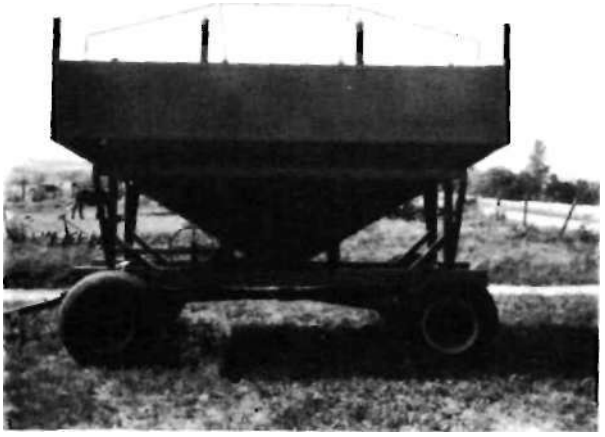
Center Drop Gravity Wagon

Author: *Steven M. Zeller*
James M. Maguin
Instructor: *Paul N. Stevenson*
School: *Kansas State University*
City & State: *Manhattan, KS*



BILL OF MATERIALS

1	14 ga.	72" x 144"	Sheet
1	12 ga.	48" x 144"	Sheet
1	12 ga.	48" x 96"	Sheet
2	14 ga.	60" x 144"	Sheet
2	20 ft.	3" x 3" x ¼"	Angle
1	20 ft.	3" x 5" x ¼"	Angle
5	20 ft.	2" x 2" x ⅛"	Angle
1½	20 ft.	2½" x 2½" x 3/16"	Angle
1	10 ft.	2½" x 2½" x ¼"	Angle
4	20 ft.	⅛" x 4"	Strip
1	8 ft.	2½" x 3/16"	Strip
2	20 ft.	¾" I.D.	Pipe
1	9 ft.	1" I.D.	Pipe
1	3 ft.	⅝"	Re-bar
76	⅛" Welding Rods		
3996	Mig Counts		
Sandblasting			
2	gal.	Metal Primer	
3	gal.	Red Implement Paint	
Sprockets, chain, and hub			Salvage

The gravity box design, was desired as it allows rapid unloading of grain without the expense and design problems inherent with hydraulic type systems. This gravity box was designed with a center dump to allow easy unloading at the local elevator or by a power take off (PTO) driven auger into a bin for on farm storage; this also provided a more balanced distribution of weight. The narrow under carriage design allows tremendous versatility in that it can be mounted on a fifth wheel frame, truck frame, or on a (4-wheel wagon) running gear.

The 8 ft. x 12 ft. dimensions were decided upon to allow a grain capacity of approximately 350 bu. and to provide a minimum of a 30° slope for the ease of unloading high moisture grain. Two other important factors were the 8 ft. maximum width for highway use and the 12 ft. length to fit our truck chassis and wagon gears.

We started the project by cutting the 2 ft. wide sides from 12 gauge sheet using an abrasive disk mounted on a circular saw. The sheets were Metal Inert Gas (MIG) welded together at the corners to form a 8 ft. x 12 ft. box. Then *2Vi"* x *2Vi"* x 3/16" angle iron was welded to the outside of each corner to add additional strength. The angle iron was cut 13 1/a" longer than the side to allow the mounting of wood extensions above the sides. A piece of 2" x 2" x *V%"* angle iron was then welded along the top edge of the sides to add rigidity.

A box formed from the sides was then inverted (topside down) to allow easier construction of the hopper sides. The hopper sides were cut from 14 gauge sheet metal using a metal shear. The two 12 ft. hopper sides were fastened to a portable crane and lifted into position and the top edges welded to the bottom sides. The frame for the center drop was made from *2"* x 2" x *Vt"* angle iron and welded into position, to provide support to the two sides. This allowed for the exact placement of the two remaining hopper sides. The two 8 ft. wide hopper sides were then lowered into position and welded along the seams. To provide additional strength to the hopper, seams 4" x *Vs"* strip was bent into a V-shape using a hydraulic break and then welded on the outside of the hopper seams.

The strips that covered the two 12 ft. seams and the seams that extended to the center drop were bent to a

135° included angle. The strips that covered the two 8 ft. seams were bent to form a 120° included angle.

With the actual bin completed, work, began to form a durable and rigid undercarriage. Two pieces of 3" x 3" x *lA"* angle iron was welded to the 12 ft. hopper sides 12" below the bottom of the vertical sides. Then, because of the different slopes of the 8 ft. and 12 ft. hopper sides, two pieces of 3" x 5" x *lA"* angle iron was welded on the hopper (8 ft.) sides to form a square frame around the hopper 12" below the bottom of the vertical sides. Four legs to support the frame was cut from 3" x 3" x *lA"* angle iron. The legs were extended down to the main beams and welded. The beams were formed by butting two pieces of 6" x *2"* channel iron together to form a box section. Then two pieces of 3" x 5" x *'A"* angle iron was welded on each end between the main beams to tie them together.

To add lateral stability to the legs, four pieces of *2W* x 2[1]/2" x *Vit,"* angle iron were used to brace the legs to the corners of the bin frame. The legs were braced longitudinally by using 2'/2" x *2Vi"* x *[A"* angle iron running from the legs to the main beams. To provide additional support to the bin frame along the 12 ft. sides, four pieces of 2" x *2"* x *V%"* angle iron were spaced evenly apart along the two sides and welded to the bin frame and main beams.

