Beef Cattle Equipment

AGRICULTURAL EXPERIMENT STATION
IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS
Animal Husbandry and Agricultural Engineering Section
C. F. CURTISS, Director
AMES, IOWA
FEEDING EQUIPMENT FOR CATTLE

By W. A. Foster and R. S. Stephenson

Practically all of the pieces of cattle-feeding equipment described in this circular have been tried out for some years in the barns and feedlots of successful feeders. They may be "home built" and when used will save time, labor and feed and add that much to the possibility of feeding cattle at a profit.

Such feeding equipment as bunks, mangers, self-feeders for both grain and roughage, watering tanks, water storage tanks, cattle stocks, shipping crates, scale pens, dipping vats and the like, is necessary; the extent and kind of this equipment will depend upon the circumstances and needs of the individual feeder.

With each piece of equipment described, except in a few instances, a list of materials is given. The cost of the materials cannot be given, because of the great variations in prices in different localities. In the case of each piece of equipment, the dimensions may be altered and units changed to suit the special needs of the feeder.

ADVANTAGES OF CATTLE-FEEDING EQUIPMENT

Cattle-feeding equipment offers several advantages which should be carefully considered. The equipment which saves money will add to the profits in feeding.

_Saves Feed._ Much grain may be saved when fed in tight boxes or troughs where the animal may clean it up and cannot throw or root it out. When once thrown on the ground it is trampled into the manure and lost, unless hogs follow the cattle and pick it up. The waste is enormous when grain is fed on the ground, in low feed boxes, or from leaking mangers. Considerable roughage,—silage and hay,—is trampled under foot when low, ill-constructed racks are used. Well designed, strongly built racks will prevent the animals from pulling out large bunches of hay which would be dropped and trampled. They will also prevent the animals from throwing their heads to the side in fly time and dropping silage or other feed.

_Reduces Labor._ Some years ago it was common to see the small feeder go to the feedlot with a basket full of broken ears of corn on his shoulder. The parts of ears were handed to the steers individually. Much time was lost and besides, the grain was partially wasted. Many grains dropped from the animals’ mouths and were lost. What was eaten was not thoroughly ground, because each steer ate hurriedly in order to get his share. Modern bunks and self-feeders have replaced this hand-feeding
method. These are placed near bins, so that the grain is quickly conveyed and distributed by means of carts, carriers or chutes. The methods of harvesting, curing and storage of roughage have been changed to facilitate labor saving in the feeding operations. Chutes are provided so the hay is quickly distributed to the racks and mangers. The use of ensilage has made it possible to pack a large amount of roughage in a small space. The form of ensilage makes it easy to handle by means of carts or carriers.

Conserves Manure. In cattle feeding, the manure produced is valuable in building up the soil and maintaining its fertility. When cattle feeding is done in barns or about bunks and racks in the feedlot, the manure is saved. Otherwise, much of it would leak, be poorly distributed or wasted.

ESSENTIALS OF CATTLE FEEDING EQUIPMENT

Any piece of cattle feeding equipment, to be practical, useful and efficient, must have some features which are essential. Other features are desirable and add to the value.

Simple Construction. Since cattle-feeding equipment is usually made by either skilled or unskilled labor on the farm where used, simple construction is necessary. It avoids the use of a large amount of material, it saves labor, and it permits joints and fastenings which give strength and stability.

Strength. Feedlot and barn equipment receives rough usage, due to the steers pushing and crowding at feed time. All equipment should be strongly and securely built to resist the strains placed upon it.

Stability. All equipment which is not anchored or secured to a building should be low down, heavy and wide to insure stability. If light in weight, the bunks or racks are shifted by the cattle, and if narrow or high, they may be easily upset.

Dependability. If any piece of equipment or machinery is to be efficient, it must do its work without getting out of order. Cattle feeding equipment is subjected to rough usage and if it has parts which may be disarranged and put out of order by the animals, it is not efficient.

OTHER DESIRABLE FEATURES

Cost. It is an advantage if the cost of any piece of equipment may be kept down by using native materials which are available, or by employing used or second hand material.

Low Up-Keep Cost. Feedlot equipment should require very little attention in up-keep. When a part is broken, immediate replacement will save further wrecking and put it in condition for use at a slight expense. Daily attention is necessary to keep it in good order and to prevent damage by animals.
Movable. The cattle-feeding equipment used outside of buildings should be movable. Such pieces as bunks, racks, and self-feeders should be built on sills or skids so they may be moved from one lot to another.

Accessible. Racks, bunks and mangers should be located and built so they may be easily served by man and reached by the animals. Stock and dipping vats should be placed so the animals may be easily and quickly corralled and driven into them. The manure pit should be close to the barn and easily reached with a spreader without passing thru many gates and feedlots.

