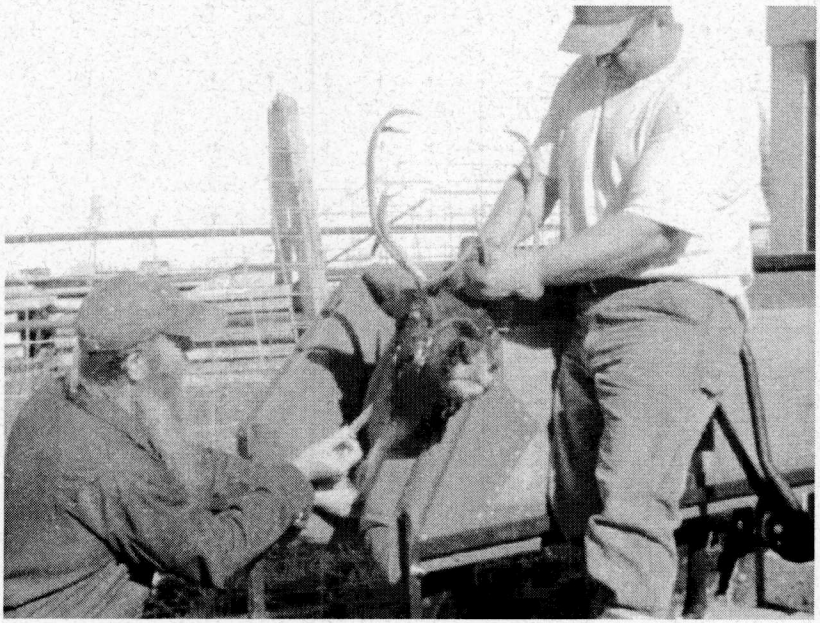
Design for a Portable Reindeer Crush

by
Greg Finstad and Lyle Renecker

Modifications
by
Todd Nichols and Alan Tonne



University of Alaska Fairbanks
Agricultural and Forestry Experiment Station
School of Agriculture and Land Resources Management

Circular 94 revised February 2001

Introduction

In Alaska, reindeer are managed under both free-ranging and farm conditions. Where reindeer are herded, they are handled twice yearly to harvest velvet antlers and to perform health and record-keeping duties. Under farm conditions, reindeer are handled more frequently to provide routine health care and monitor weight gain. In both types of management there is a need to efficiently and safely restrain the animal with minimal stress to it.

A pneumatic crush for red deer is manufactured in New Zealand and has been used in Alaska for years to restrain reindeer. However, this crush is both expensive and cumbersome to transport.

The Reindeer Research Program at the University of Alaska Fairbanks designed a lightweight, portable reindeer crush that can be built locally. This crush can be manufactured with materials that are readily available and assembled with minimal welding and construction skills. The materials can be purchased in most areas for less than $500.

The design is offered as a prototype for the builder and should be personalized and improved upon to meet the needs of each handling facility. If the crush is to be stationary, heavier materials can be incorporated into its construction and additional bracing can be added at stress points. Also, smaller or larger versions can be built to specialize in restraining calves or bulls.

Construction of Components

Frame

All items listed in the materials section (Table 1) are specified in finished English and metric measurements and no further cutting is necessary. Round pipe can be substituted for the square tubing.

It is much easier to drill all holes in the frame components before it is welded. While a drill press makes this job easier, it can be done with a ½" (13mm) drill and a good-quality SHARP drill bit. The RPMs should be low when drilling so the bit does not overheat causing it to lose it's temper. Drill all holes 5/16" (1.6mm) larger than the recommended bolt diameters.

The builder must take extra care to "square" the frames before welding. The corners should be tacked quickly then welded a little at a time to prevent overheating, thereby avoiding warping of lighter gauge steel. If not, the crush will be difficult to erect

