement was in SLOW-SETTING and RAPID-HARDENING. We have made THIS KIND OF CEMENT and ADVERTISED THIS FACT for years.

¶ "VULCANITE" Portland Cement has back of it a SPLENDID REPUTATION. This Company was incorporated in 1893 and has been under the same management ever since.

THE BRAND WITH A REPUTATION

¶ The raw materials are argillaceous limestone and pure lime carbonate, in the exact proportion of lime, silica, alumina and iron oxide, ground very fine. The finished product includes more impalpable powder or flour than other cements, which, however, can only be determined by the elutriation test (suspension of the finer particles in air) and positively not by the 200 sieve. "VULCANITE" is a special cement, having persistent and definite qualities, causing it to be preferred for more important work.

Write to any Engineer of National reputation as to his opinion on Vulcanite.