Durability. At a slight expense the posts resting on the ground may be creosoted or painted to prevent quick decay. A little care in selecting durable weather-resisting woods will add to the life of the equipment.

For convenience, the pieces of cattle-feeding equipment will be classified under several heads, namely, mangers, bunks, self-feeders, tanks and miscellaneous.

Mangers

Mangers are built-in receptacles for holding feeds from which the animals eat. Their efficiency is measured by the ease in serving, the small amount of space occupied and the reduction of feed waste to a minimum. Furthermore, the manger should be accessible and inviting to the animal or herd. For convenience, mangers may be classed as wall mangers and center-feed alley mangers. Wall-mangers are placed along the wall and reached from one side only, while center-alley mangers are accessible from both sides.

WALL MANGERS

The wall manger may be served from chutes above, using the manger as a feed alley for distribution, or it may be of the basket or rack type with feed box on front. This second kind requires distribution of the grain from the front and of the hay or forage either from the front or by dropping thru a continuous chute from the mow. The former requires more work in feeding and the latter utilizes valuable mow space for the continuous chute.

The wall manger shown in fig. 1 was used some years by the writer with good results. It was used for tie stalls, altho it may be used for loose stock. The box next to the front was continuous. It was used for grain or silage. The low back enables the animals to reach the roughage, clover or alfalfa which was dropped thru the chute to the manger and distributed.

The size, height of front and width of manger or alley should be made to suit the kind and weight of cattle fed. The animals should easily reach the back of the manger when feeding.
BILL OF MATERIALS WALL MANGER (Fig. 1)

(16 foot unit.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity/Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 sills,</td>
<td>2&quot;x6&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>9 joists,</td>
<td>2&quot;x4&quot;x4'-0&quot;</td>
</tr>
<tr>
<td>5 flooring,</td>
<td>1&quot;x10&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>4 front,</td>
<td>1&quot;x10&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>1 trough back,</td>
<td>1&quot;x6&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>32 ft. corner molding.</td>
<td></td>
</tr>
<tr>
<td>1 rail guard</td>
<td>2&quot;x8&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>4 uprights</td>
<td>2&quot;x4&quot;x7'-0&quot;</td>
</tr>
<tr>
<td>All Materials S 4 S.</td>
<td></td>
</tr>
<tr>
<td>2 lbs. 20d nails</td>
<td></td>
</tr>
<tr>
<td>3 lbs. 8d nails</td>
<td></td>
</tr>
<tr>
<td>Concrete—</td>
<td></td>
</tr>
<tr>
<td>2/10 cu. yds. for wall,</td>
<td></td>
</tr>
<tr>
<td>1/10 cu. yds. for pillars</td>
<td></td>
</tr>
<tr>
<td>8 feet apart</td>
<td></td>
</tr>
<tr>
<td>5 bags cement</td>
<td></td>
</tr>
<tr>
<td>1/2 cu. yd. sand</td>
<td></td>
</tr>
<tr>
<td>1 cu. yd. pebbles</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. Section of wall manger.
Fig. 2. Cross section and front elevation of center alley manger with dirt floor.
CENTER ALLEY MANGER

A center feed alley with dirt floor is shown in fig. 2. The feed boxes are placed at the sides with hay racks above. This permits quick distribution of grain and roughage. The leaves and seed which drop from the hay fall into the feed box and are not trampled into the bedding and lost for feed.

This type of manger,—troughs and racks,—is extensively used in cattle feeding. The troughs may be set on a concrete curb or on short posts. The former method is more desirable because it retains the manure and will not encourage or shelter rats and mice.

BILL OF MATERIALS CENTER ALLEY MANGER (Fig. 2)

(16 foot length)

Concrete—2 cubic yards.

<table>
<thead>
<tr>
<th>Feed Troughs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4 trough fronts</td>
<td>2'x8&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>2 trough bottoms</td>
<td>2'x10&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>2 trough bottoms</td>
<td>2'x8&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>2 corner strips</td>
<td>5'x2&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>16 joists</td>
<td>2'x4&quot;x2'-0&quot;</td>
</tr>
<tr>
<td>16 posts</td>
<td>2'x6&quot;x2'-0&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feed Racks</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 rack bottoms</td>
<td>2'x8&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>6 rack frame</td>
<td>2'x6&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>2 rack frame</td>
<td>2'x4&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>6 rack backs</td>
<td>1'x8&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>8 rack hangers, back</td>
<td>2'x4&quot;x3'-0&quot;</td>
</tr>
<tr>
<td>20 rack hangers, front</td>
<td>2'x4&quot;x6'-0&quot;</td>
</tr>
<tr>
<td>20 rack slats</td>
<td>2'x7&quot;x3'-6&quot;</td>
</tr>
</tbody>
</table>

All Materials S 4 S

BUNKS

Two types of feed bunks are shown, one (fig. 3) for grain, concentrates and silage and the other (fig. 4) for grain and roughage. These bunks are built in convenient lengths of about 12'-0" each. The width is about 4'-0" for stability.