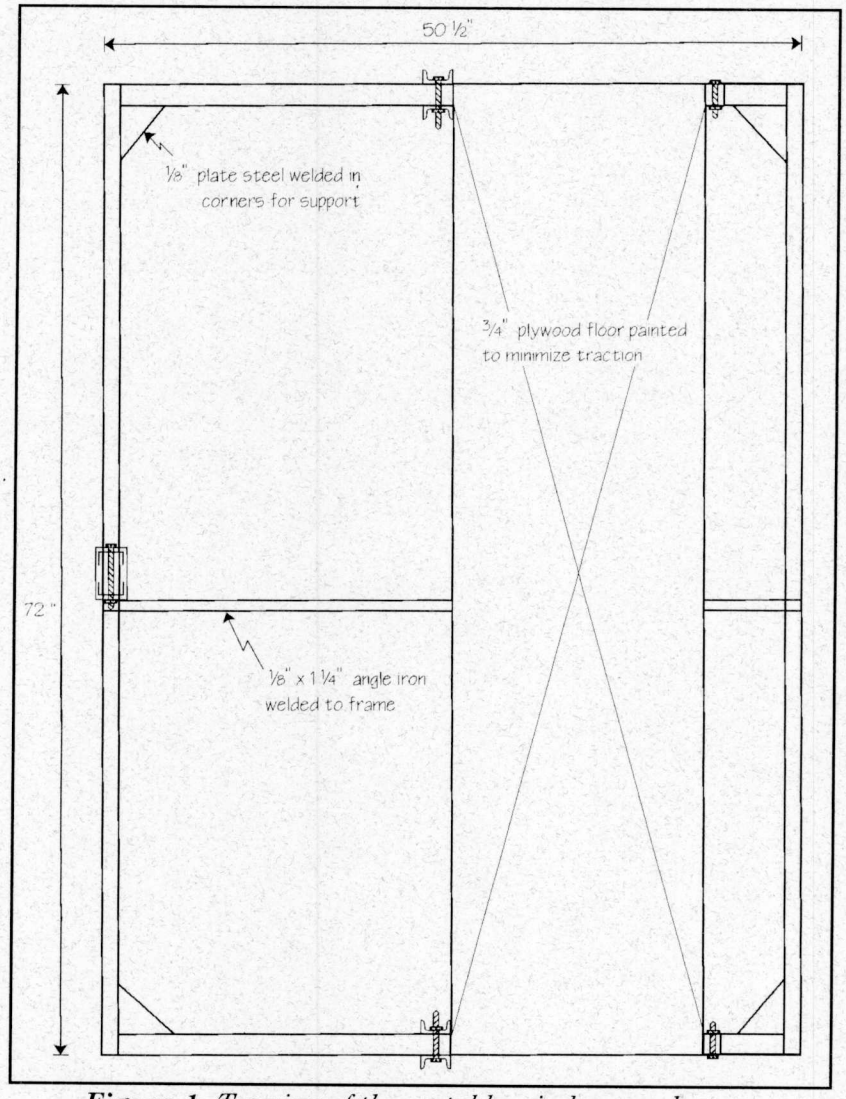


Figure 1. *Top view of the portable reindeer crush.*

in the field and the frame will bind during operation.

Welding of the triangular corner bracing is important to ensure reliability of the crush (Fig. 1). Without the bracing, stress on the framework will eventually break the welds at the corners. A steel tube-to-tube weld did not hold up on an earlier prototype.

Holes can be drilled through the bottom framework of the crush to attach a Tru-test electronic scale. Weights can be gathered easily and quickly whenever an animal is held in the crush. After construction has been completed, all sharp edges and burrs

must be ground or filed from the frame and painted with a coat of rust-proof paint.

The plywood floor, lower side panels and the exposed side of the upper panels can be cut and painted with wood enamel (Fig. 2). The upper padded side panels can be made adjustable by drilling sets of holes four inches apart through the frame uprights (Fig. 3). Remember to cut the lower side panel down far enough for the lowest adjustment. The panels can be placed at the lowest adjustment for handling calves.

An alternative for adjusting the height of the upper panels is to set the legs into sleeves of the next-sized (diameter) tubing (Fig. 2a). This design allows for quicker adjustment and avoids knocking loose the bolts within the padded sides. The leg bracing, made with angle-iron, for the stationary side upright allows for

