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A Mining Research Contract Report  
May 1988

# MINE MAINTENANCE MATERIAL HANDLING: VOLUME II - PROTOTYPE DEVICE SPECIFICATIONS

Contract H0113018  
Canyon Research, Inc

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Bureau of Mines  
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<p>This report describes background research and concept development on a project intended to design, construct, and evaluate devices to reduce the injury risk and manual effort associated with the handling of maintenance materials in underground coal mines.</p> <p>Project activities included a review of literature, previous research programs, and accident statistics; visits to mines for study and data collection; data analysis and specification development; and concept generation and evaluation. Five prototype manual material handling devices were then designed, fabricated and transported to operating coal mines for field evaluation.</p>			
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Material Handling		Manual Material Handling	
Mine Maintenance		Material Handling Equipment	
b. Identifiers/Open-Ended Terms			
Material Handling Injuries		Equipment Design	
Accident Reduction		Over Exertion	
Back Injuries		Timbers	
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## FOREWORD

This report was prepared by Monterey Technologies, Inc., Carmel, California, under U.S. Bureau of Mines Contract H0113018. The contract was initiated under the Coal Mine Health and Safety program. It was administered under the technical direction of Pittsburgh Research Center with Mr. Richard Unger acting as the Technical Project Officer. This report is a summary of work recently completed as part of this contract covering the period June 1985 through present. This report is dated May 1988.

No U.S. or foreign patents have been applied for or granted for the concepts, designs, or devices discussed in this report.

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## \*\*\*1. INTRODUCTION AND SUMMARY

### INTRODUCTION TO VOLUME II

Manual materials handling (MMH) represents a critical and persistent source of personnel injuries in underground coal mining operations. On an annual basis, MMH-related injuries represent the largest category of non-fatal, lost-time injuries. In 1983 and 1984, this category of injury accounted for 35% of all lost-time injuries. Approximately 26.3% of all MMH-related injuries are associated with actual mine maintenance or equipment maintenance task performance.

U.S. Bureau of Mines Contract H0113018 specifically addressed the mine maintenance and equipment maintenance material handling problem. During the course of this project, a detailed analysis of mine and machine maintenance tasks was completed and sources of injuries identified. Concepts for non-powered manual material handling devices were then developed and evaluated. Five of these devices were fabricated and delivered to operational underground coal mines for operational evaluation.

Volume I of this report summarizes the technical approach employed during this project. It covers accident analysis and hazard identification procedures, summarizes results of job and task analyses, reviews preliminary device concepts, discusses the rationale for selection of the five field prototypes, and presents conclusions and recommendations.

Volume II of this report presents a brief discussion of the five prototype devices fabricated for field evaluations, along with supporting engineering drawings and specifications.

### OBJECTIVE

The following is a summary list of the project objectives--

Identification of underground coal mine maintenance and mining equipment related maintenance tasks performed by miners,

Define mine maintenance materials, tool, and machine components routinely handled during mine and machine maintenance tasks,

Identify and describe sources of material handling risks and the types of injuries associated with mine and machine maintenance,

Design and construct five man portable manually operated machines or devices to reduce manual material handling effort and to reduce the risk of injury associated with the above maintenance tasks,

Evaluate the material handling devices in underground coal mine operating conditions, and

Document the project

As noted in Volume I, particular attention was focused on the design and testing of practical, low-cost, easily fabricated materials handling devices likely to be broadly applicable in underground operations. Where possible, the designs incorporated off-the-shelf components to permit fabrication of the devices by mine site personnel.

It is also pointed out that the devices discussed in this report were not intended to be final designs. Rather, they are working prototypes that have been field evaluated and presented herein in the hopes of stimulating other innovative designs on the part of mine personnel and local manufacturers.

#### SCOPE

This project specifically addressed MMH during the performance of mine maintenance and equipment maintenance tasks performed in underground coal mines. Surface material handling tasks and the transporting of supplies or materials from the surface to the operating section were outside the scope of this project.

Representative mine maintenance tasks addressed during this project included--

Installation/removal of ventilation, electrical, communications, or other mine operations support systems

Installation of timbers, cribbing, crossbars, and other materials used in roof or rib control

Installation, repair, or retrieval of track for underground railed vehicles

Rock dusting, installation of brattice curtains, air control walls, sprinklers or other dust or fire control systems

Typical machine maintenance material handling tasks falling within the scope of this project included--

Removal and replacement of belt drives, heads, pumps, drive motors, and other major machine parts on stationary equipment

Assembly, installation and or repair of all production equipment, including mobile face equipment

Routine servicing of mining equipment

All underground coal mine seam heights were included in this study. However, emphasis was placed on lower seam coal mines (e.g., under 58" seam heights). Preliminary data suggested that the highest risks of MMH injuries were associated with lower seam mines.

#### SELECTION OF PROTOTYPE DEVICES

Phase I and Phase II analyses indicated that--

38.6% of all mine maintenance and 31.9% of all machine maintenance injuries involved the lower back;

44.9% of all mine and 38.4% of all machine maintenance accidents were the result of over-exertion; and

67.6% of mine maintenance injuries involved the handling of timbers, posts, caps, and cribbing materials, while 32.4% of the machine related accidents involved the handling of metal machine components.

These data and other investigations suggested the need for material handling devices that would lift, swing/transport, lower and/or maneuver heavy timbers or machine parts. Twenty-four MMH device concepts were developed during Phase I of the project to respond to these identified needs. The preliminary device concepts were screened on the basis of--

Practicality

Cost-effectiveness

Safety

Acceptability

After careful review and evaluation by the project technical team, Bureau of Mines personnel, and participating mine personnel, the following devices were selected for fabrication and preliminary testing--

Scoop Mounted Lift Boom

Machine Mounted Swivel Crane

Mine Jack

Mine Mud Cart

Mobile Container/Workstation Vehicle

Functions performed by, and design specifications for each of these devices are discussed in the following section.

## \*\*\*2. PROTOTYPE MMH DEVICES

### SCOOP MOUNTED LIFT BOOM

One of the major identified needs was for a simple underground boom device capable of lifting and maneuvering components weighing up to 3,000 pounds. The device had to be mounted on a powered mobile machine and had to be quickly installed and removed to minimize production downtime for the machine. It had to be relatively light weight so that it could be lifted by two to four miners, but rugged enough to permit use in an operational underground coal mine environment.

This tool would be used for transporting and maneuvering heavy machine components such as a continuous miner heads. It also could be used to remove steel rails from rail cars, lift the corner or end of other mining equipment, or assist in the assembly of new equipment.

A quick mounting lift boom device was developed for installation on the front of a battery powered coal scoop with its bucket removed. The design features of the scoop mounted lift boom include--

- 3,000 pound lift capacity

- Hydraulic or battery powered lift capability

- Installation and removal in five minutes or less

- Simple design to permit fabrication at the mine site

- Readily stored in working sections or underground shop area

The lift boom is attached to the scoop lift mechanism by means of attachment pins. The six pins correspond in size and location to the pins used to secure the scoop bucket. The overhead design of the lift boom permits lifting/lowering of components being handled. The bucket tilt mechanism permits up and down maneuvering of the components being handled, while the scoop's normal steering permits lateral and forward reverse maneuvering. This design can be adapted to fit most coal scoops.

Figure 1 provides details on the design and fabrication of the lift boom device.

Table 1 summarizes the materials and components required for lift boom fabrication.

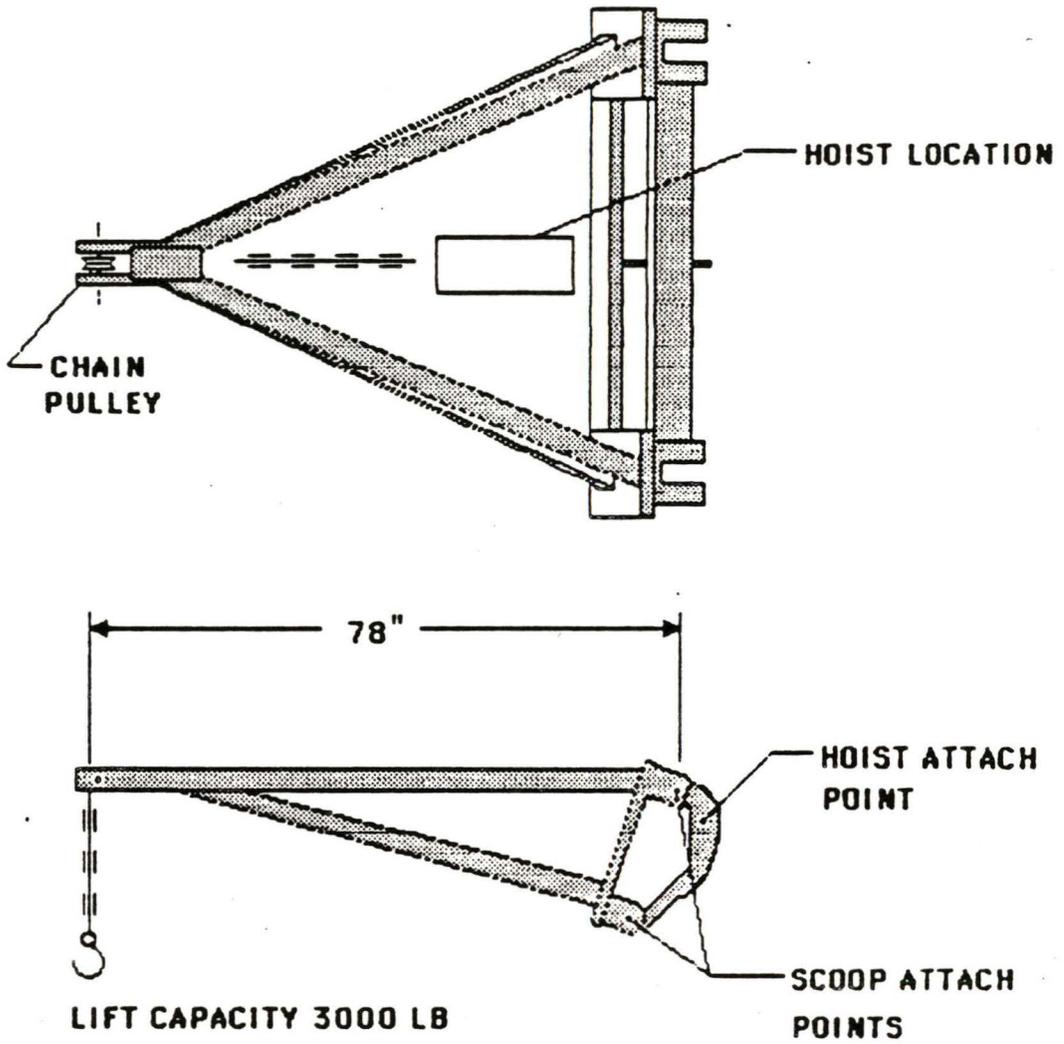
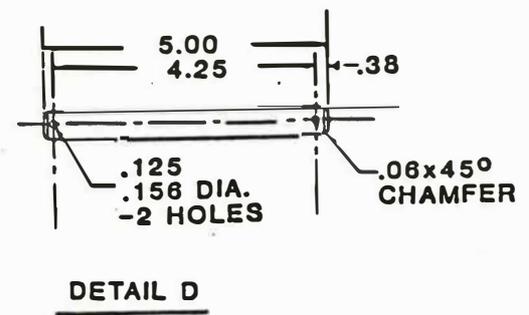
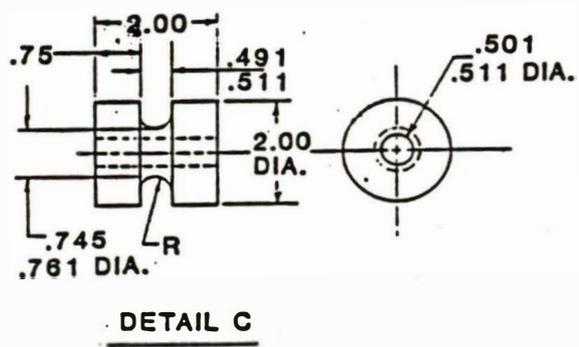
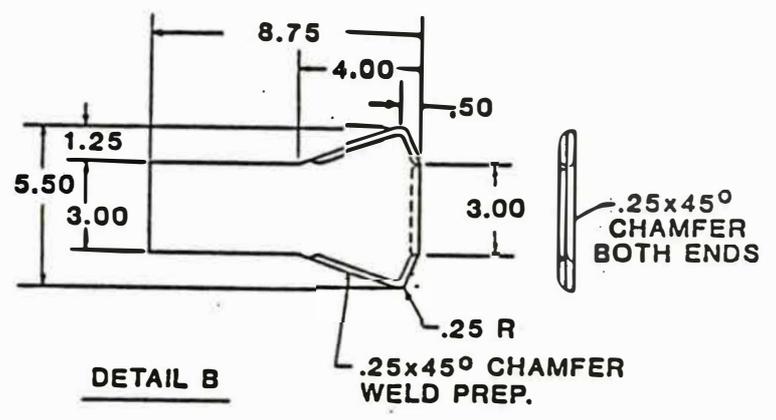
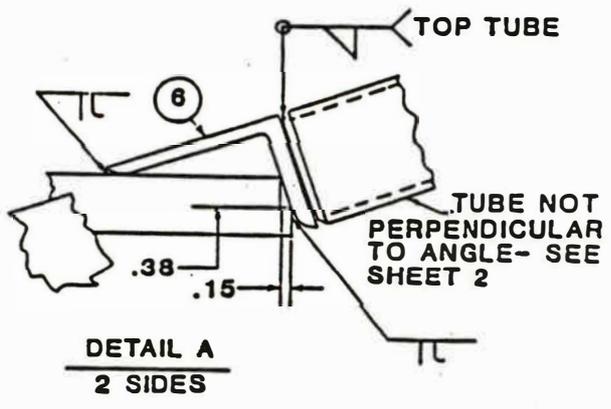
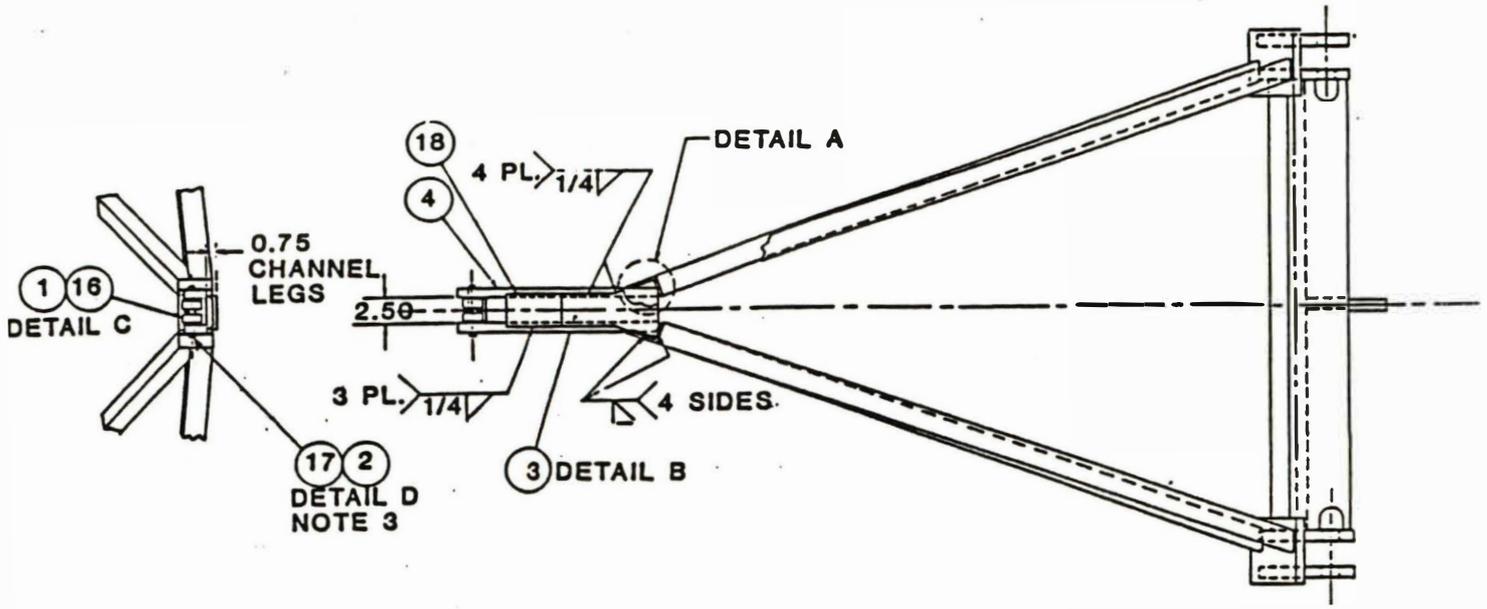