OPEN GRAIN BUNKS

Four by four posts are used with two-inch flooring and sides. Two-inch matched flooring, resting on 2'x6" joists, form the bottom of the bunk. Two by eight inch sides are shown, which give sufficient depth so the grain is not pushed out.

Cross and end bracing of 2'x4" is shown, which is necessary to strengthen the bunks since they receive rough usage.

COMBINATION BUNKS

The combination bunks in fig. 4 are similar to the open bunk, except that a low rack is built over the feed box. Hay, fodder or straw may be placed in this rack in addition to using the feed troughs for grain.
Fig. 3. Bunks for grain, concentrates and silage.

Fig. 4. Combination bunks which may be used for grain and hay, fodder or straw.
Long posts are necessary to support the framing for the rack. Two by fours are used for the rack, spaced ten inches apart. This permits a six inch opening, which allows animals to feed on roughage without pulling out large bunches and dropping them. The troughs catch the leaves which fall from the roughage and serve for feeding grain.

**BILL OF MATERIALS OPEN GRAIN BUNK (Fig. 3)**
(12 foot length)

- 6 posts
- 4 joists
- 4 cross braces
- 4 diagonal braces
- 2 end braces
- 2 trough sides
- 2 trough ends
- 4 bottom
- 2 bolts

All Materials S 4 S.
3 lbs. nails 16d and 20d.

**BILL OF MATERIAL FOR COMBINATION BUNK (Fig. 4):**
(12 foot length)

- 6 posts
- 4 joists
- 4 diagonal braces
- 2 end braces
- 2 trough sides
- 2 trough ends
- 2 topside rails
- 2 topend rails
- 1 cross tie
- 5 bottom
- 2 rack stays
- 30 rack slats, side
- 6 rack slats, end

All material S 4 S.
8 pounds nails.

**FEED RACKS**

Feed racks are built for holding forage, such as hay, straw and other roughage. They may be built of a small size which is filled daily, or of a large size which will hold several days' supply. Also, the rack may be mounted on a low down wagon or truck.

The small rack is built like the combination bunk shown in fig. 4 except that it is built low down and no troughs are provided for grain. It may be built from fig. 5 by reducing the width to about 4'0" and the length to 6'-0" or less.

**LARGE RACK**

A large rack is shown in detail in fig. 6 and may be built 12 to 16 feet long. The frame is built on sills which serve for runners when moved from one lot to another. The uprights or
Fig. 5. Large feed rack that will hold several days' supply of forage.

posts are 4"x4" set 4'-0" apart. The slats of the rack are 2"x4", spaced 10 to 12 inches on center. The larger spacing may be used, since the roughage will pack and pull out in small bunches. A large temporary roughage rack is shown in fig. 5. Six posts were planted and a light frame made to support basket. While this rack could not be moved readily, it made a serviceable rack for several years at a low cost for materials and labor.

Fig. 6. Side and end elevation of large feed rack.
BILL OF MATERIALS SMALL ROUGHAGE RACK
(12 foot length)
4 posts 4”x4”x3’-6”
4 side rails 2”x6”x12’-0”
2 side rails 2”x8”x12’-0”
4 end rails 2”x6”x4’-0”
2 end rails 2”x8”x4’-0”
4 frame side 2”x6”x12’-0”
4 frame end 2”x6”x4’-0”
30 side slats 2”x4”x5’-0”
6 end slats 2”x6”x5’-0”
3 joists 2”x6”x4’-0”
All materials S 4 S.
6 pounds nails 16d and 20d.

BILL OF MATERIALS FOR LARGE ROUGHAGE RACK (Fig. 5)
(16 foot length)
3 runners 2”x6”x16’-0” cypress
10 posts 4”x4”x6’-0” fir or Y. P.
4 side rails 2”x8”x16’-0” fir or Y. P.
4 side rails 2”x6”x16’-0”
4 end rails 2”x6”x6’-0”
4 end rails 2”x8”x6’-0”
2 end boards 1”x8”x6’-0”
2 side boards 1”x8”x12’-0”

FEED RACK FOR WAGON

A feed rack may be built for a low-down wagon which may be filled at the stack or mow and hauled to the feedlot. (Fig. 7.) This saves handling and enables the feeder who has his lots some distance from the barns to save the drudgery of hauling the hay a second time in feeding.