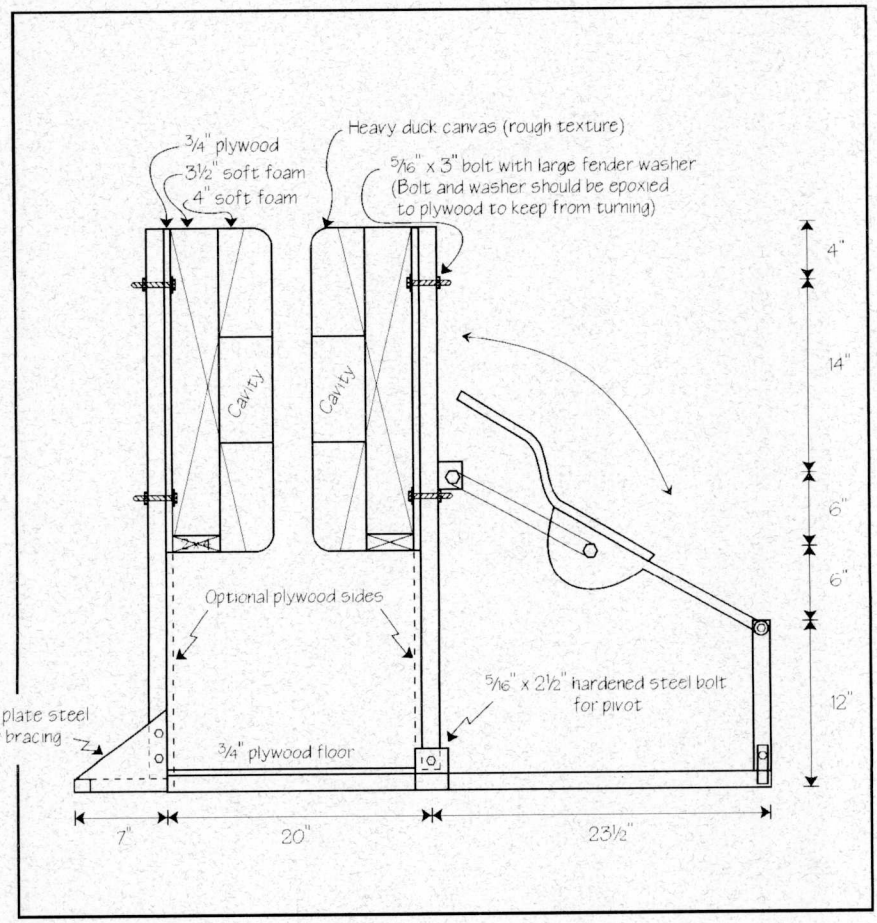


Figure 2. *Front view of portable reindeer crush.*

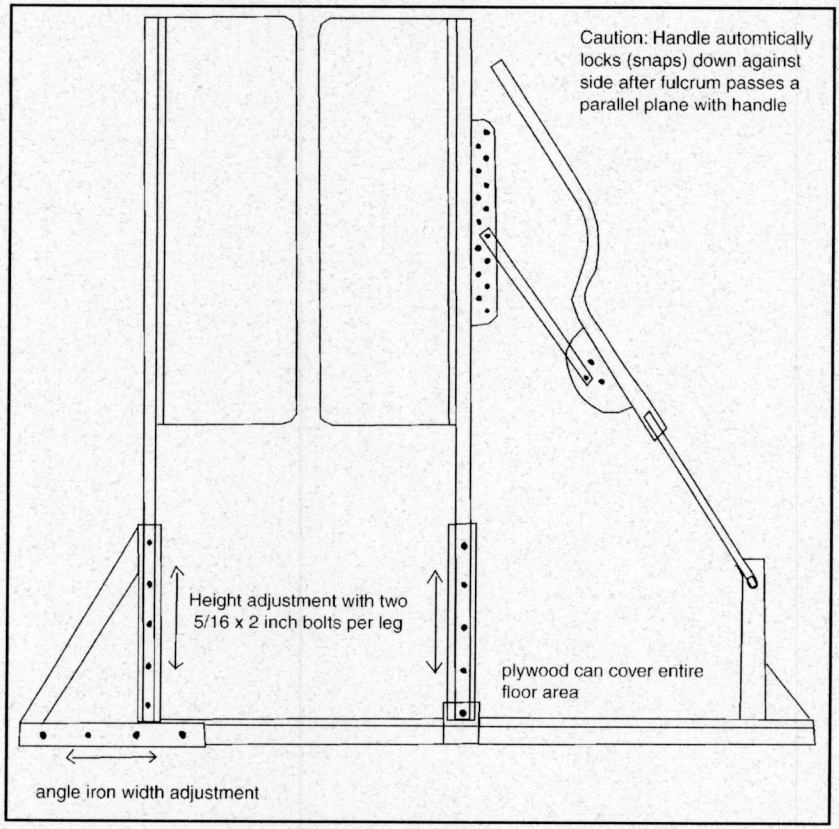


Figure 2a. *Front view with alternative handle and adjustments.*

width adjustment. Each of these adjustment sites (six total) require at least two 5/16" x 2" hexhead bolts.