FIGURE 1. - Scoop mounted lift boom



ESSEX CORPORATION/CANYON RESEARCH GROUP		
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DATE: 7/3/83		REVISED
FIGURE 1. - Scoop mounted lift boom		
Sheet No: 1	Of: 2	DRAWING NUMBER 3095-10-1



TABLE 1. - Boom lift device parts list

ITEM	QTY.	NAME	MATERIAL	SIZE
1	1	ROLLER	BAR, RD, AISI 1035	2 DIA
2	1	PIN	SHAFTING, 1025	1/2 DIA (.499-.501)
3	2	PLATE, JOINT	PLATE, ASTM A36	1/2 THK
4	2	BAR, RIB	CF BAR, AISI 1018	3/4x2x18.00 LG
5	1	PLATE, FILLER	PLATE, ASTM A36	2.50x6.75x1/4 THK
6	2	ANGLE	STEEL, M1020	3x2x1/4, 3.00 LG
7	1	TUBE	SQ. PIPE, HR STEEL	2x2x.145
8	1	TUBE		
9	1	TUBE		
10	1	TUBE		
11	2	PLATE, MOUNT	PLATE, ASTM A36	5.50x20.00x3/4 THK
12	4	PLATE, CLEVIS	PLATE, ASTM A36	1 THK
13	1	PLATE, HOIST	PLATE, ASTM A36	1 THK
14	1	BEAM, UPPER	RST, ASTM A500B	5x2x1/4
15	1	BEAM, LOWER	RST, ASTM A500B	3x2x3/16
16	2	WASHER, FLAT	STL	1/2ID, .109 THK
17	2	COTTER PIN	STL	1/8x2
18	1	COVER	CHANNEL, ASTM A36	3 5.0, 6.00 LG

NOTES:

1. Trim to fit at assembly
2. Remove sharp edges
3. Lubricate pin with moly disulfide at assembly

## MACHINE MOUNTED SWIVEL CRANE

Phase I analysis suggested the need for a simple swivel crane device to lift components on and off transport vehicles, to position them for use and to assist in maneuvering heavy machine components in confined spaces within a mining machine.

To address these requirements, a lightweight, removable, lift crane was designed. This crane can be installed at various locations on maintenance carts or on mining machines themselves. The height of the crane could be varied by quickly adjusting the crane leg. The reach of the crane can be varied by changing the boom length. The inexpensive mounts can be bolted or permanently welded at various locations on the machine frame and are designed to resist damage during normal machine operation. Two or more quick mounts could be installed on the same machine to permit access to all machine locations.

Design features of the swivel boom include--

- Load capacity of 1000 pounds

- Boom height could range from 24" to 68" depending on leg length and mine seam height

- Arm radius of 24" to 48"

- Mounts by sliding base into machine mounting plates - no tools are required

- Light weight for carrying by one person

- Can be adapted for mine shop and surface shop applications

Figure 2 illustrates the machine mounted swivel boom concept along with detailed drawings of the crane and the mounts. It is pointed out that several commercially available swing arm cranes could be readily adapted for the same purpose.

Table 2 lists the parts and materials required for swivel crane fabrication.

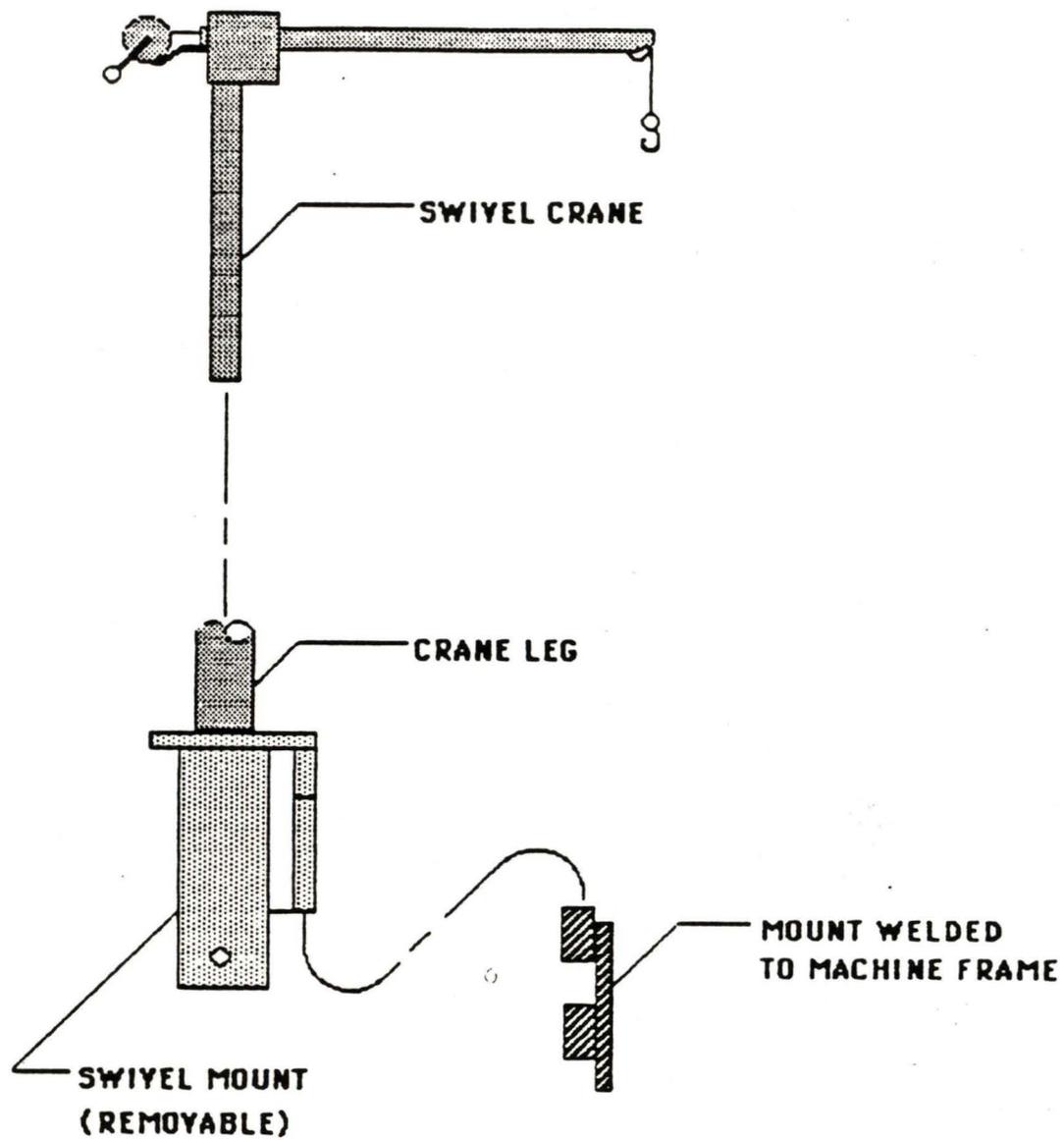
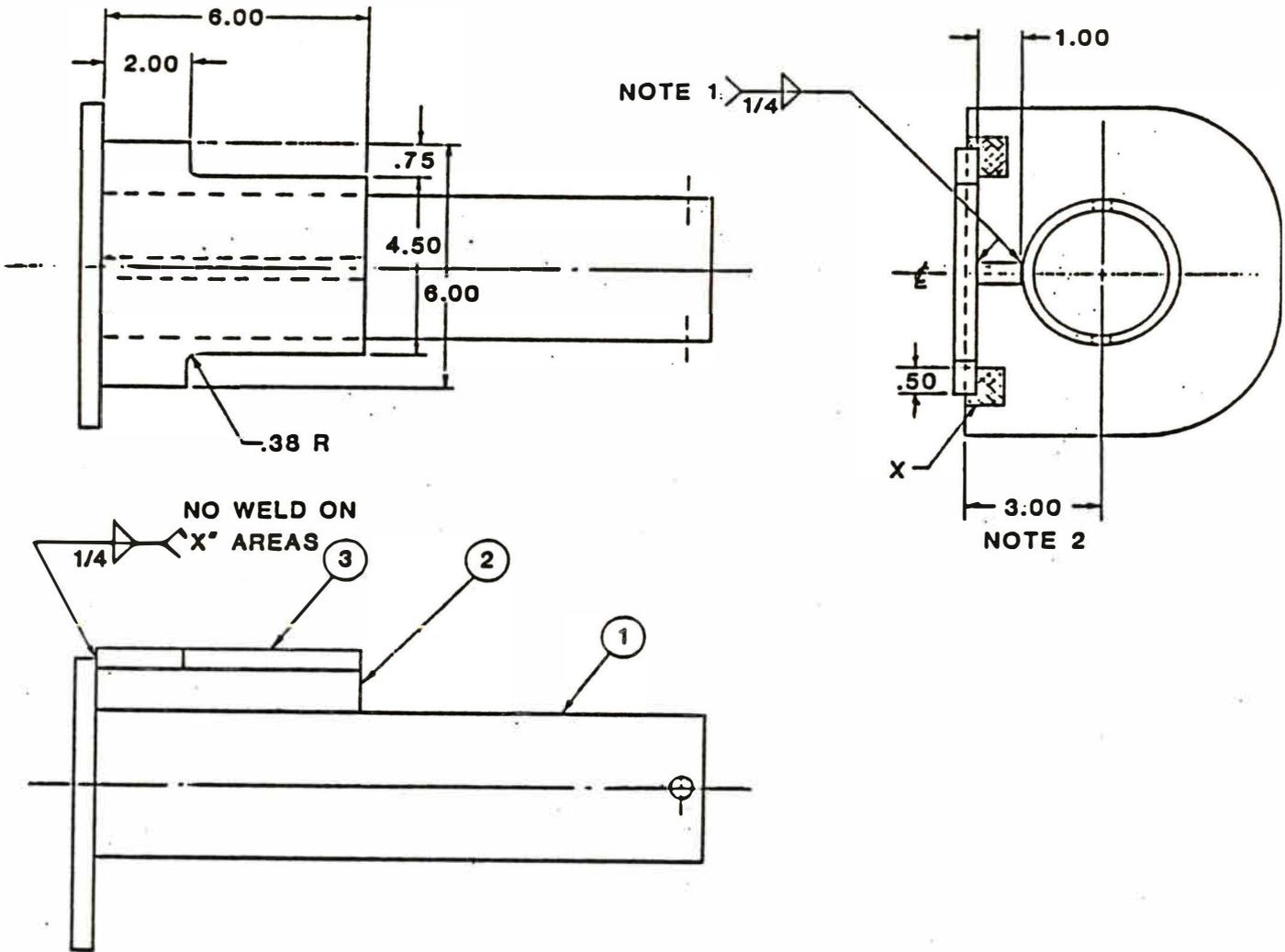