A low-down wagon with movable tongue is used. The rack sills should be raised to permit the front wheels turning under for short turns.

BILL OF MATERIALS FOR FEED RACK FOR WAGON (Fig. 7)
2 pieces sills 2”x10”x16’-0”
4 “ “ side rails 2”x6”x16’-0”
2 “ “ end rails 2”x6”x8’-7”
5 “ “ cross rails 2”x4”x6’-0”
10 “ “ uprights 2”x4”x3’-4”
32 “ “ side slats 1”x4”x3’-4”
8 “ “ end slats 1”x4”x4’-7”
4 “ “ “ “ 1”x4”x3’-6”
4 “ “ “ “ 1”x4”x2’-5”
4 “ “ floor joists 2”x4”x3’-2”
3 “ “ “ “ 1”x12”x16’-0”
10 U clamps 3”x3”x14”
6 lbs. assorted nails.
5 sills 2”x4”x6’-0” Fir or Y. P.
1 tie 2”x6”x6’-0” “ “ “
7 end slats 2”x4”x6’-0” “ “ “
36 side slats 2”x1”x8’-0” “ “ “
All materials S 4 S.
10 pounds assorted nails 8d, 16d and 20d.
Fig. 7. A feed rack which may be placed on a wagon and hauled from stack or mow to feedlot.

**SELF-FEEDER FOR CATTLE**

While the self-feeder has not been generally used in cattle feeding, it has been used successfully for some years by a good many cattle feeders. It consists of a large hopper-shaped bin with troughs at the sides. The grain flows from bin to troughs by gravity as it is consumed by the animals. (Fig. 8.)

**BILL OF MATERIAL FOR CATTLE SELF-FEEDER (Fig. 8)**

(12 foot length)

All materials S 4 S.

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 runners</td>
<td></td>
<td>6&quot;x6&quot;x14'-0&quot;</td>
</tr>
<tr>
<td>8 posts</td>
<td></td>
<td>6&quot;x6&quot;x2'-0&quot;</td>
</tr>
<tr>
<td>4 cross joists</td>
<td></td>
<td>2&quot;x6&quot;x6'-0&quot;</td>
</tr>
<tr>
<td>4 joists</td>
<td></td>
<td>2&quot;x6&quot;x12'-0&quot;</td>
</tr>
<tr>
<td>100 bd. ft. flooring 12 ft. length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 braces</td>
<td></td>
<td>2&quot;x4&quot;x6'-0&quot;</td>
</tr>
<tr>
<td>2 trough fronts</td>
<td></td>
<td>2&quot;x4&quot;x12'-0&quot;</td>
</tr>
<tr>
<td>4 accelerator</td>
<td></td>
<td>1&quot;x10&quot;x12'-0&quot;</td>
</tr>
<tr>
<td>8 studs</td>
<td></td>
<td>2&quot;x6&quot;x6'-0&quot;</td>
</tr>
<tr>
<td>8 bin ribs</td>
<td></td>
<td>2&quot;x6&quot;x5'-0&quot;</td>
</tr>
<tr>
<td>2 girts</td>
<td></td>
<td>2&quot;x4&quot;x12'-0&quot;</td>
</tr>
<tr>
<td>4 girts</td>
<td></td>
<td>2&quot;x6&quot;x12'-0&quot;</td>
</tr>
<tr>
<td>1 miscellaneous</td>
<td></td>
<td>2&quot;x4&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>180 bd. ft. bin sides</td>
<td></td>
<td>1&quot;x10&quot;x12'-0&quot;</td>
</tr>
<tr>
<td>100 bd. ft. bin ends</td>
<td></td>
<td>1&quot;x10&quot;x12'-0&quot;</td>
</tr>
<tr>
<td>2 ridge</td>
<td></td>
<td>1½&quot;x8&quot;x14'-0&quot;</td>
</tr>
<tr>
<td>300 bd. ft. roof</td>
<td></td>
<td>1&quot;x10&quot;x16'-0&quot;</td>
</tr>
<tr>
<td>2 pair 8-inch strap hinges.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 rods ½&quot;x6'-4&quot;, washers and nuts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 rolls roofing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 pounds assorted nails</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fig. 8. Cross section and side elevation of self-feeder for cattle.
Fig. 9. Movable self-feeder.

Two different feeders are shown in figs. 9 and 10. One is built on runners and may be moved about the feedlot, while the other is not movable; it is set on short posts and shed shelters are provided on each side. This latter feeder is filled from the ends while the movable feeder may be filled from the ends or by lifting a section of the roof.

Self-feeders for cattle should be wide and well braced so they will withstand winds and rough usage. They should be low

Fig. 10. Stationary self-feeder, which affords shelter as well.
down and compact to prevent upsetting. A length of 12 feet as shown in fig. 8 will hold about 200 bushels of small grain.