There are two alternative designs for the front "working end" of the upright side panels (Fig 3a). First, both sides can be cut at angles allowing for easier access for veterinary duties, such as taking blood samples (cover photo). Second, using pipe and angle-iron, a "neck shelf" can be welded to extend out on the stationary upright of the square design.

The crush can be disassembled into components for transportation from one location to the next. It will easily fit in the back of a pickup truck or a 2' x 4' x 6' (0.6m x 1.2m x 1.8m) space. If the crush is to be transported by boat, plane or snowmachine the components can be cut into 24" (0.6m) sections. The crush can be reassembled by using pins made from 1" (2.5cm) tubular steel inserted into the cut ends of the 1¼" (3.2cm) frame components. Bolts, 1½" (3.8cm), can be inserted through the frame and pins to hold them firmly in place.

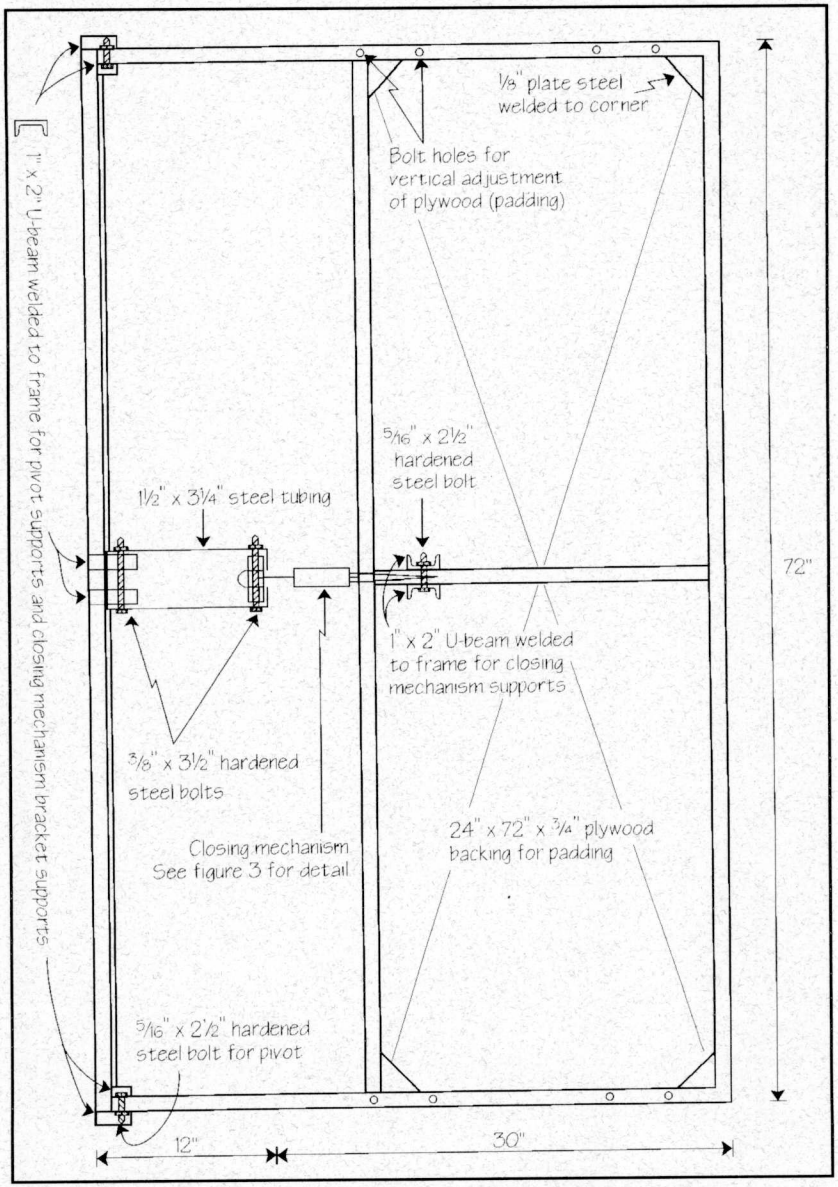


Figure 3. *Side view of the portable reindeer crush.*

Pads

One of the 4' x 8' (1.2m x 2.4m) sheets of plywood can be cut into two pieces measuring 2' x 6' (1.2m x 1.8m) (Fig. 3). These pieces of plywood are to be used as the backing for the pads of the crush. They can be painted at this time with enamel paint.