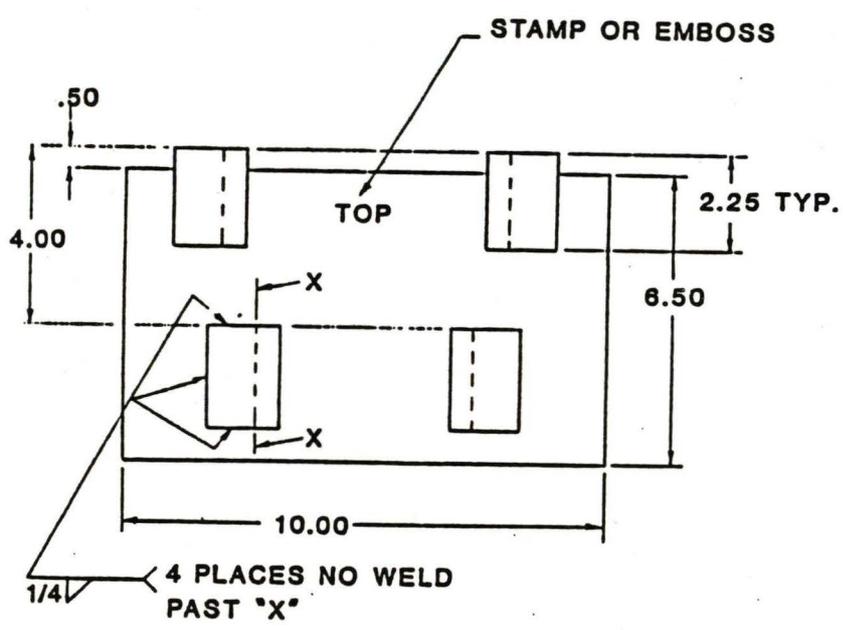
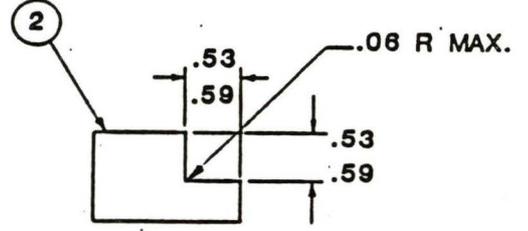
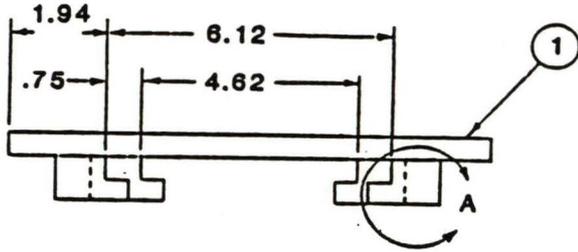
FIGURE 2. - Machine mounted swivel crane



**NOTES:**

- 1. PROTECT TUBE FROM HEAT DISTORTION WHEN WELDING
- 2. CUT FLANGE TO THIS DIMENSIONS
- 3. BREAK SHARP EDGE

ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
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FIGURE 2. - Machine mounted swivel crane		
Sheet No: 1	Of: 2	DRAWING NUMBER 3095-30-1



DETAIL A

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SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
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FIGURE 2. - Machine mounted swivel crane		
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TABLE 2. - Machine mounted swivel crane parts list

ITEM	QTY.	DESCRIPTION	MATERIAL
2	4	Bar	1 1/2 x 1 Steel, M1020
1	1	Plate	1/2 Thk. Steel, 1010
3	1	Plate, .50 Thk.	Steel, ASTM A-36
2	1	Plate, .50 Thk.	Steel, ASTM A-36
1	1	Swivel Base	Thern P/N SA5110

## UNDERGROUND MINE JACK

Another identified need was for an service jack that could be used underground to lift heavy machine components from the underside, transport them over short distances, and hoist them into position for installation. Saddles on the lift point could be designed to permit additional maneuvering of the component during actual installation.

This type of device could be used, for example, to install drive motors under the non-removable fenders in shuttle cars, install tires on mining machines, or remove components from the underside of a machine.

The device utilizes a standard hydraulic jack floor mechanism to provide the lift mechanism. The jack head itself would be tiltable and rotatable to permit close-in maneuvering. The jack itself would travel along the device frame by means of a sump drive mechanism. This motion would permit forward backwards movement of handled components and balancing of components over the lift/transport device wheels during travel. The long handle would permit the user leverage by which to maneuver loads up and down or sideways, as required. Dual tires or oversized balloon tires would increase device stability and permit easy movement over uneven floors.

The design features of the underground mine jack include--

- Up to 1000 pounds lift capacity

- Mounted on balloon tires for ease of transporting manually

- Utilizes standard automotive floor jack for lift mechanism

- Simple design permits local fabrication

- Can be used to lift and maneuver a heavy component as it is being removed or replaced on a mining machine

- The jack head can be trammed forward or back on the frame for close-in maneuvering or for load balancing

Figure 3 presents drawings of the underground mine jack. It is noted that single balloon tires can be substituted for the tandem tires illustrated in these drawings.

Table 3 lists materials and components required for device fabrication.

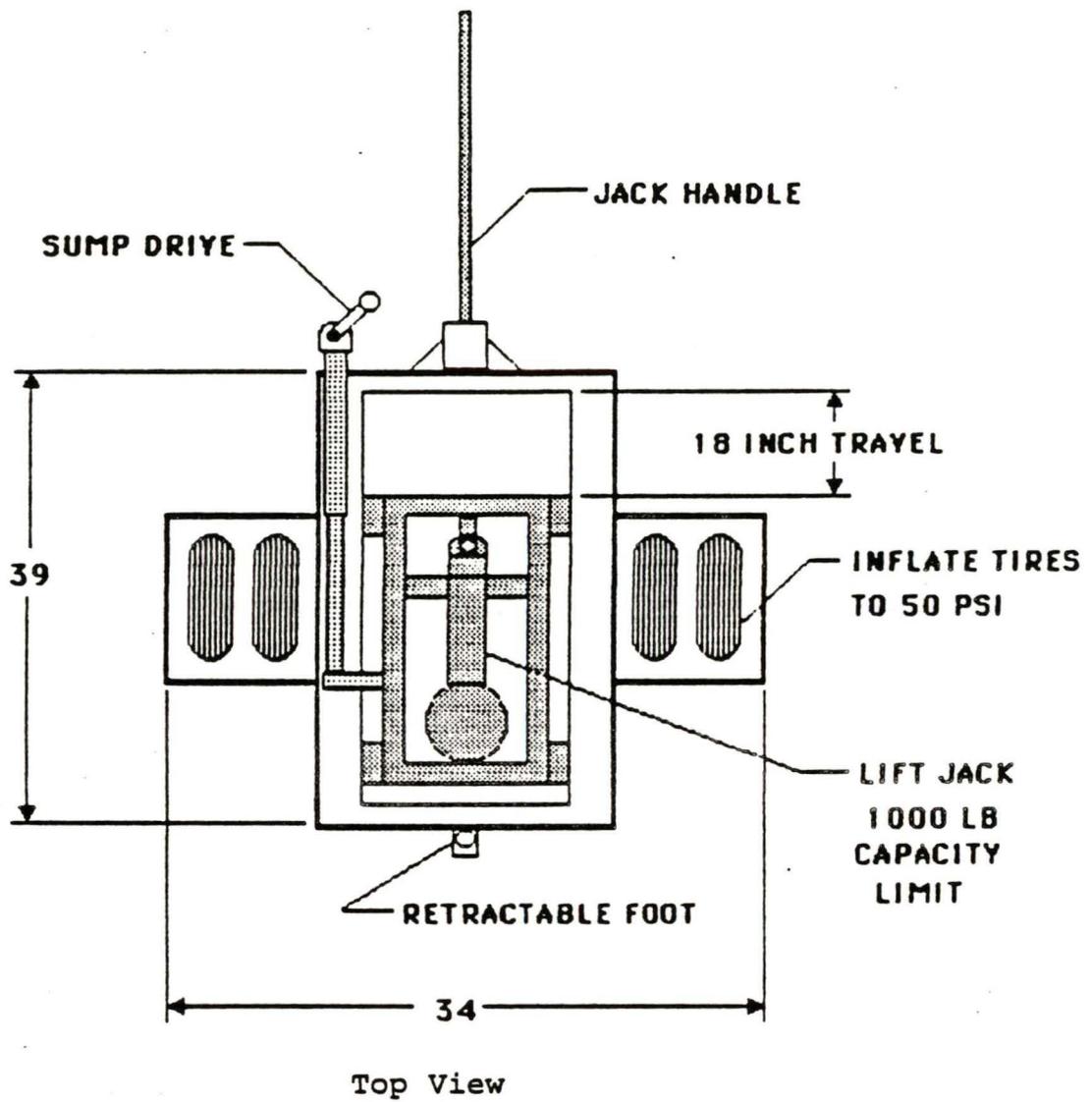
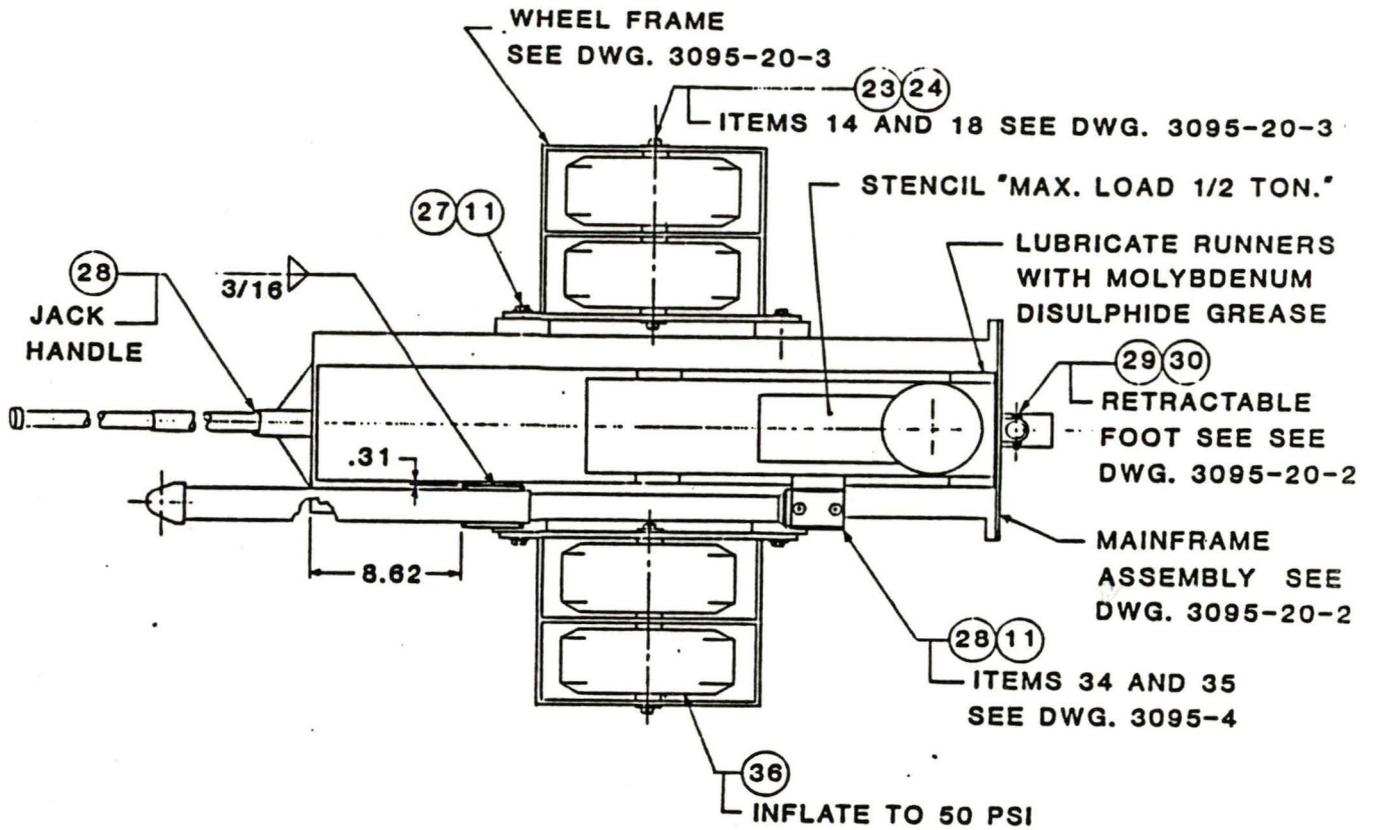
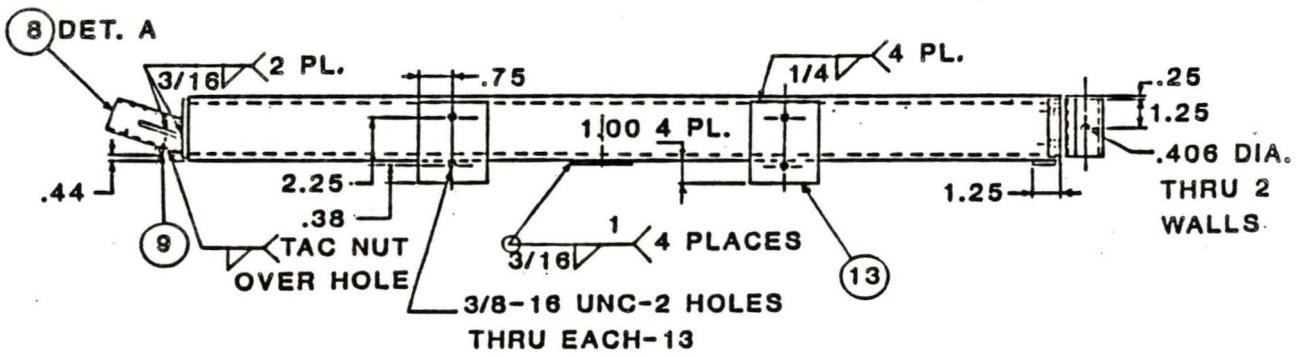
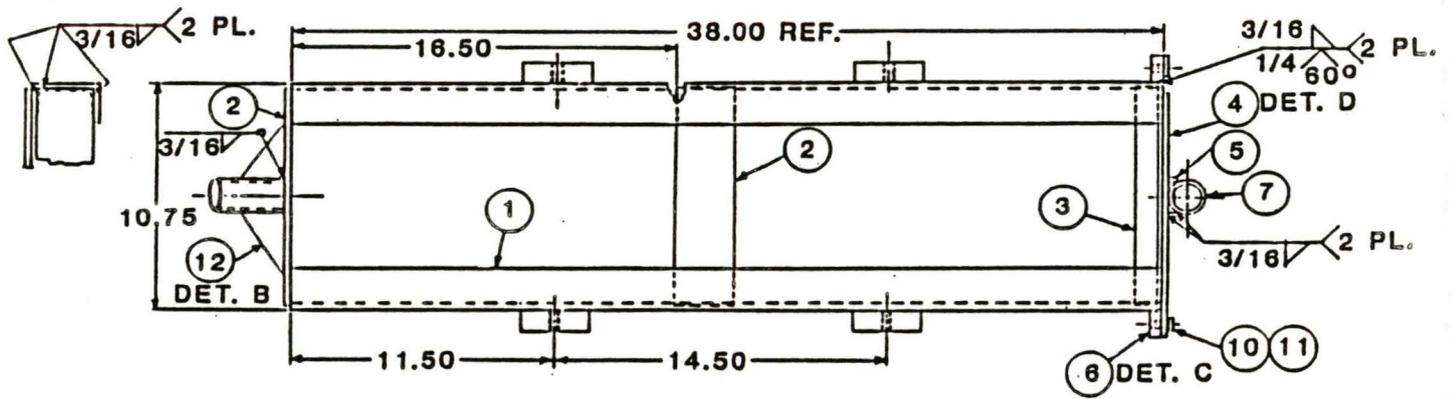
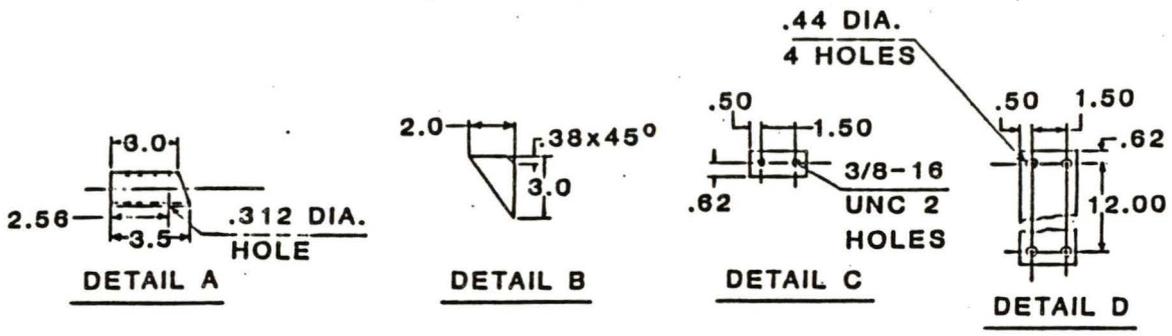