WATER TANKS

An abundant supply of water is more important in the feedlot than food. Cattle will subsist longer without food than without water. Modern improvements have made a good water supply possible without depending upon springs and running streams, as formerly.

An elevated storage tank or cistern supplied by a pump from a deep well will furnish water to the farmstead at a small expense after it is installed. The pump may be operated by wind or electric power or by an internal combustion engine.

The storage tank and cistern, and the stock tank and float control will be briefly described.

Where a hill or rising land is close to the farmstead, a cistern may be built for storage of water. It has some advantages over the elevated tank in being protected from heat and cold. A storage cistern is shown in fig. 11 which is a popular type for the middle west.

The elevated tank makes the gravity water system possible when no natural elevation is at hand. The tank may be elevated on a timber frame or placed on a masonry silo. The wood tank is used on piling or frame as in fig. 12, and the masonry tank on the silo tower. The former is subject to the weather, while the latter must be carefully built and water-proofed to prevent leaking. The supply pipe to the tank should be well insulated

Fig. 11. Storage cistern for water supply.
to avoid freezing. When these faults are overcome, this tank makes an ideal storage tank. (Fig. 13.)

A wood tank supported and enclosed in a silo tower has many advantages which make it practical and of sufficient merit for consideration by any feeder needing an inexpensive gravity system. The silo tower is built of small diameter of hollow tile to the height required for the bottom of the tank. A door frame is set in the wall and one or more small windows may be placed for light. This room under the tank may be used as a milk house, pump house or storage for garden and lawn tools.

The tank is supported on an I beam which bears on the tile wall. A wood tank is used and by placing a continuous silo door in the enclosing part of the tower, the hoops may be tightened or the tank replaced whenever necessary. A low conical shaped concrete roof with a scuttle is used. (Fig. 14.)

The height of elevation and the capacity of the tank will depend upon individual requirements. Wood tanks may be secured from stock from four to ten feet in diameter and up to ten feet high; large sizes may be secured on special order.
The material for the tower may be secured from any hollow block manufacturer who makes silo blocks. The number will depend upon the size.

The tower may be erected near the well, but never over a deep drilled well on account of the occasional need of lifting the pump out.

WATER TANK FOR STOCK

The concrete tank needs a brief mention in this bulletin because many tanks are made which do not last. Too little reinforcement, small slope on the inside and lean mixtures of concrete have been, in many cases, the faults which cause failure.

The mixture of concrete must be rich, one part cement, two parts sand and four parts pebbles. When bank run gravel is used it should be screened out and be remixed in the proper proportions. Place the concrete and spade well next to the forms in order to secure a smooth surface.

A four inch slope on the inside of the tank, with a smooth wall will save the tank from bursting due to freezing. The expansion will bulge on the top surface as in the freezing of water in a flaring pail or tub.

Proper reinforcing is desirable. Woven wire placed as shown in fig. 15 is usually considered sufficient for reinforcing. It is, however, advisable to keep on the safe side by using a rod around the top as shown. This may be a 1/4 inch to 1/2 inch square rod or larger of new reinforcing, or old rods, such as silo hoops, bridge rods or hay track. Such old rods are available on most farmsteads or may be secured at a small cost from the local junk yard.

All reinforcing should be thoroughly embedded in the concrete. When reinforcing is spliced, it may be overlapped and wired or hooked together.

Fig. 14. Wood tank in silo shell.
When sufficiently overlapped it need not be wired. Tanks may be built of any shape, circular, square, rectangular or oval. Any desired size may be made.

The efficiency of a tank may be increased by placing it in a fence line so that it may serve two or more feedlots or fields. This may mean a larger tank, but one supply pipe and drain will serve and reduce the expense of building several tanks.

A concrete platform which extends a few feet out from the tank will prevent the unsightly mudhole or wallow which results from a leaking tank or from stock splashing water over the sides.

**FLOAT CONTROL**

The stock tank requires some device for keeping the water at a constant level. The float controlled valve has solved this problem and it may be installed at a low expense. It is neither freeze nor fool proof and will require constant attention. The float will freeze in winter and not work, and it is easily put out of order by children and animals.

A float may be installed at a slight expense which will be both freeze and fool proof and which will control one or more tanks. A slight elevation or mound is desirable for a location and a float chamber is built of concrete or by using a linseed oil barrel. (Fig. 16.) Since water seeks its level, the chamber is built so the float in the chamber will be of the same height or elevation as the water in the tank. This level may be secured by using a spirit level and setting stakes or by a drainage level. The float valve is set as in the tank and since the chamber is
covered and buried, a sealed crockery jug or large bottle will serve as well as the copper float.