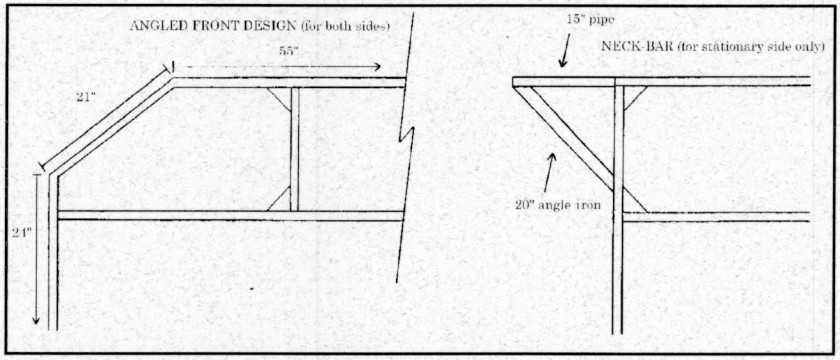


Figure 3a. *Side view of two alternative front designs.*

Holes should be drilled at the corners of the plywood so they can be bolted to the frame. The 5/16" x 3" (0.8cm x 7.6cm) bolts should be inserted into the holes while using the fender washers or carriage bolts may be used to provide a firm seat into the wood. The bolts should be glued, with an epoxy resin, firmly to the plywood; once the padding is applied the head of the bolt will no longer be accessible. Remember not to overtighten the nut when bolting the pads to the frame or the bolt will break free of the epoxy and spin in place.

The wood 2" x 4" (3.8cm x 8.9cm) should be cut to 6' (183cm) and attached to the bottom edge of the plywood with the 2" (52mm) sheetrock screws (Fig. 2). Often, a reindeer will "collapse" in submissive posture while in the crush and this will act as a ledge for supporting the animal and will not allow it to fall to the ground.

The 2' x 6' (0.6m x 1.8m) pieces of foam can be glued to the plywood backing. The 8" x 6' (0.2m x 1.8m) pieces are then glued flush to the top of the larger piece of foam and the bottom of the 2" x 4" (3.8cm x 8.9cm) leaving a cavity to enclose the reindeer (Fig. 2).

The fabric to cover the foam should be rough textured, not smooth, to provide friction to "grip" and hold the animal. A heavy-duty canvas duck works well and is inexpensive. The canvas duck should be cut two feet larger than the plywood backing to allow plenty of overlap for attachment. The canvas should be tucked at the corners, making a square corner. It should be stretched tight and attached to the plywood with 3/4" (19mm) roofing nails through a 1½" hem along the edge of the canvas. One nail every two inches is sufficient. It is best to start with the top edge (around the bolts first), stretch the canvas over the bottom edge and square the ends last.