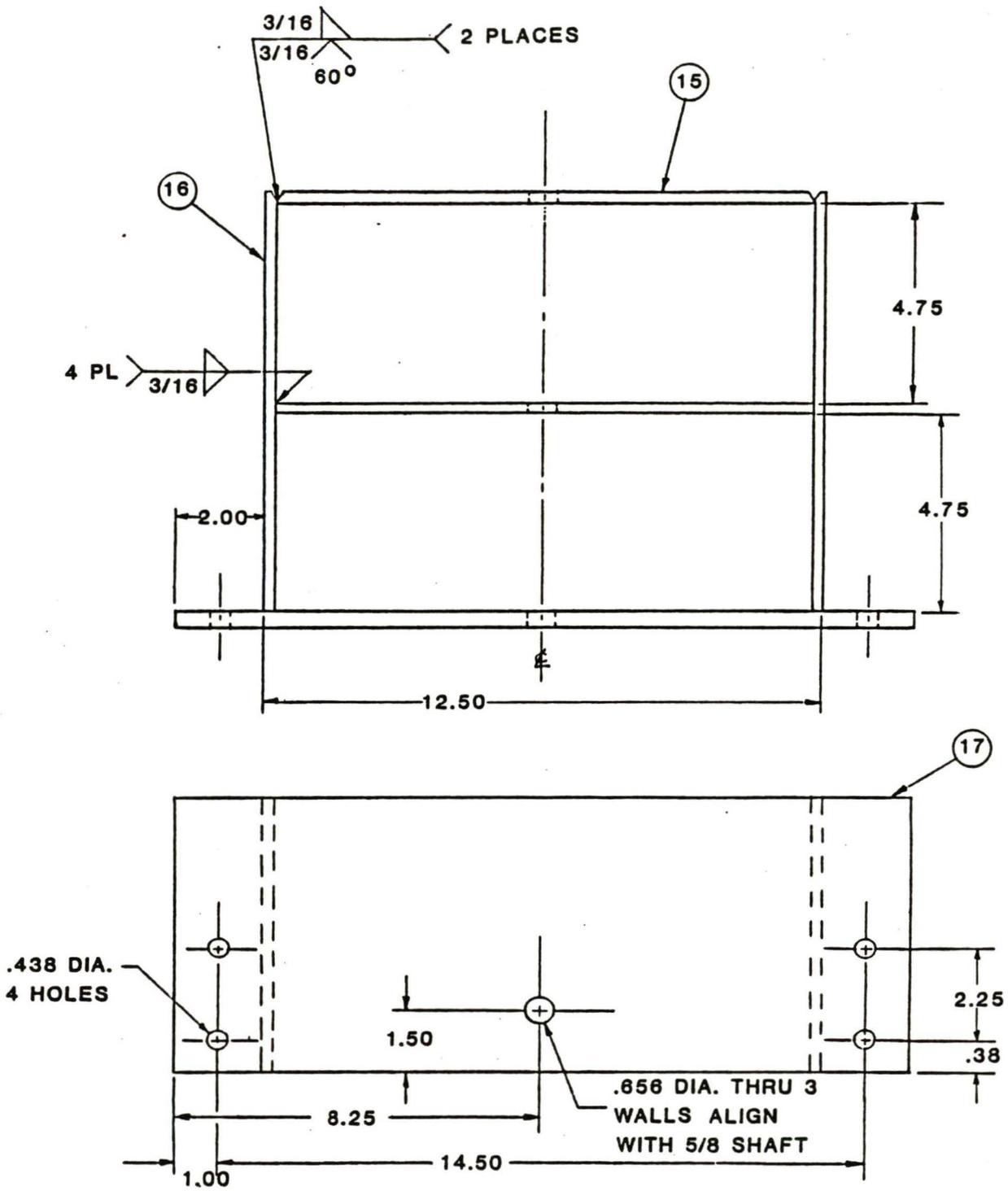
FIGURE 3. - Underground mine jack



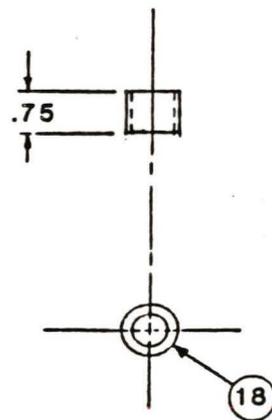
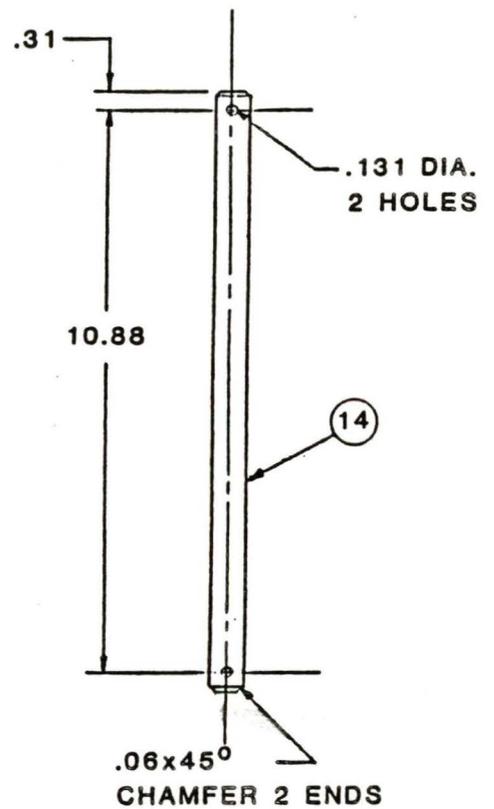
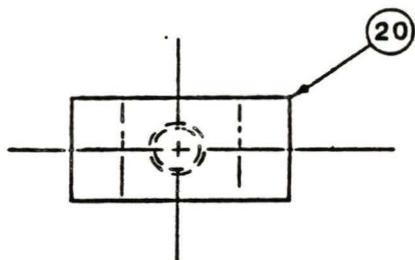
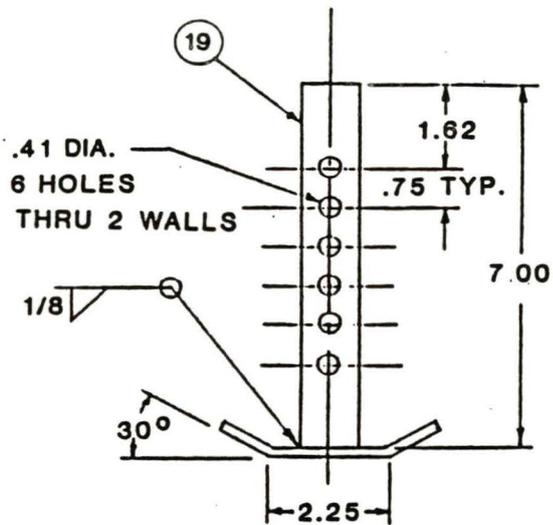
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FIGURE 3. - Underground mine jack		
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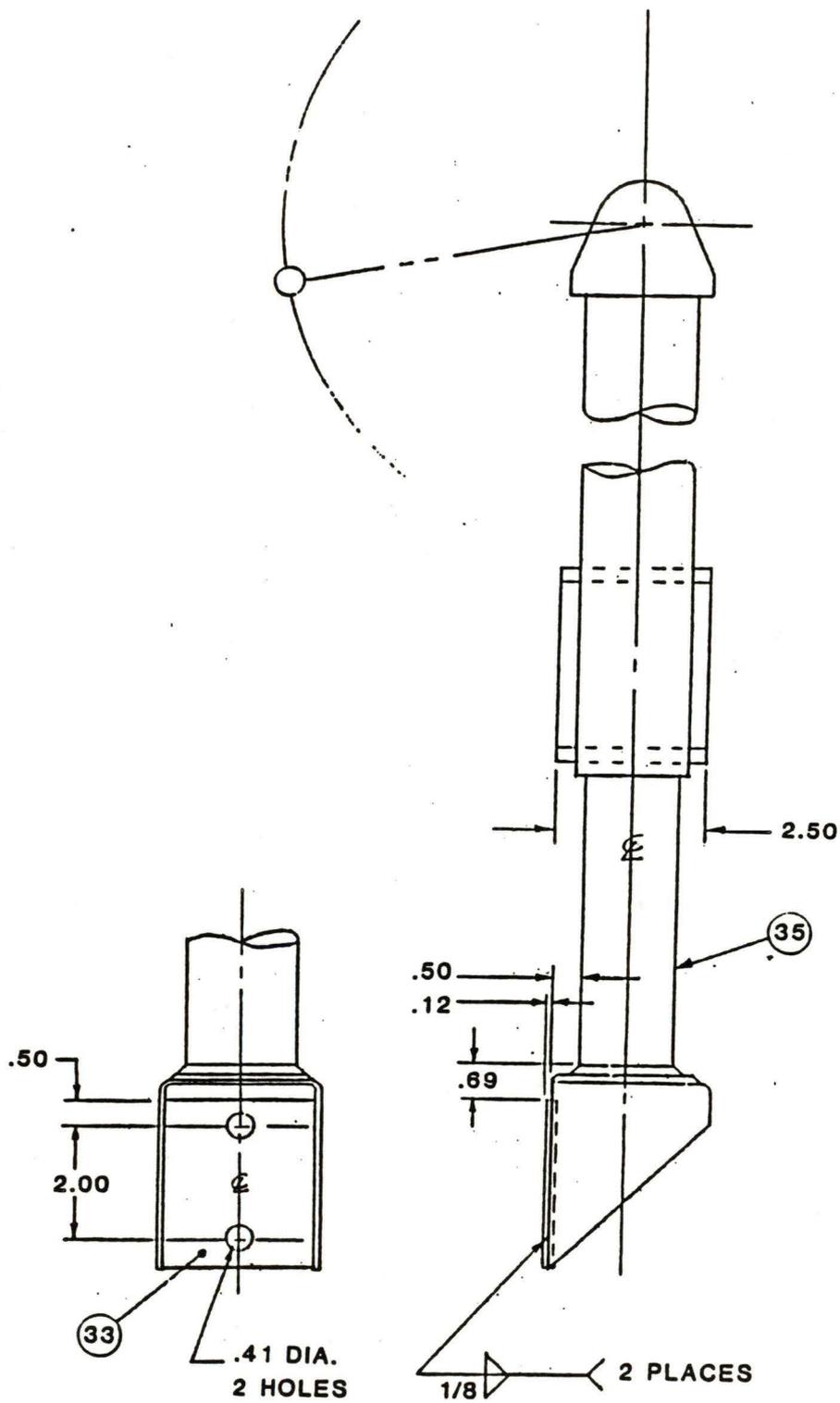
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FIGURE 3. - Underground mine jack		
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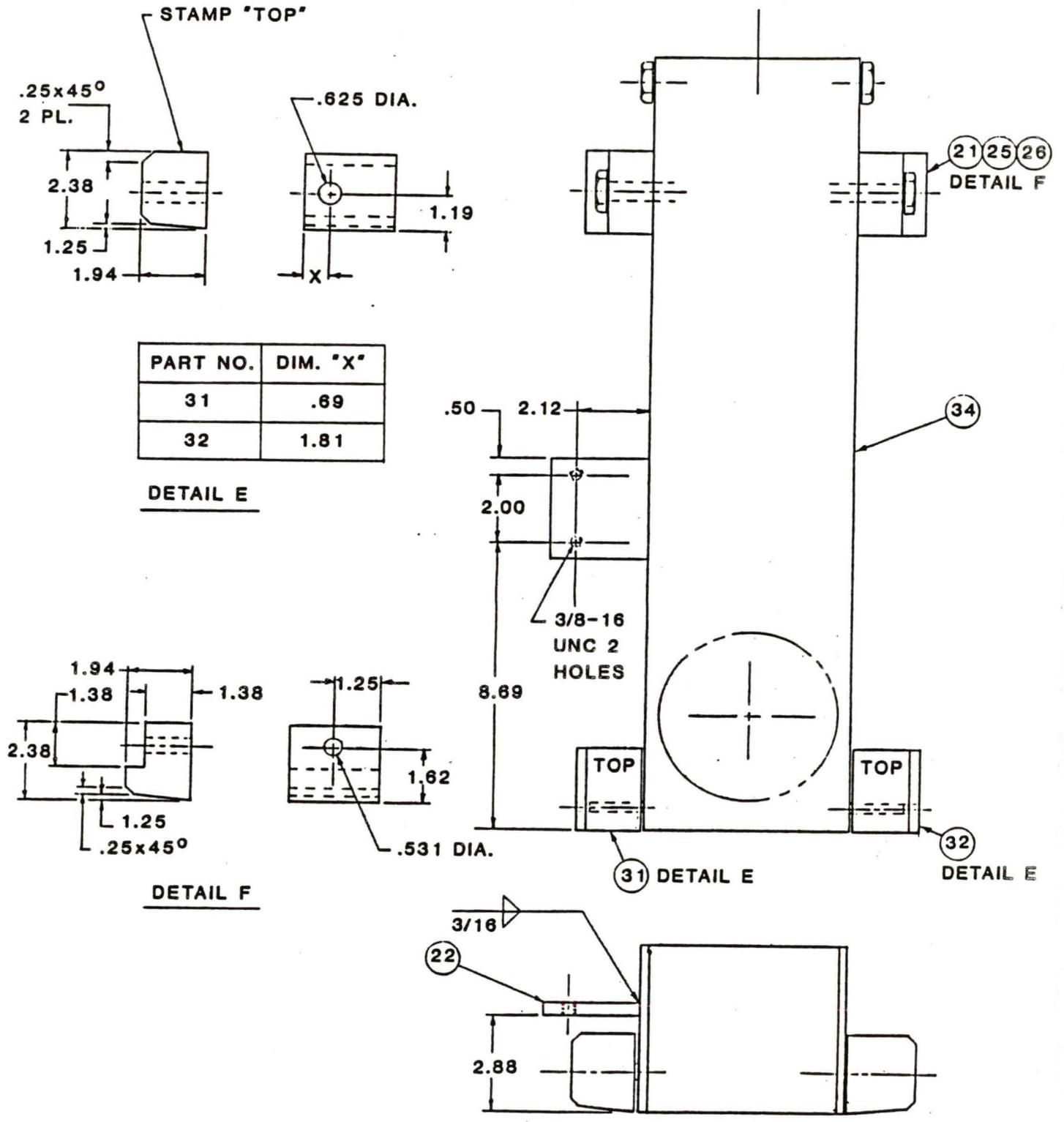
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FIGURE 3. - Underground mine jack		
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FIGURE 3. - Underground mine jack		
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ESSEX CORPORATION/CANYON RESEARCH GROUP		
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FIGURE 3. - Underground mine jack		
Sheet No: 4A	Of: 4	DRAWING NUMBER 3095-20-4A