The float chamber should be kept within a reasonable distance from the tank. It should be large enough so that the float valve may be easily set. The pipe from the float chamber to the tank should be ¾ inch or larger, to reduce the friction so that the tank will quickly fill up when animals are drinking. This pipe should be taken from the bottom of the float chamber and enter the bottom of the tank to avoid freezing.

These float controls have been in successful use in Iowa for several years. After once set and regulated, the control should be covered with a slab having a small pipe vent and it may then be covered with earth. A number of tanks may be controlled by one float centrally located.

Fig. 16. Float control for stock tank.

MISCELLANEOUS FEEDING EQUIPMENT.

Many pieces of home built cattle feeding equipment may be listed under this head. Only the more important equipment will be discussed, such as stocks, erates, scales pens, manure pit, dipping vat, feed carts and feedlots.

CATTLE STOCKS

No large feedlot is complete without a set of cattle stocks. They may be used for swinging injured animals, for hoof trimming or dehorning.

A serviceable set of stocks is shown in fig. 17, which may be built by any carpenter or handy man. The timbers, which are large, should be framed together and pinned or bolted.

The tie sill should extend at least three feet in front of the stocks. It rests upon 2"x6" set on edge, which is flush with the
Fig. 17. Cattle stocks.

BILL OF MATERIALS FOR CATTLE STOCKS (Fig. 17.)

Concrete Base 1½ cu. yds. concrete

2 pieces sills 6"x6"x7'-0"
9 pieces floor 2"x10"x4'-3"
2 pieces tie sills 6"x8"x12'-0"
2 pieces guards (undersill) 2"x6"x7'-0"
4 pieces posts 6"x6"x8'-0"
2 pieces tie beams 6"x6"x7'-0"
1 pieces cross tie 6"x6"x4'-0"
3 pieces front 2"x6"x4'-3"
4 pieces stanchion rails 2"x6"x4'-3"
2 pieces stanchions 2"x6"x5'-0"
4 pieces braces 4"x4"x3'-0"
4 pieces cleats 1"x2"x3'-0"
12 bolts 1½"x12'
4 bolts ½"x8"
2 bolts (tie) ½"x4'-4"
2 rollers 4" pipe 4'-9" long
4 spindles 1½" pipe 18" long
10 lbs. assorted nails
1 gallon paint
1 swing
inside face of the tie sill. This prevents the animals' feet from slipping under the sill.

The stanchions are made from 2"x6" oak and are held in place by $\frac{1}{2}"$ bolts or pins. Additional holes are provided for adjustment.

The rollers for supporting a canvas swing are made of 4" wrought iron pipe with a smaller pipe in the ends for axle spindles. These are held in place by filling the large pipe with concrete.

The stocks should be built of durable timber which has been thoroly seasoned. It should be kept painted. A roof built over the stocks will make them more serviceable and lengthen their life. Frequently, however, the stocks are built in a shed or barn.

**SHIPPING CRATE**

Shipping crates should be strong, light in weight and serviceable and at the same time stable and occupy the least amount of floor space. A serviceable crate is shown in fig. 18. The animal's head is kept low to prevent its jumping out. White pine is a desirable wood for the shipping crate, since it is easily worked, light and strong.

The dimensions and amount of material will depend upon the size of the animal. The shape of the crate may be as shown or full. Some shippers prefer to keep the animal's head down to prevent crowding or jumping, while others allow the animal more freedom.

A tight floor should be used and it should be firmly nailed to the 2"x4" sills. For small animals the side sills are sufficient, but an intermediate sill should be used for large, heavy animals. The uprights are 2"x4" and the crating should be 1"x4" and 1"x6", No. 2 white pine. No. 2 white pine should be used throughout for strength and for a light weight crate.

Fig. 18. Shipping crate.
SCALE PEN

The farm scale is an important piece of equipment on most farmsteads. It is most efficient when it has a pen which may be set up quickly when weighing loose animals or thrown aside when weighing a loaded wagon of loose hay. A pen which has these features is shown in fig. 19. It has been used some years and has proved to be satisfactory in every way.

The sides are built of four uprights of 2"x6"x8'-0" oak and eight 1½"x6"x16'-0" boards for each. The boards are spaced as shown in the side elevation of fig. 19, and set in uprights as shown in the cross section. The bottoms of the uprights are cut off at an angle of 60 degrees (cut 7 to 12) and serve as stops or rests for the side when thrown back for weighing hay.

A tenon was placed on top of each upright and the cross ties were mortised and held the tops together. A 14" gate hinge was bolted to each upright and the post part of the hinge was screwed thru the floor into the sill. The pins of three of these hinged parts extend in the same direction and the fourth is turned in an opposite direction. This holds the side in place and prevents shifting by the animals. The side is set in place by slipping the hinges on the three pins, then bolting on the fourth hinge. It is removed by unbolting this hinge.