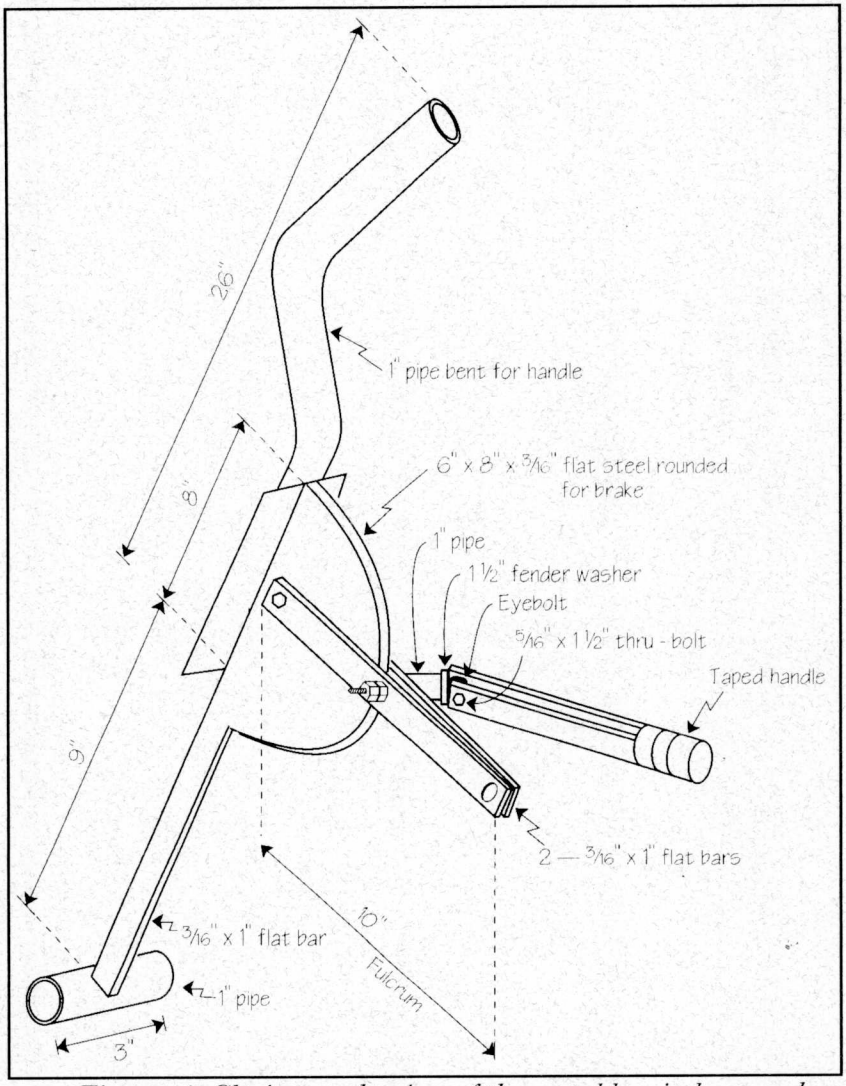


Figure 4. *Closing mechanism of the portable reindeer crush.*

Closing Mechanism

The closing mechanism consists of an arm to close the crush and another locking arm (optional) to brake the movement at any point along the fulcrum (Fig. 4). The arm is made from 1" (2.5cm) pipe welded to 6" x 8" (16cm x 20cm) plate steel. The plate should be rounded on one side and welded to a piece of 1¼" x 8" (3.2cm x 20.3cm) plate perpendicularly to each other, then welded to the pipe handle. Instead of 17" (43cm) flatbar for the lower half of the

handle, a ¾" pipe sleeved and welded into the 1" pipe will provide a stronger handle (Fig. 2a). A 2¾" (7.0cm) length of ¾" (19mm) pipe is welded on the end of the ¾ " pipe. It is bolted through the top of the housing on the frame with a ⅝" x 4½ " hexhead bolt with lock-washer and pivots as the crush is opened or closed.

The fulcrum consists of two pieces of flat bar bolted loosely on each side of the steel plate. The end of the fulcrum attached to the "squeezing side" upright can be adjusted for a proper "snug" squeeze (Fig. 2a). Caution: when squeezing, after passing the point where the fulcrum and handle are on a parallel plane the handle will automatically snap and lock against the side panel. So, watch your fingers (push on the handle with an open palm). An optional locking mechanism is used to brake the action of the crush by compressing the two pieces of flat bar around the steel plate.

Conclusion

This crush design has been tested with good results both at the University of Alaska facility and during field operation. The crush is lightweight and can be disassembled for easy transportation. It can be fabricated with a minimal amount of welding for less than $1,500 (including labor).

Table 1. Materials

Crush

	(English)		(Metric)
4	1¼" x 1¼" x ⅛" x 72" steel tubing (frame)	=	3.18cm x 3.18cm x 3.2mm x 182.9cm
2	1¼" x 1¼" x ⅛" x 69 ½" "	=	3.18cm x 3.18cm x 3.2mm x 176.5cm
3	1¼" x 1¼" x ⅛" x 48" "	=	3.18cm x 3.18cm x 3.2mm x 121.9cm
4	1¼" x 1¼" x ⅛" x 40" "	=	3.18cm x 3.18cm x 3.2mm x 101.6cm
2	1¼" x 1¼" x ⅛" x 23" "	=	3.18cm x 3.18cm x 3.2mm x 58.4cm