PART NO.	DIM. "X"
31	.69
32	1.81

DETAIL E

DETAIL F

ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 3. - Underground mine jack		
Sheet No: 4B	Of: 4	DRAWING NUMBER 3095-20-4B

TABLE 3. - Underground mine jack parts list

ITEM	QTY.	DESCRIPTION	MATERIAL
1	2	3 MC 7.1	Steel Channel, ASTM A36
2	2	1/4x2 1/2x10 1/4	Steel Plate, ASTM A36
3	1	1/4x1x10 1/4	Steel Plate, ASTM A36
4	1	1/4x2 1/2x13 1/4	Steel Plate, ASTM A36
5	2	1/4x3 8x2x 1/2	Steel Bar or Plate
6	2	1/2x1 1/4x2 1/2	Steel Bar or Plate
7	1	1 1/4 pipe x 2 1/2	Steel Pipe, Sch. 40
8	1	1 1/4 pipe	Steel Pipe, Sch. 40
9	1	1/4-20 UNC	Steel Nut
10	4	3/8-16x1 long	Cap Screw, Steel
11	12	3/8 ID	Lockwasher
12	2	1/4 TNK	Steel Plate, ASTM A36
13	4	1x3x3 3/4	Steel Plate, ASTM A36
14	2	5/8 dia. x 11 1/2	1045 C.F. Round Bar
15	4	6 1/2x12x1/4	Steel Plate, ASTM A36
16	4	6 1/2x10x1/4	Steel Plate, ASTM A36
17	2	6 1/2x16 1/2x3/8	Steel Plate, ASTM A36
18	8	1 ODx3/16 wall	1025 DOM Tubing
19	1	1 IN pipe	Steel Pipe, Sch. 40
20	1	2x4 1/4x1/4	Steel Plate, ASTM A36
21	4	2x2 1/2	Steel Bar, M1020
22	1	3x3x3/8	Steel Plate, ASTM A36
23	4	3/8 ID	Washer, Flat
24	4	1/8x1 1/4	Cotter Pin
25	2	3/4-20 UNEFx2 LG	Cap Screw, Gr. 8 Steel

TABLE 3. - Mine jack parts list - continued

ITEM	QTY.	DESCRIPTION	MATERIAL
26	2	3/4ID	Lockwasher
27	8	3/8-16 UNCx1 1/4 LG	Cap Screw, Gr. 5 Steel
28	1	3/8-16 UNCx3/4 LG	Cap Screw, Gr. 5 Steel
29	1	3/8-16, UNCx2 LG	Cap Screw, Gr. 5 Steel
30	1	3/8-16 UNC	Nut, Self Locking

## MINE MUD CART

One of the basic problems faced by all miners is the need to carry heavy timbers, machine components, or supplies such as concrete blocks from supply dump point to the point of use. If a powered vehicle is not available, the task is typically accomplished manually.

The intent of this concept was to design a small manually pulled cart that could transport up to 900 pounds of materials over a short distance. The mine mud cart has the following design features:

Narrow vehicle width to permit passage by a parked mining machine

Tandem design to prevent tip over if one unit is loaded and the second is empty

Permits carrying longer items

Balloon tires for transit through mud/water and over mine floors

Handle designed for pulling by one or two people  
Can also be adapted to be towed behind foremans cart or other small mine vehicle

The mine mud cart is illustrated in Figure 4 along with detail drawings. The illustration shows a tandem cart concept. The cart could also be fabricated as a single cart.

Table 4 lists materials required for the tandem cart.

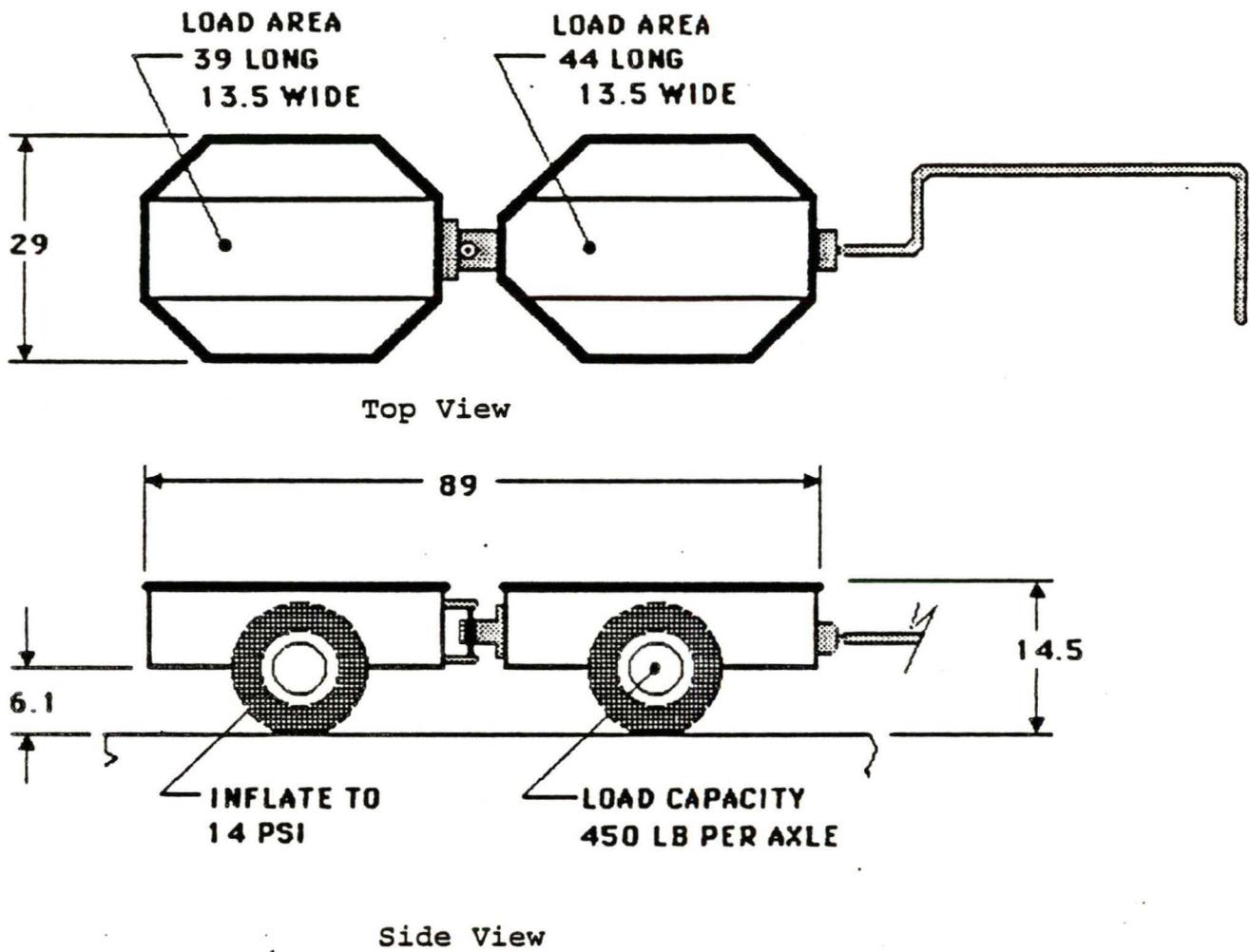
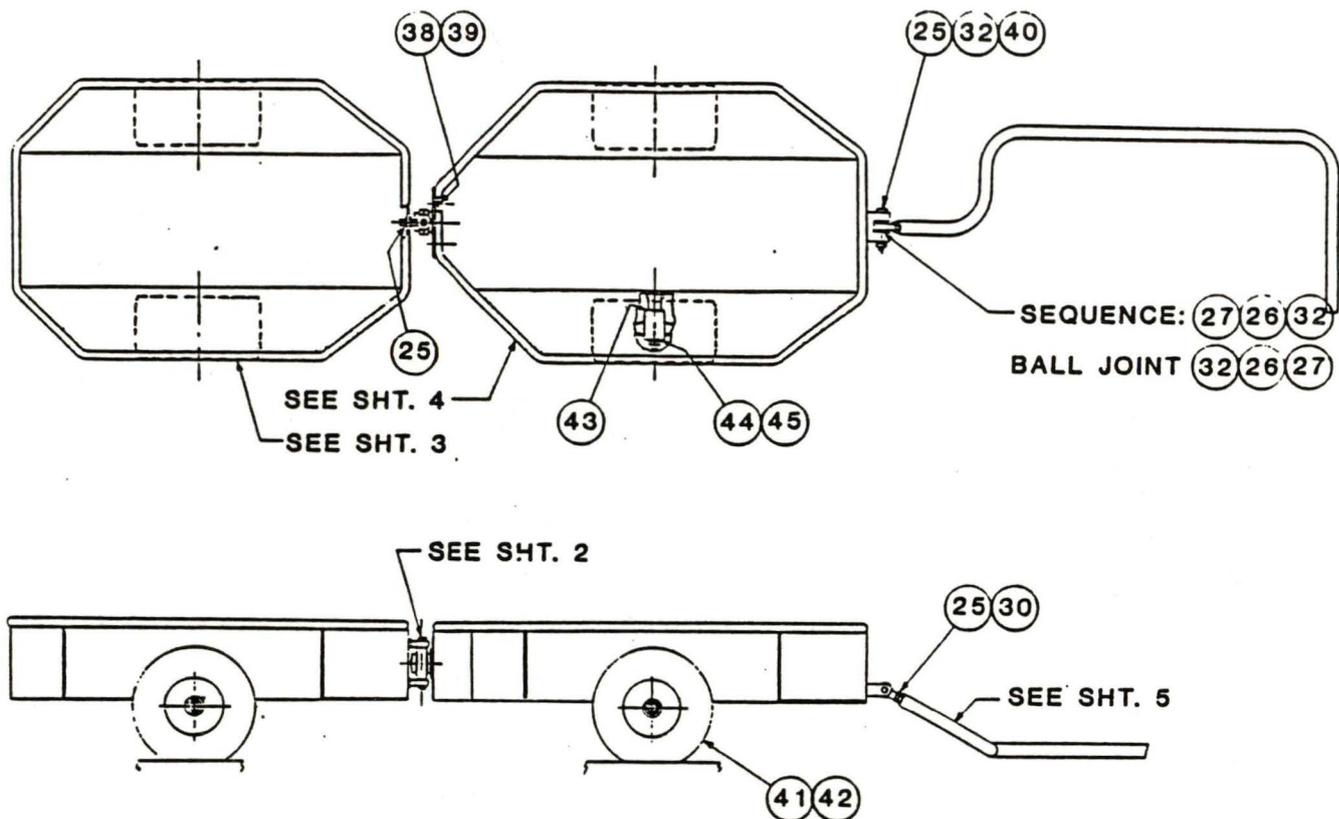
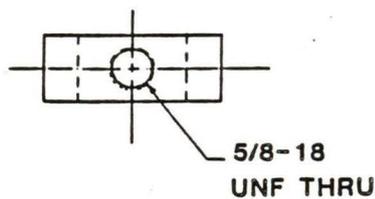
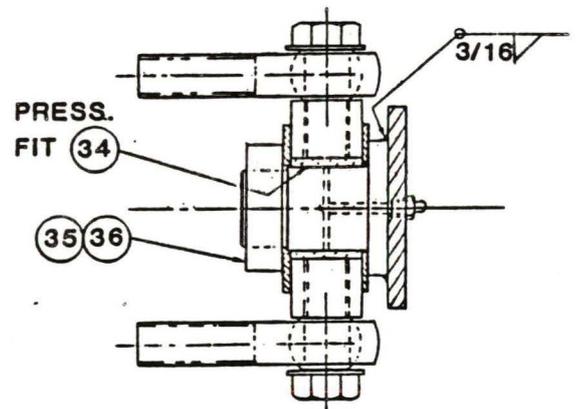
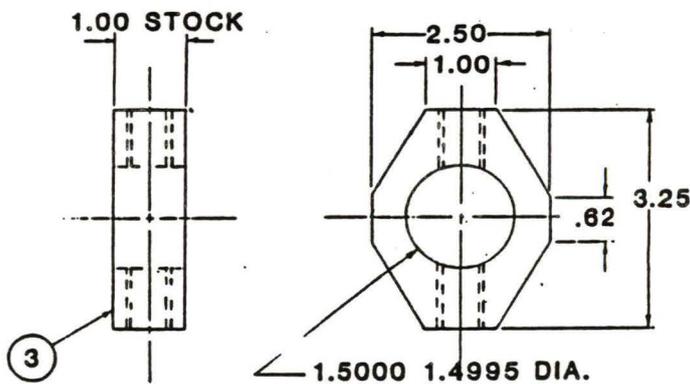
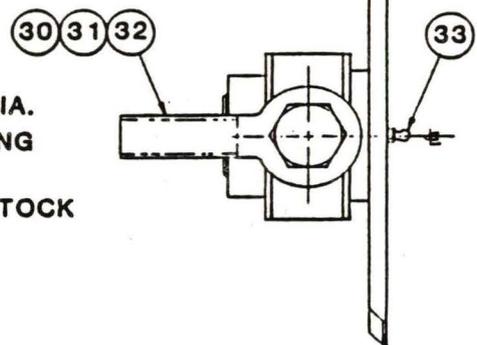
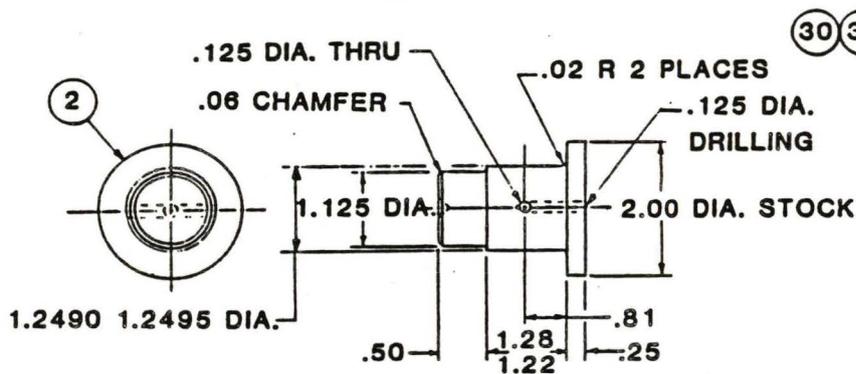
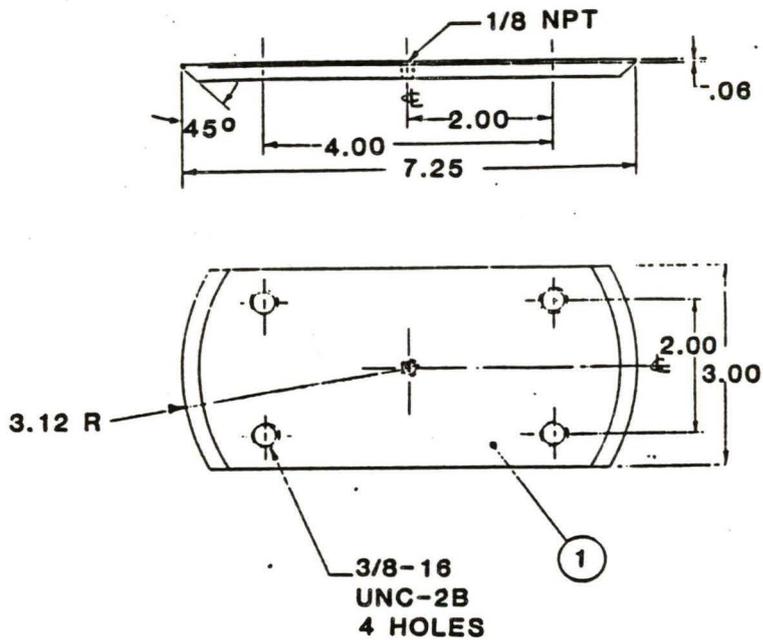


