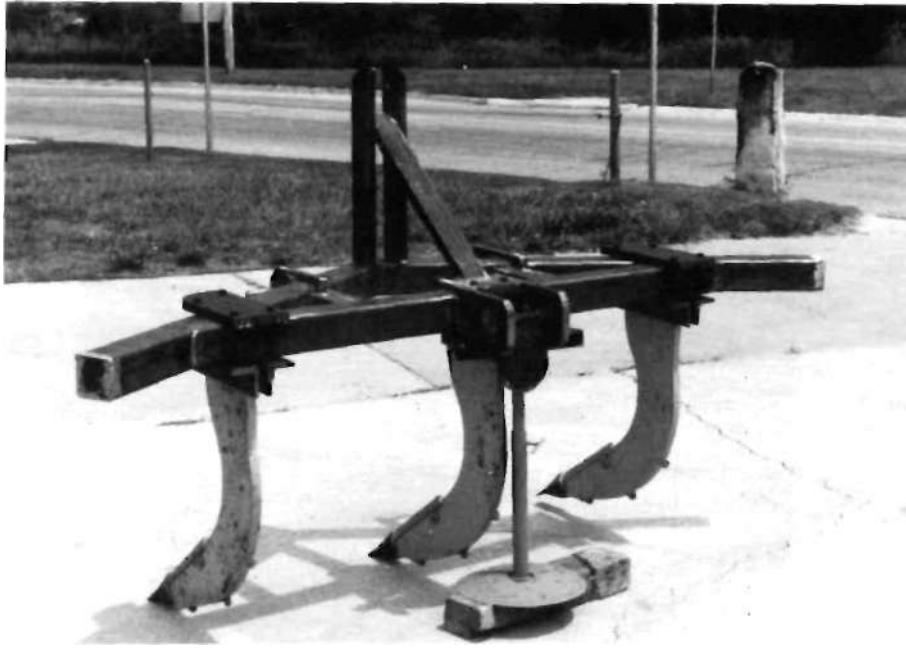


Sub-Soil Ripper



Bill of Materials

Ref. letter	No. of pieces	Part	Dimensions and Material
A	1	Hitch tongue	1" x 6" x 9" flat iron
B	2	Hitch brace	1" x 6" x 14" flat iron
C	1	Axle shaft	1 1/4" x 8 1/2" shafting
C-C	1	Swivel hitch	1 3/8" x 6" pipe
D	1	Shank mount	1" x 6" x 10" flat iron
E	1	Rear brace	1/2" x 4" x 4" x 60" steel tubing
F	2	Frame	1/2" x 4" x 4" x 57" steel tubing
G	1	3-Point brace	1 3/8" x 3" x 28" channel iron
H	4	Brace	1 3/8" x 3" x 14" channel iron
I	2	Lower hitch	1" x 6" x 11" flat iron
J	2	Hitch pin	1 1/4" x 5" shafting
K	2	Outer shank mounts	1" x 6" x 14" flat iron
L	2	Upper 3-point hitch	1 3/8" x 3" x 23" channel iron
M	1	Hitch pin	1 1/4" x 7" shafting
N	4	Bottom shank mounts	1/2" x 3" x 3" x 14" angle iron
O	2	Inner bottom shank mount	1/2" x 3" x 3" x 10" angle iron
P	3	Ripper shank	1" high carbon steel complete
Q	12		1/2" x 7" No. 8 bolts
R	3	Shear bolts	1/2" x 3" No. 8 bolts
S	3		3/4" x 3" No. 8 bolts
T	15		1/2" nuts
U	3		3/4" nuts
V	15		1/2" lockwashers
W	3		3/4" lockwashers

Design Features

The constructed project is of a basic "V" shape design. A majority of the iron used was 1/2", 4" x 4" square tubing, 1" x 6" steel plate, and 1-3/8" x 3" channel iron. The ripper blades were to be attached on the underside of the frame. The hitch for the tractor was constructed to allow free movement of the lower hitch arms and a clear hitch area for the upper hitch. The hitch for the nurse tank was constructed to allow the tongue of the nurse tank to swivel at ease.

Construction Process

Main Frame and Three-Point Hitch

The materials used in construction of the main frame consisted of the following:

Ref. letter	No. of pieces	Dimensions	Material
E	1	1/2" x 4" x 4" x 60"	Steel tubing
F	2	1/2" x 4" x 4" x 57"	Steel tubing
L	2	1 3/8" x 3" x 23"	Channel iron
G	1	1 3/8" x 3" x 28"	Channel iron
H	4	1 3/8" x 3" x 14"	Channel iron
I	2	1" x 6" x 11"	Flat iron
J	2	1 1/4" x 5"	Steel shafting
M	1	1 1/4" x 7"	Steel shafting

The frame was basically made from 2, 1/2" x 4" x 4" square tubing cut 57 inches long. A 30 degree angle was cut on one end of each tube (F). These were welded together to form a "V".

For the lower hitches of the 3-point hitch, 2 pieces of 1" x 6" flat iron were cut, 11" long (I). A 4" x 4" hole was cut to fit them around the frame. Then a 1-1/4" hole was drilled into the flat iron to fit the 1-1/4" x 6" pins (J). The hitch pins were welded solid.

The flat plates (I) were then placed over the tubing 16 inches from center and 32 inches apart and welded to the tubing.

Another piece of 4" x 4" tubing was then cut 60 inches long. Both ends were cut at a 30 degree angle (E). This was then welded onto the rear to form a brace and ripper shank mount.