***Optional angled-front design:**

2	1¼" x 1¼" x ⅛" x 72" steel tubing (frame)	=	3.18cm x 3.18cm x 3.2mm x 182.9cm
2	1¼" x 1¼" x ⅛" x 40" "	=	3.18cm x 3.18cm x 3.2mm x 101.6cm
2	1¼" x 1¼" x ⅛" x 55" (top bar)	=	3.18cm x 3.18cm x 3.2mm x 139.7cm
2	1¼" x 1¼" x ⅛" x 21" (angles)	=	3.18cm x 3.18cm x 3.2mm x 53.3cm
2	1¼" x 1¼" x ⅛" x 24" (front legs)	=	3.18cm x 3.18cm x 3.2mm x 61.0cm

***Neck-bar** (for stationary side only of standard design)**:**

1	1" x ⅛" x 15" pipe	=	2.54cm x 3.2mm x 38.1cm
1	1½" x 20" angle-iron	=	3.8cm x 51.0cm

15	6" x 6" x ⅛" triangular steel plate (corner bracing)	= 15.3cm x 15.3cm x 3.2mm
1	3" x 1 ½" x ⅛" x 11" tubing (handle mount)	= 7.6cm x 3.8cm x 3.2mm x 28cm
2	2" x 1" x ⅛" x 4" U-beam (brace for pivot)	= 5.1cm x 2.5cm x 3.2mm x 10.16cm
4	1½" x 1½" x ⅛" x 12" tubing (panel leg sleeves)	= 3.8cm x 3.8cm x 3.2mm x 30.5cm
2	1½" x 10" and 12" angle-iron (adjusting brackets)	= 3.8cm x 25.4cm and 30.5cm
1	3" x ¼" x 8" flatbar (adjustable fulcrum support)	= 7.6cm x 6.4mm x 20.3cm
8	5/16" x 3" carriage bolts w/ 1 washer and locknut ea.	= 8.0mm x 7.6cm
1	epoxy	
12	5/16" x 2" hexhead bolts w/ 2 washers and 1 nut ea. (for sides)	= 8.0mm x 5.1cm
6	5/16" x 1½" hex bolts w/ 2 washers and 1 nut ea. (for floor)	= 8.0mm x 3.8cm
2	7/16" x 2½" hex bolts w/ lockwasher and 1 nut ea. (pivot)	= 1.1cm x 6.4cm
2	¾" sheets plywood (both cut to 6' and one rip in half)	= 1.28cm x 183cm x 122cm
2	2" x 4" x 8' (cut to 6') fir board	= 3.8cm x 8.9cm x 183cm
~40	sheetrock screws	= 5cm
1	1 lb. ¾" roofing nails	= 5 kg / 1.3cm
1	4' x 18' (6 yds) #10 OD (mold-proof) canvas duck	= 122cm x 549cm
4	3 to 4" x 2' x 6' foam padding	= 10.2cm x 61.0cm x 183cm
2	cans undercoat metal spray paint	
1	1 quart (liter) wood enamel	

Closing mechanism/ Handle

1	1" x ⅛" x 30" steel pipe (handle)	=	2.54cm x 3.2mm x 76.2cm
1	¾" x ⅛" x 12" pipe (sleeved handle extension)	=	1.9cm x 3.2mm x 30.5cm
1	¾" x 2¾" pipe (housing for bolt in handle mount)	=	1.9cm x 7.0cm
2	1¼" x ¼" x 16" flatbar (fulcrum)	=	3.18cm x 6.4mm x 40.6cm
1	1¼" x 8" plate (surface to weld adj. handle plate on)	=	3.18cm x 20.3cm
1	6" x ¼" x 8" plate (adjustment plate for fulcrum)	=	15.2cm x 6.4mm x 20.3cm
1	⅝" x 4½" hexhead bolt w/ nut and lockwasher	=	1.59cm x 11.4cm
2	⅜" x 1" hex bolts w/ 1 nut and lockwasher ea. (fulcrum)	=	9.5mm x 2.54cm

*Optional locking mechanism:

2	1" x 3/16" x 6" plate	=	2.54cm x 4.76mm x 15.2cm
1	1" x ⅛" x 1" pipe	=	2.54cm x 3.2mm x 2.54cm
1	5/16" x 1½" hex bolt w/ nut and washer	=	7.9mm x 3.8cm
1	¼" x 3" eyebolt w/ two nuts/ washers	=	6.4mm x 7.6cm
1	1½" fender washer		

Tools:

welder (wire-feed is best for small gauge steel)
metal band saw or chopsaw
circular saw
drill press and/or ½" electric drill
grinding wheel
hammer
screw driver
wrenches
tape measure
paint brush