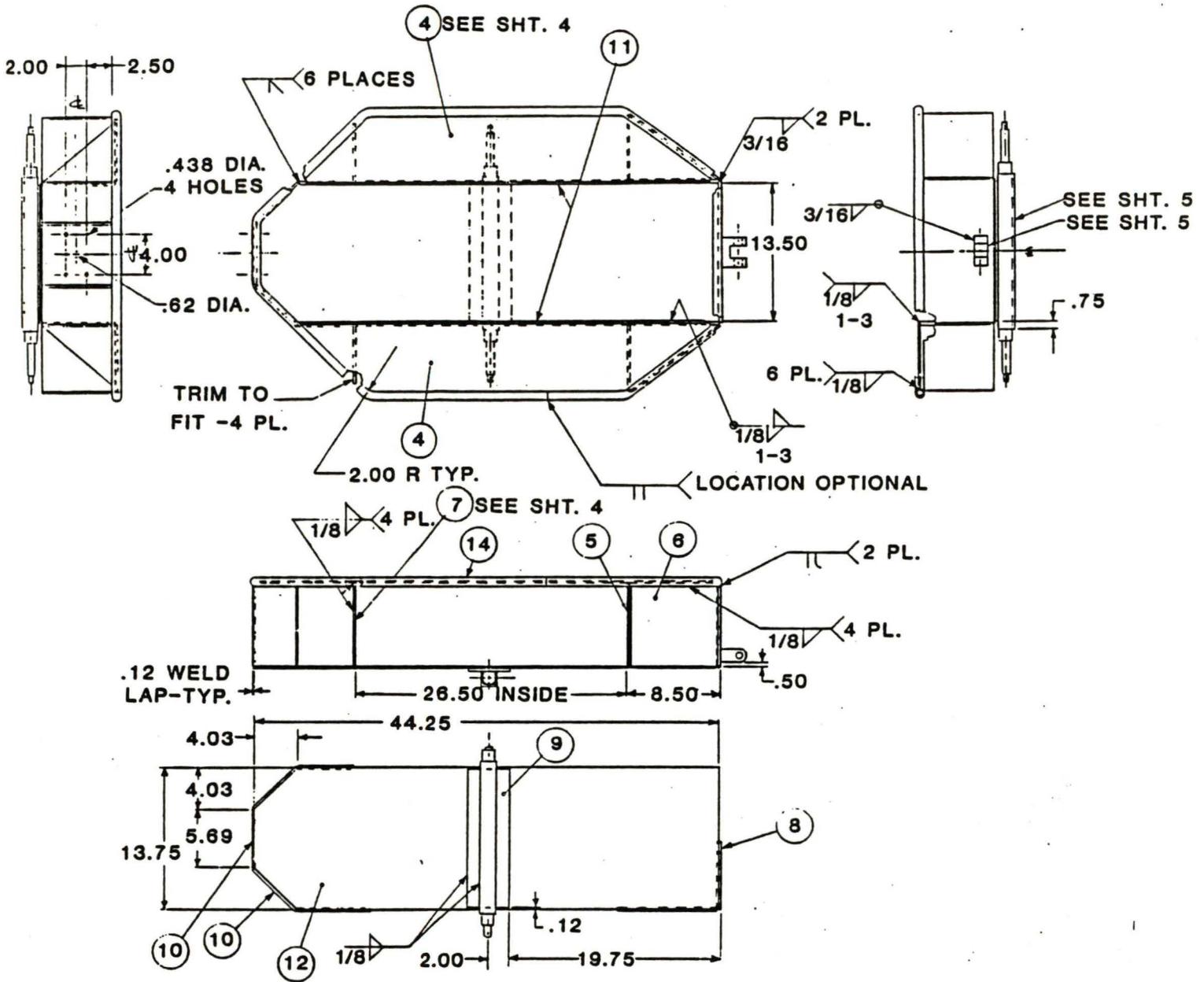
FIGURE 4. - Mine mud cart



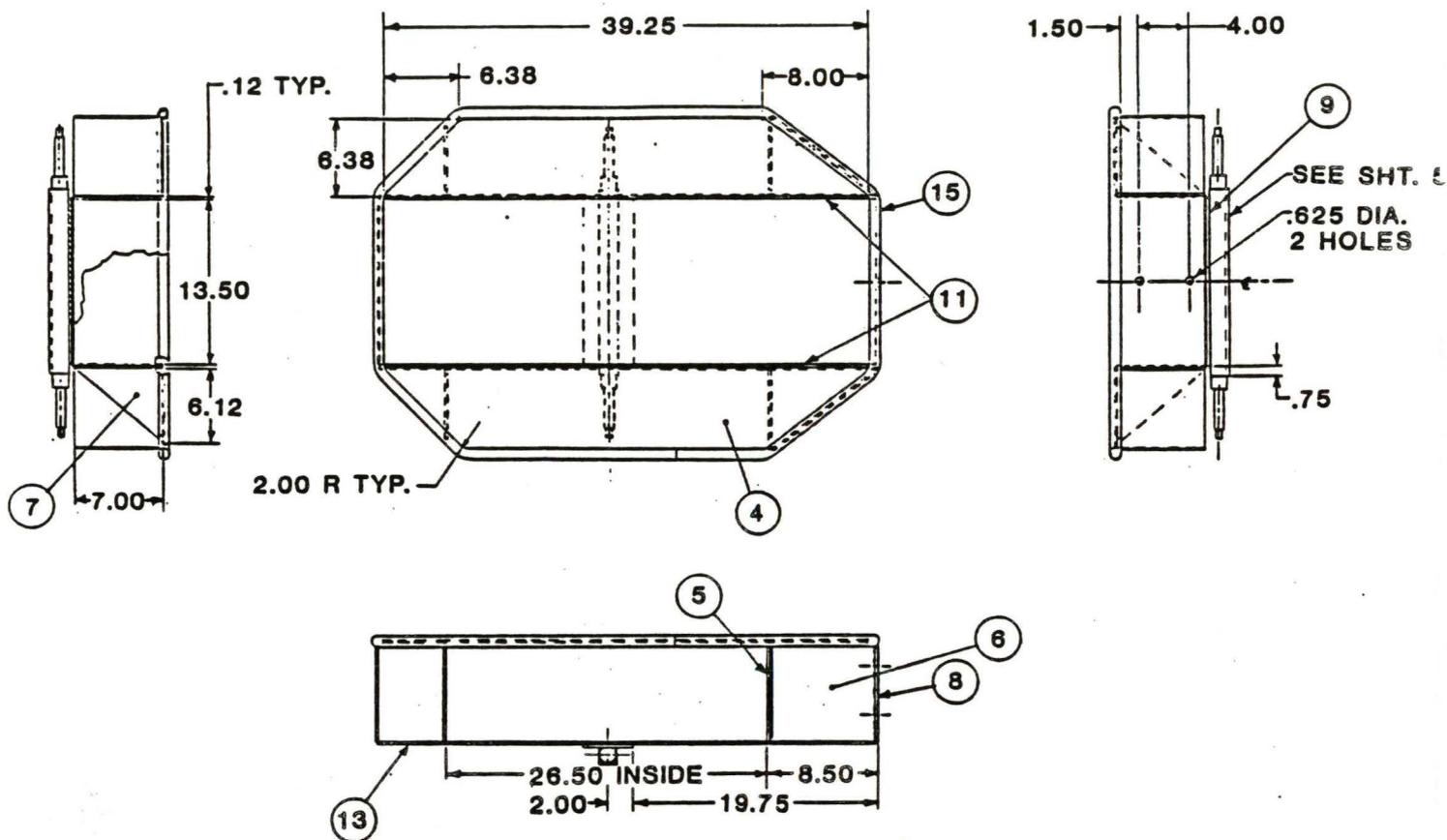
ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 4. - Mine mud cart		
Sheet No: 1	Of: 5	DRAWING NUMBER 3095-40-1