The end gates are built as shown in the end elevation and are hinged to each side. This permits a one-man pen, because the
Fig. 19b. Cross section of scale pen, plan and side and end elevations of which are shown in figs. 19a, c and d.

---

Fig. 19c. Side elevation of scale pen, cross section of which appears above.
gates hold the sides upright during the time and after the cross ties are removed. The gates are then opened so they are in line with the side and the whole thrown back; then the gate is lifted from its hinges and set aside. The second side is handled in a like manner. Two men can work to a slight advantage in removing the pen, since the gates can be removed before laying the sides back.

Since most scales are built in the open, cypress boards and oak uprights, when given reasonable care and painting, will out-last two or more floors.

When building this pen in a scale house, sufficient space must be allowed to permit the sides to drop back. The cut at the bottom may be made at a less angle. Hinges should be placed so a full bracing is given on rake cut of uprights when thrown back.

**BILL OF MATERIALS, SCALE PEN** (Fig. 19.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform 8'x14'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All materials S 4 S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 pieces uprights</td>
<td></td>
<td>2&quot;x6&quot;x8'-9&quot; oak</td>
</tr>
<tr>
<td>4 pieces cross ties</td>
<td></td>
<td>2&quot;x6&quot;x8'-0&quot; oak</td>
</tr>
<tr>
<td>16 pieces side fencing</td>
<td></td>
<td>1½&quot;x6&quot;x14'-0&quot; cypress</td>
</tr>
<tr>
<td>8 pieces end fencing</td>
<td></td>
<td>1½&quot;x6&quot;x16'-0&quot; cypress</td>
</tr>
<tr>
<td>4 pieces uprights</td>
<td></td>
<td>1½&quot;x6&quot;x14'-0&quot; cypress</td>
</tr>
<tr>
<td>2 pieces end braces</td>
<td></td>
<td>1½&quot;x6&quot;x18'-0&quot; cypress</td>
</tr>
<tr>
<td>96 bolts gates</td>
<td></td>
<td>¾&quot;x4&quot;</td>
</tr>
<tr>
<td>16 bolts cross ties</td>
<td></td>
<td>5/16&quot;x6&quot;</td>
</tr>
<tr>
<td>4 pair 14&quot; gate hinges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 bolts for hinge</td>
<td></td>
<td>¾&quot;x6½&quot; (to fit hinges)</td>
</tr>
<tr>
<td>1 gallon paint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 lbs. assorted nails 8d, 10d, and 12d</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MANURE PIT

Manure is a valuable by-product in feeding. To secure the greatest benefit, it should be properly stored, since it is impossible and impractical to remove it to the fields each day. Some receptacle must be provided in which it may be placed until hauled out. The manure pit best fills this need. It consists of a concrete tank or pit built partially or wholly below grade. The manure is dumped into this and removed at convenient times.

The manure pit should be large enough to care for the greatest amount likely to accumulate at any time. The manure should

Fig. 20a. Plan and side elevation of manure pit.
HILL OF MATERIALS FOR MANURE PIT (Fig. 20.)
(Size 16’x24’x6’ deep)

PIT

Concrete footing 1 cu. yd.
5” floor .14 cu. yds.
6” wall 7 cu. yds.
22 cu. yds. 140 bags cement

11 cu. yds. sand
22 cu. yds. pebbles

SHELTER SHED

6 pieces bed plate 2”x6”x12’-0”
10 bolts (plate to wall) 1/2”x12”
24 pieces studs 2”x4”x3’-6”
26 pieces rafters 2”x4”x10’-0”
4 pieces wall plate 2”x6”x12’-0”
2 pieces wall plate 2”x6”x16’-0”
6 pieces gable framing 2”x4”x16’-0”
4 pieces sash (glazed) 9 light 8”x10”x13/8” and frames
4 pieces ties 1”x8”x12’-0”
1 piece 1”x6”x16’-0”
2 doors 3’x7’-6” frames and track
2 doors 3’x8” frames and track
20 cu. ft. 1”x3” corner trim
20 cu. ft. 1”x4” corner trim
300 bd. ft. drop siding
600 bd. ft. shiplap
6 rolls roofing
50 pounds nails, assorted
1 gallon paint
be protected from freezing, leaching out and burning. A shed built over the pit affords this protection and if carefully built will keep out flies and prevent their breeding in the manure. It should be closed tightly, should be light and screened.