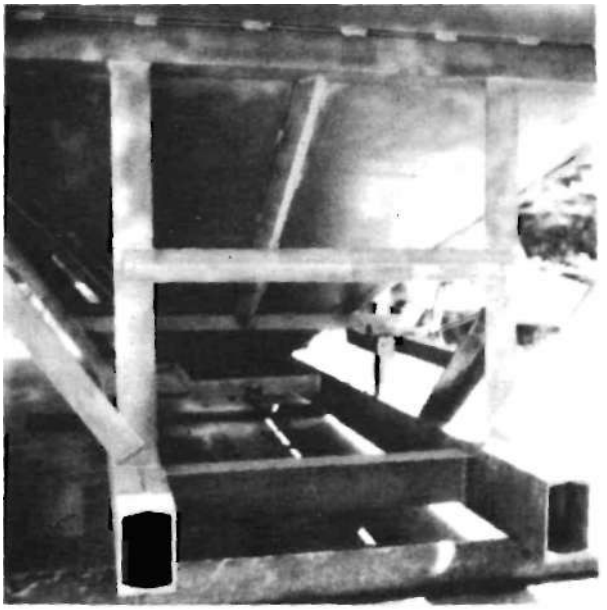
To provide additional support to the middle at the hopper sides four pieces of 2" x 2" x *V»"* angle iron were welded to the bin frame and extended down to the frame around the center drop.

The bottom door was cut from *Va"* plate steel and smoothed up for easy sliding in its track. The door slides were made by putting two pieces of 2" x 2" x Vs" angle iron to the angle iron frame surrounding the bin opening to form a track. The angle iron was spaced *Va"* to allow clearance for easy door operation, but to prevent grain or fertilizer from jamming the door.

The door opening mechanism consists of a rack welded to the bottom of the door, which engages to a pinion gear on a shaft mounted to the main beams. On one side of the shaft, the support is welded solid to the main beam and on the other side the shaft support is bolted to the beam to allow for easy removal of the shaft for lubrication and inspection.

To drive the pinion gears shaft a small sprocket was welded to the shaft. The chain from this sprocket runs down to an arbor shaft made from a short piece of 1" I.D. pipe and %" shaft. On one end of the shaft a sprocket is mounted and on the other end a removeable steering wheel is mounted. The arbor shaft housing is supported by pieces of 2" x *2"* x *Vt"* angle iron welded to one of the bin legs and the main beam. The steering wheel was formed by bending a piece of *W* re-bar into a circle and mounting it to a hub using four short pieces of steel rod.

To provide additional support for the wood extensions,

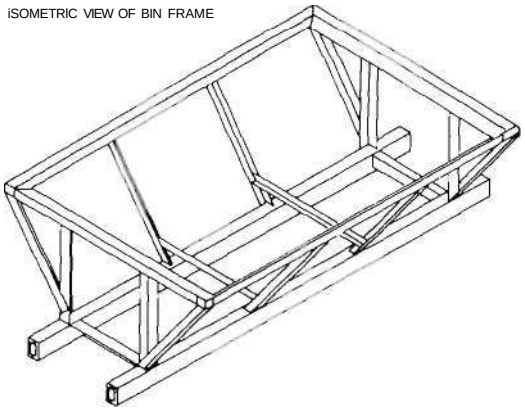


six pieces *2Vi"* x [3]/i6" strips were cut and welded to the 2" x 2" x *V%"* angle iron running around the top of the vertical sides.

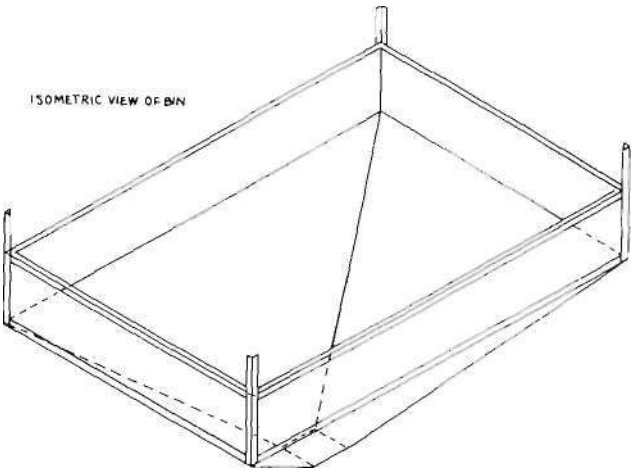
The frame for the tarp canopy was formed from five pieces of *W* l.D. pipe. The first piece was mounted lengthwise over the center of the bin and welded to the 2'/2" x [3]/i6" strips (wood extension supports). This piece of pipe was bent so that there was four feet in the center twelve inches above the top of the wood extension supports. This was done to provide rapid water shed from the tarp. The other four pieces of pipe were cut and bent to join the center pipe for added rigidity and complete the tarp canopy frame.

The wagon bolsters and clamps which went on the wagon gear to hold the box secure to the rear axles were made by the author. In the front the bolsters were made so that the box would float when going over uneven ground.

ISOMETRIC VIEW OF BIN FRAME



ISOMETRIC VIEW OF BIN



CENTER DROP GRAVITY WAGON