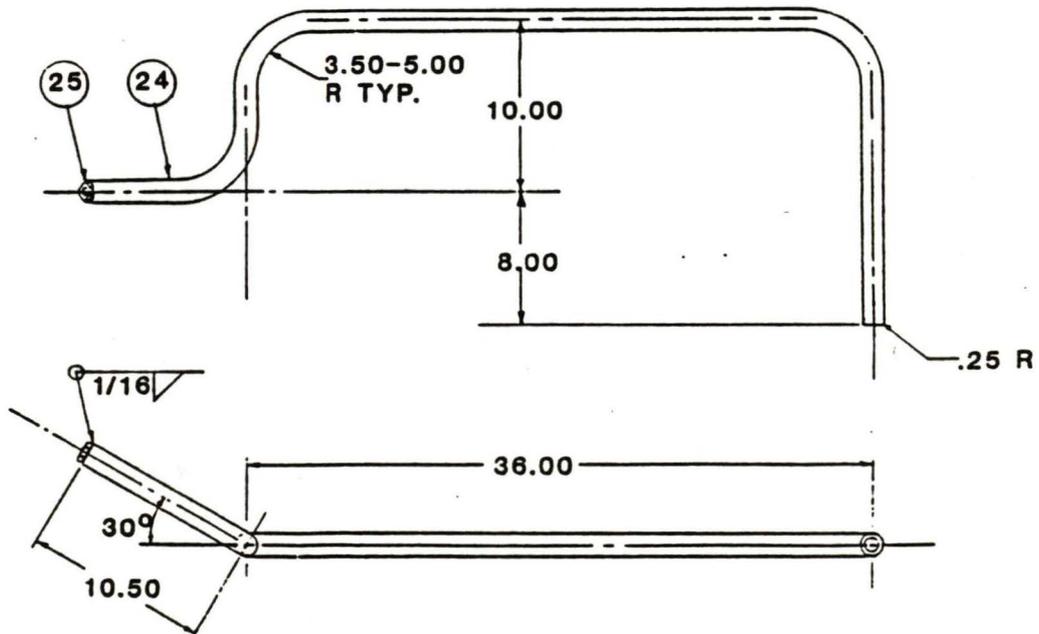
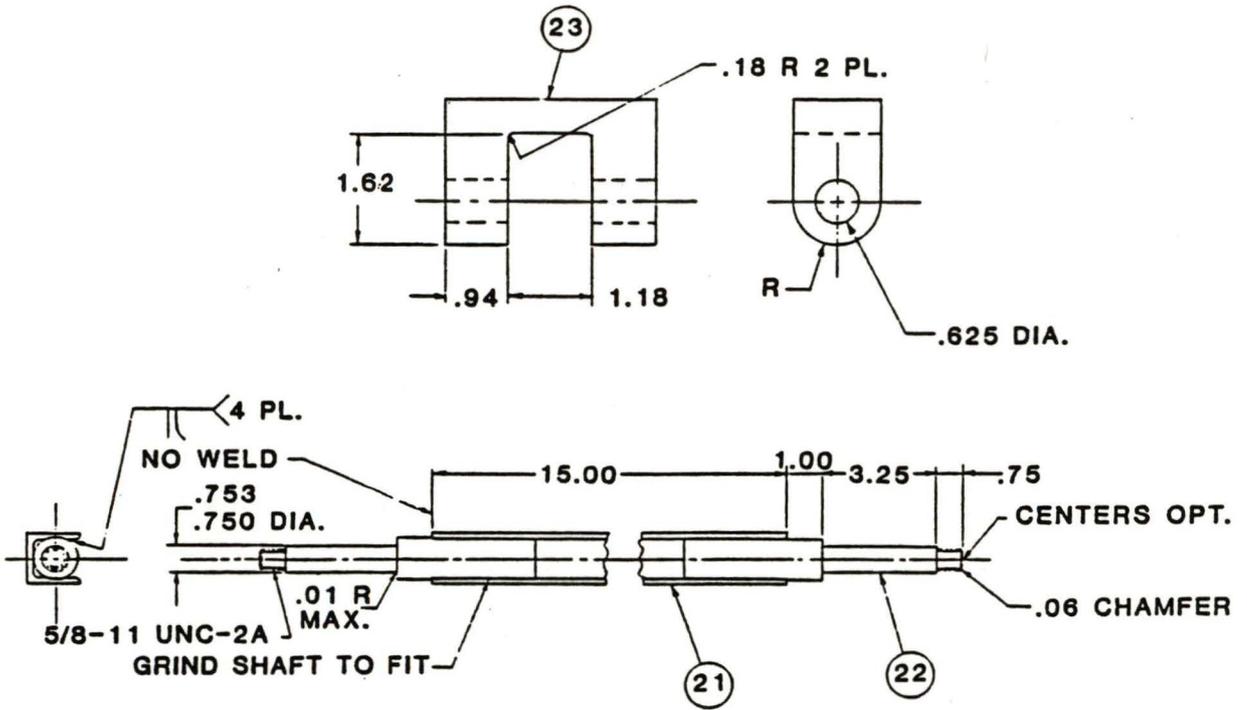
ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 4. - Mine mud cart		
Sheet No: 2	Of: 5	DRAWING NUMBER 3095-40-2



ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 4. - Mine mud cart		
Sheet No: 3	Of: 5	DRAWING NUMBER 3095-40-3



ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 4. - Mine mud cart		
Sheet No: 4	Of: 5	DRAWING NUMBER 3095-40-4



ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 4. - Mine mud cart		
Sheet No: 5	Of: 5	DRAWING NUMBER 3095-40-5

TABLE 4. - Mine mud cart parts list

ITEM	QTY.	DESCRIPTION	MATERIAL	SIZE
1	1	Mount	Stl Plate	1/4 Thk
2	1	Pivot	C F 1045	2.0 Dia
3	1	Yoke	Stl Plate	1.0 Thk
4	4	Deck	Stl Sheet	14 Gage
5	4	Gussett	Stl Sheet	14 Gage
6	4	Fender	Stl Sheet	14 Gage
7	4	Gussett	Stl Sheet	14 Gage
8	3	End	Stl Sheet	10 Gage
9	2	Support	Stl Sheet	10 Gage
10	3	End	Stl Sheet	10 Gage
11	4	Side	Stl Sheet	10 Gage
12	1	Bottom	Stl Sheet	14 Gage
13	1	Bottom	Stl Sheet	14 Gage
14	1	Edging	Stl Tube, 1025	3/4 OD x .035 Wall
15	1	Edging	Stl Tube, 1025	3/4 OD x .035 Wall
21	2	Axle	Stl Channel	1 1/2 x 1 1/2 x 3/16
22	4	Shaft	Stl Bar, CF 1045	1 1/4 Dia x 8 Long
23	1	Pivot	Stl Plate	1 1/4 OD x 2 1/8 x 3
24	1	Bar	Stl Tube, 1025	1 1/4 OD x .065 Wall
25	7	Jamb Nut	M/C 91079A035	5/8-18
26	2	Washer	M/C 90126A035	5/8 ID SAE
27	2	Spring	M/C 92161A035	5/8 ID SS
30	3	Ball Joint	M/C 6072K25	5/8 Bore, 5/8 Stud
31	2	Cap Screw	HEX HD, Gr. 8	5/8-18 UNF x 1.5
32	5	Lockwasher	Split Type	5/8 ID

TABLE 4. - Mine mud cart parts list - continued

ITEM	QTY.	DESCRIPTION	MATERIAL	SIZE
33	1	Grease Fitting	Stl	1/8 NPT
34	1	Bearing	M/C 6391K295	1 1/2OD x1 1/4ID x1 Long
35	2	Washer	M/C 90126A040	1 1/4 ID
36	1	Shaft Collar	M/C 6436K19	1 1/8 Bore
38	4	Screw	HEX HD, Gr. 8	3/8-16 UNC x 3/4
39	4	Lockwasher	Split type	3/8 ID
40	1	Screw	HEX Hd, Gr. 8	5/8-18 UNF x 3.5
41	4	Tire	Armstrong	13x6.5-6 Ultra Trac
42	4	Hub	Armstrong	6x4.50, 3/4Bore, 3.0 Hub
43	4	Washer, Hardn	M/C 980232A036	3/4 ID
44	4	Washer, Hardn	M/C 98023A035	5/8 ID
45	4	Nut, Self Lock	M/C 94828A035	5/8-11

M/C=McMaster-Carr Catalog Number 88  
Chicago (312) 833-0300

## CONTAINER/WORKSTATION CART

There is a need for a vehicle that could be used to transport small containers or portable workstations from location to location in the working sections for purposes of completing maintenance tasks. For example, tools and supplies required for many maintenance tasks performed in a section could be mounted on a transportable container. Frequently used spare parts such as valves, seals, hose fittings and other expendable items can also be stored in this portable device. Grease, oil and other fluids could be contained in container that is pulled to the service point.

There could be many other uses for the containers themselves. Uses might include; tool station, lubrication module, rock dust unit, fire and safety equipment storage, repair workstation, cable splicing module, etc.

This concept is for a device that allows a single, man-powered mechanism to lift and transport the above containers.

To move the container around the working section, the transporter would be positioned around the container and a lift mechanism would secure it and lift it off the floor. The transport would position the load slightly ahead of the axle. The load would be carried by the wheels while the operator controls motion by pulling, steering, and balancing the unit on its' axle.

Design features of the container/workstation cart include--

- Rapidly interchangeable containers that could be picked up or dropped off as required

- Containers could be used as secured storage units when dismounted from vehicle

- Up to 1000 pound load capacity

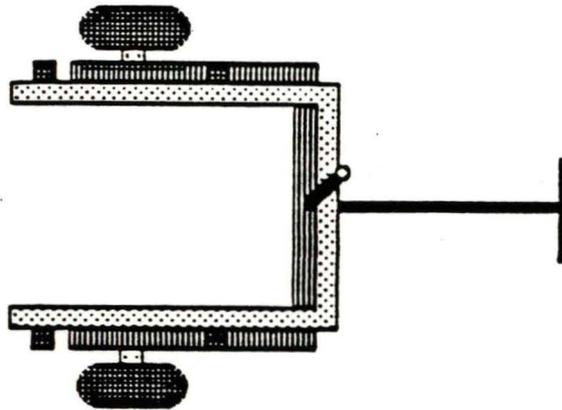
- Adjustable ground clearance

- Balloon tires for easy transporting on unimproved mine floors

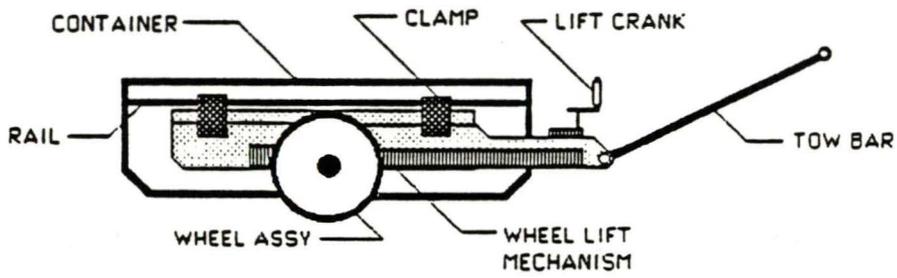
- Tow bar could be adapted for towing behind utility vehicles

Figure 5 illustrates the container/workstation vehicle concept and presents drawings.

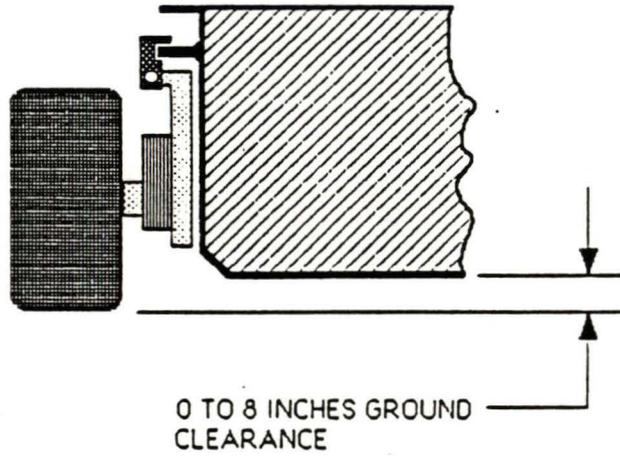
Table 5 lists materials and components for the device.