Two additional braces were made by box welding two pieces of 1-3/8" x 3 inch channel iron (H). These were cut and welded into place behind the hitch plates (I) to rear brace (E).

For the upper hitch area for the three-point hitch, two pieces, 23 inches long, of 3 inch channel iron were used. A 1-1/4" inch hole was drilled in one end of each piece to accept the 1-1/4 inch pin (M). The upper hitch is designated by letter "L".

A channel iron brace (L-L) was placed from the rear tubing area up to the perpendicular channel iron.

The hitch pins were lathed to bevel the edges for easier hook-ups. Appropriate holes were drilled for lock pins.

Rear Hitch Construction

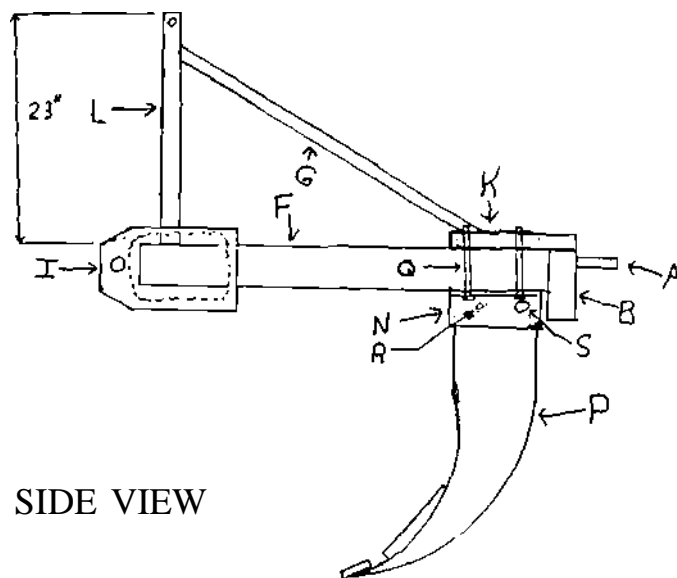
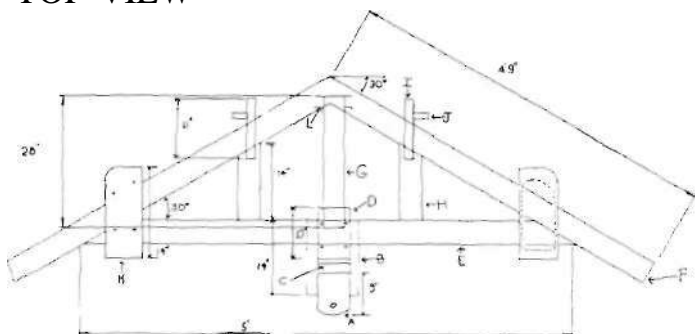
The following materials were used for the rear hitch:

Ref. letter	No. of pieces	Dimensions	Material
D	1	1" x 6" x 10"	Flat iron
A	1	1" x 6" x 9"	Flat iron
B	2	1" x 6" x 14"	Flat iron
C	1	1 1/4" x 8 1/2"	Steel shafting
C	1	1 1/2" O.D. x 6'	Steel pipe

Construction of the nurse tank hitch started with two pieces of 1" x 6" x 14" flat iron (B). They were trimmed and a 1-1/4" diameter hole was cut into them for placement of the axle rod of the swivel hitch. These pieces were then notched to butt up and over the top of the rear tubing and near the middle rear shank attachment plate (E). The bottom was cut to later fit at the side of the 1/2" x 3" x 3" angle iron (O) that would hold the middle shank. They were then welded solid to the frame.

To make the actual tongue for the hitch, a piece of 1" x 6" x 9" flat iron (A) was used. It was rounded off one end and a 3/4 inch hole drilled for the nurse tank hitch pin. The tongue was then butt welded to the 1-1/2 inch O.D. pipe (C-C). The 1-1/4" x 8 inch shafting (C) was then inserted through the

TOP VIEW



SIDE VIEW

1-1/4 inch holes in the vertical plates (B), through the pipe, and then welded. This forms the nurse tank hitch to pull anhydrous ammonia (nitrogen) tanks.

Shank Attachments and Shanks

The following materials were used:

Ref. letter	No. of pieces	Dimensions	Material
K	2	1" x 6" x 14"	Flat iron
D	1	1" x 6" x 10"	Flat iron
N	4	1/2" x 3" x 3" x 14"	Angle iron
O	2	1/2" x 3" x 3" x 10"	Angle iron
Q	12	1/2" x 7"	No. 8 bolts
T	15	1/2"	No. 8 bolts
V	15	1/2"	Lockwashers
R	3	1/2" x 3"	No. 8 bolts
S	3	3/4" x 3"	No. 8 bolts
U	3	3/4"	No. 8 bolts
W	3	3/4"	Lockwashers
P	3	1" high carbon steel ripper shanks complete	

The shanks were attached to 1/2" x 3" x 3" angle iron on the bottom of the main frame. The angle iron was then bolted to a 1" x 6" wide plate on top of the frame. In order to accurately place and drill needed holes, the one inch plate and angle iron were pre-assembled, then tack welded. This allowed all holes to match their counterparts when assembling.

The center ripper shank attachments were shorter since it only covers a four inch area, while the outer two are on the joint (E and F area). Number 8 bolts were used for strength.

A shear bolt (1/2" x 3") (R) was used as the front bolt on the shank. This was used to prevent damage to shank and frame in case a hidden obstacle was encountered. The shanks were purchased from a local supplier.

Final Assembly

After the final welding and preparations of all components, the unit was assembled, cleaned and painted.