A well planned manure pit is shown in fig. 20. This pit is designed for a sloping site with an incline for backing a spreader in on the low side. The pit walls are built of concrete with a frame structure built on this for shelter. The pit may be ventilated by placing shield windows and screened louvers in gables, or by using hog house ventilators on the roof.

**DIPPING VAT**

While the dipping vat is not generally used in the feeding plant, it is in occasional demand. A concrete dipping vat is shown in fig. 21, with general dimensions. The size shown is large enough for hogs, sheep and young stock. The dimensions should be increased for heavy feeders and breeding stock. For the average feeders the width should be at least 3'-0" at top and 20 inches or more at the bottom. The length should also be increased to 7'-6" or more and the depth to 5'-0".

The location of the dipping vat is important. The fences of the run must be strong to prevent animals breaking out. Drainage is essential to draw off the dip and to remove the surface water which will run in from rains.

No bill of material is given because of the variations in sizes. The size shown will require about four cubic yards of concrete or 25 bags of cement, two cubic yards of sand and four cubic yards of pebbles for a 1:2:4 mixture.

---

![Fig. 21. Dipping vat.](image-url)
SILAGE CARRIERS AND CARTS

In the feed lots shown in fig. 24, a carrier was used to splendid advantage. The bunks were built with high posts which support the track.

A cart may be used over the bunks as shown in fig. 22. In this case the cart was home-made. The bunks were in line and the trough fronts and the horizontal member from post to post above the trough were placed inside of the posts so they would serve as a track for the cart, which was equipped with small flange wheels. This cart was run under the silo chute, filled and the silage raked out as it was pushed over the bunks.

This cart was run on the top side of the rails of the bunks, but it could be set down on the trough fronts, which were also set on the inside of the posts. The labor of lifting the silage to top of the bunks was saved when the silage was low in the silo. The axle shaft should not extend beyond the face of the wheel, to allow sufficient clearance for the cart.

Only a small amount of materials is required if the bunks permit the rails and trough fronts to be used as a track. The small flange wheels may be secured from a junk yard or heavy hardware dealer. They should be small, about 6" or 8" in diameter. A pipe would serve as axles and a large packing box for body of cart.

Fig. 22. Feed cart over bunks.
Another feed cart is shown in fig. 23 which is similar to the above, but adapted to a center alley manger. The center of the alley is elevated about four inches above the floor of the troughs, which permits the flange wheels of the cart to run on the edge as a track. If the boards are uneven, a thin metal strip may be used, 3/4" wagon box iron, to protect the edge and save wear. The flange wheels of this cart are placed with flanges on the outside.

The rear end of the body box is left open so that the silage may be raked out. By placing a diamond shaped frame on the under side of the box, the ensilage may be pushed into the feed trough on the return trip to the silo chute. Grain may be distributed easily with this cart.

FEEDLOT OR PADDOCKS

Each feeder has the problem of arranging his lots to suit his conditions and best serve his purpose by keeping the labor reduced. A cattle feeding plant is shown in fig. 24, which was designed in cooperation with a large feeder in western Iowa. A crescent-shaped, high hill sheltered a maple grove on the southeast. The lots were located in this sheltered area and arranged as shown. Silos were located and a row of permanent bunks
Fig. 24. Suggested arrangement of feedlots.
with feed carrier track was located on the center line. This track passed between double cribs, thru the feed room into which the silo chutes emptied, to a grain bin at the west end of the lots. Alfalfa was ricked in a line north and south of the silos and these ricks separated the lots.

A scale pen and hog lot with feeding floor were placed south of crib. By making a drive on the west and south, the scales were accessible to all feed lots. Cattle in the feed lot were driven thru the hog lot and drive. A section of movable bunks was placed at each side of the feed room and a grain bin at the west end. This was desirable at silo filling time and when weighing cattle in lot one.

The object of this arrangement was to feed the cattle quickly at the least expense of labor. The carrier was filled with grain at the cribs or the east grain bin. This bin was connected to the elevator in the cribs by means of a gravity chute. The grain was distributed in bunks between lots two and four. Silage was then loaded into the carrier, and was distributed in the bunks between lots one and three. The carrier was then loaded with grain from the west bin and the grain distributed in the bunks between lots one and three. Silage was again loaded in the carrier and distributed in the bunks between lots two and four. One trip and return was sufficient to serve the four lots of cattle with both silage and grain.

Cattle in the early feeding stage, requiring the least grain, were placed in lots one and three. All four lots were kept in roughage, which was thrown from the ricks directly into feed racks.

The bunks were built to allow the hogs to circulate under them to pick up all grain which fell thru. They also prevented rats from harboring about the feedlots.

While this plant may not be adaptable to many feed lots, it shows that careful planning will save labor and that all resources such as shelter from hill and hay ricks should be utilized to best advantage.