Top View

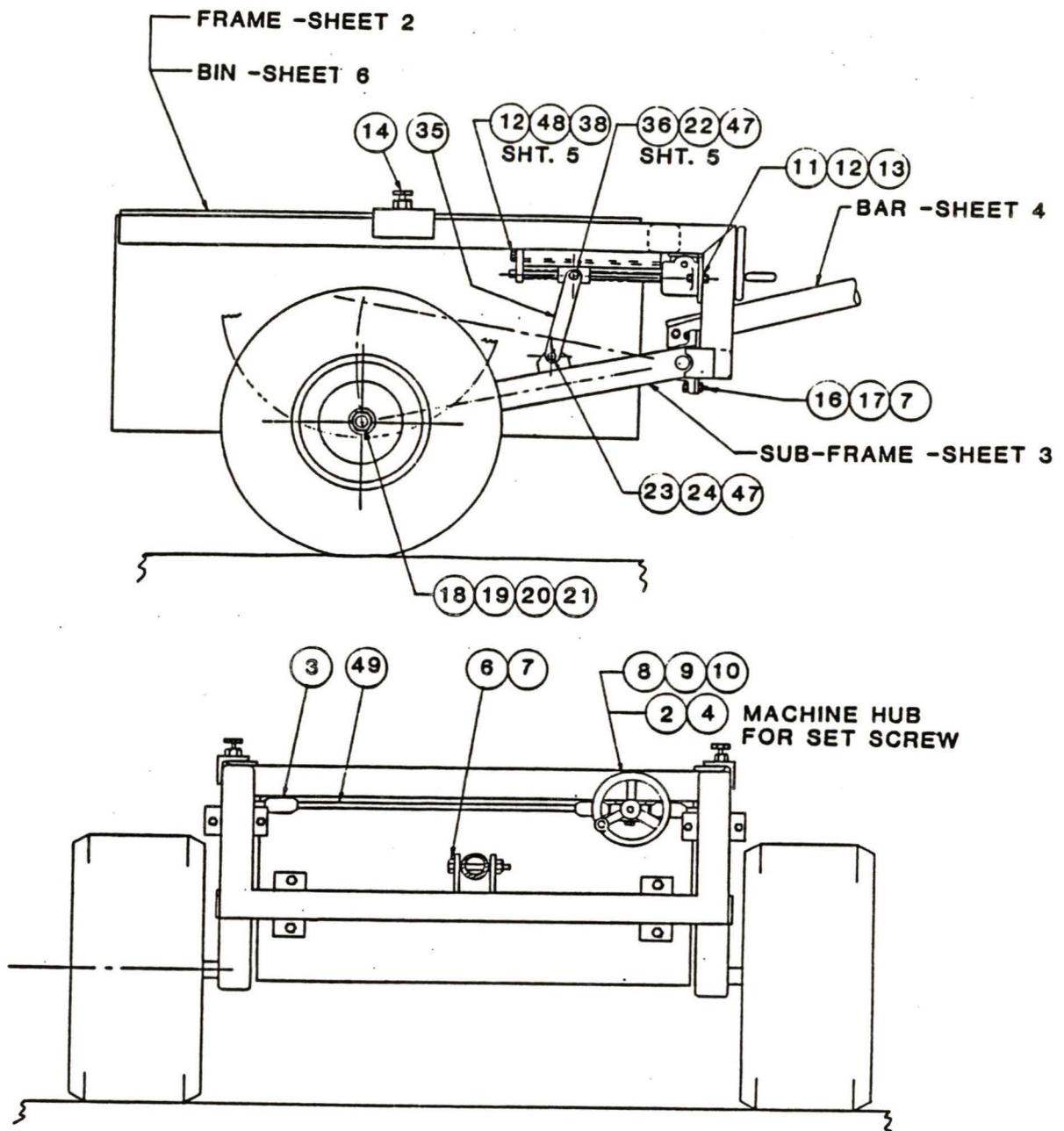


Side View

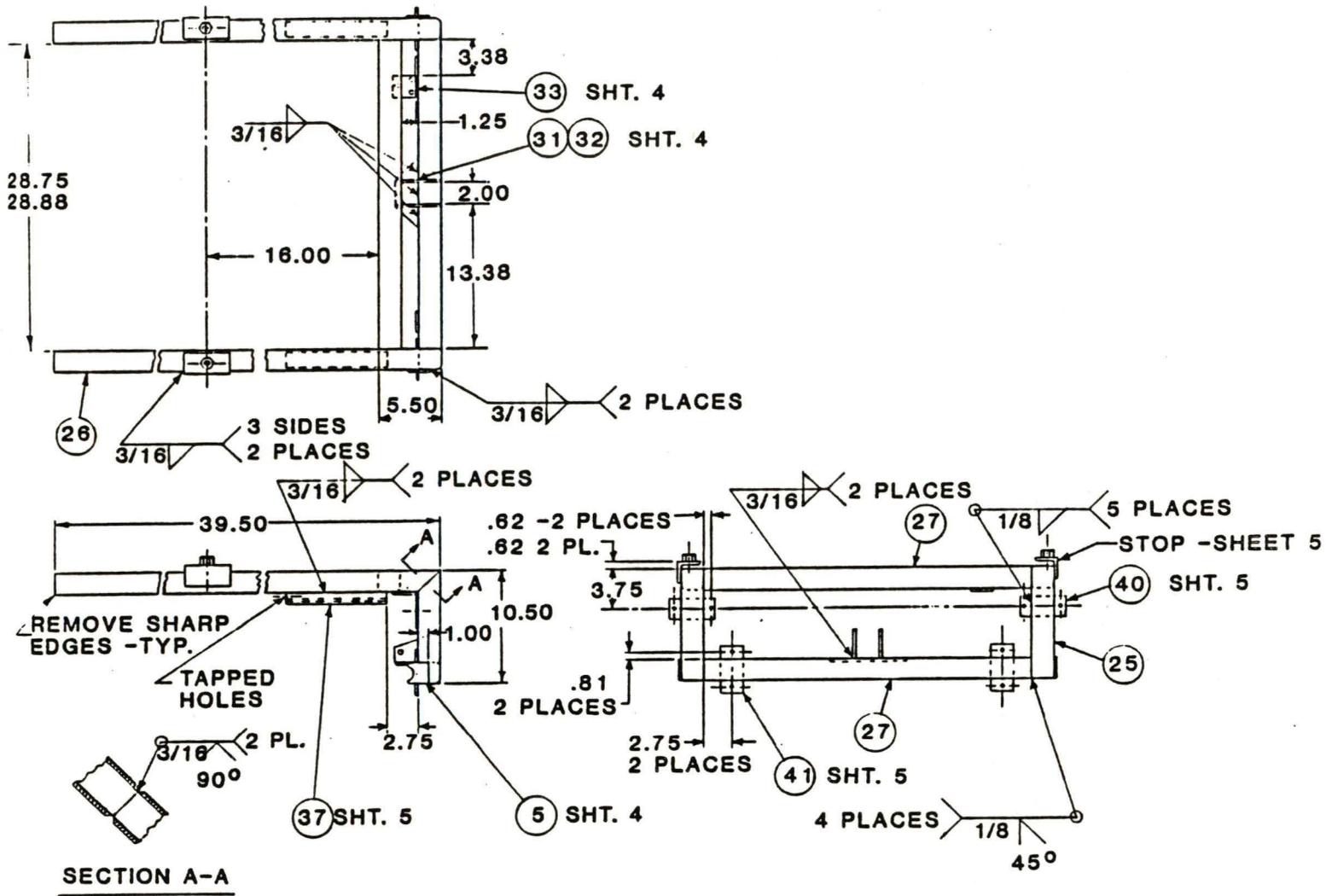


End View

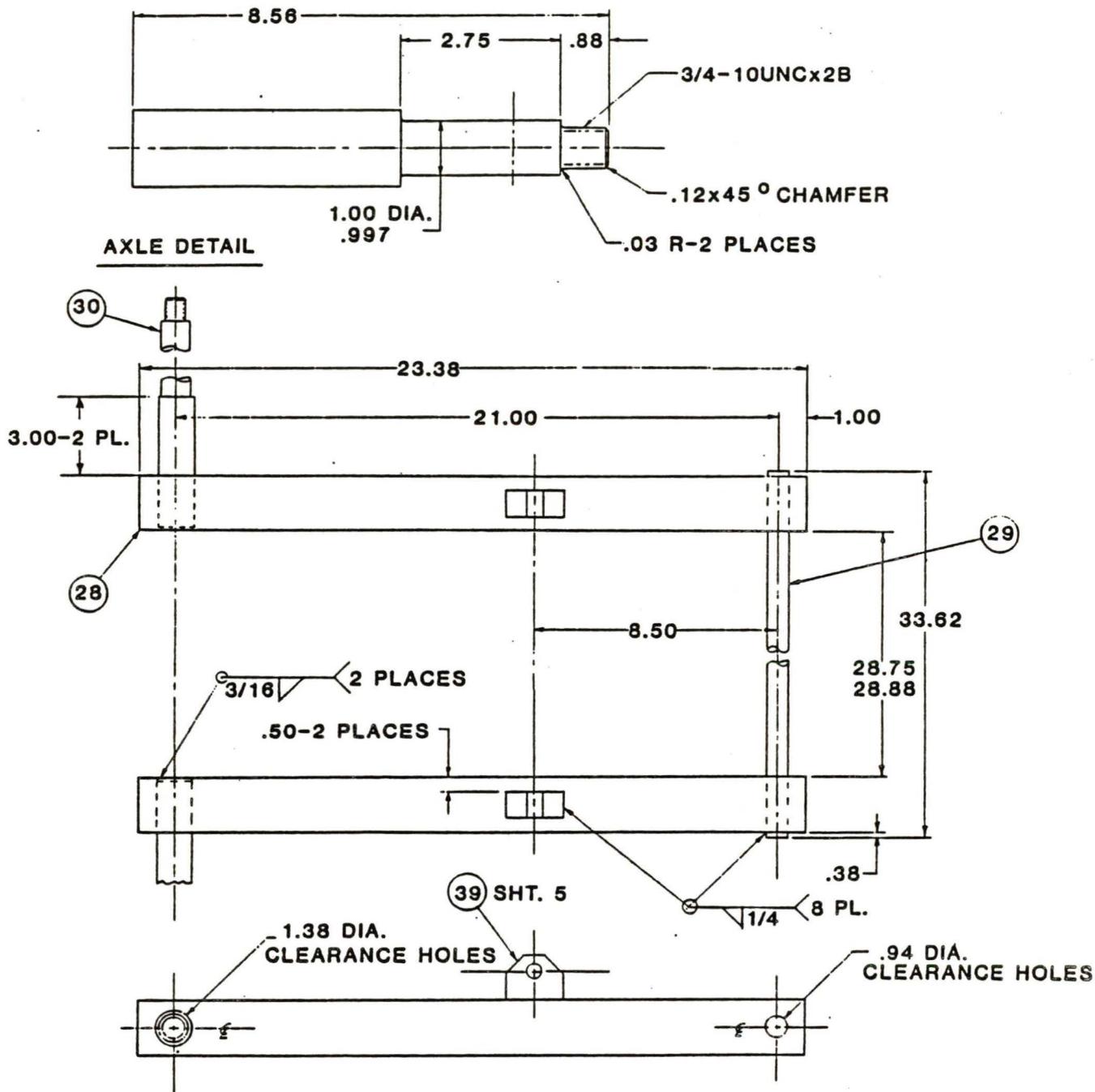
FIGURE 5. - Container/workstation



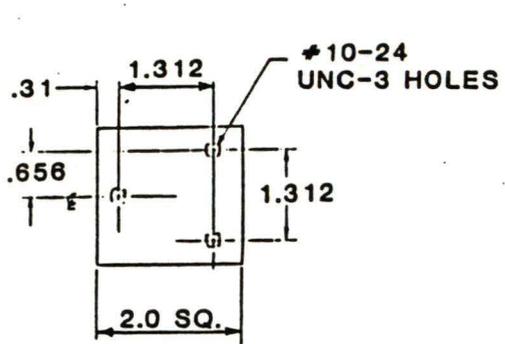
ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 5. - Container/workstation		
Sheet No: 1	Of: 6	DRAWING NUMBER 3095-50-1



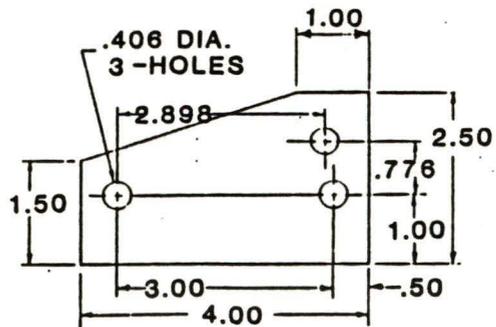
ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 5. - Container/workstation		
Sheet No: 2	Of: 6	DRAWING NUMBER 3095-50-2



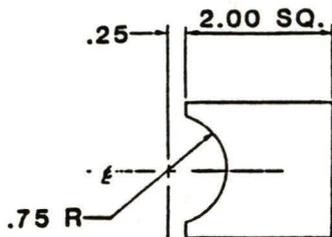
ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 5. - Container/workstation		
Sheet No: 3	Of: 6	DRAWING NUMBER 3095-50-3



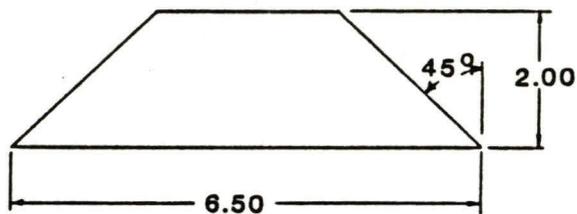
ITEM 33 DETAIL



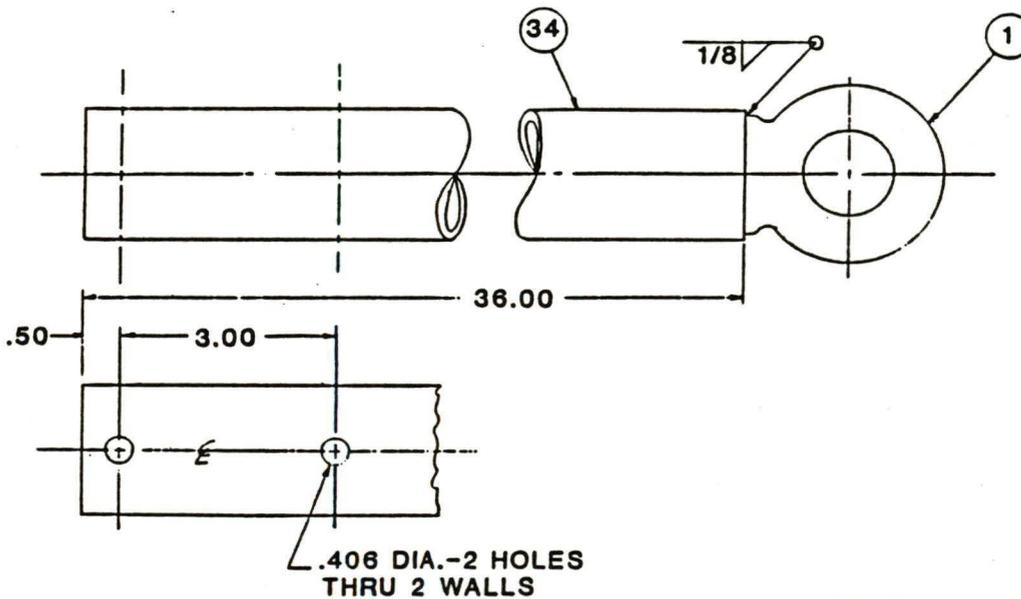
ITEM 32 DETAIL



ITEM 5 DETAIL

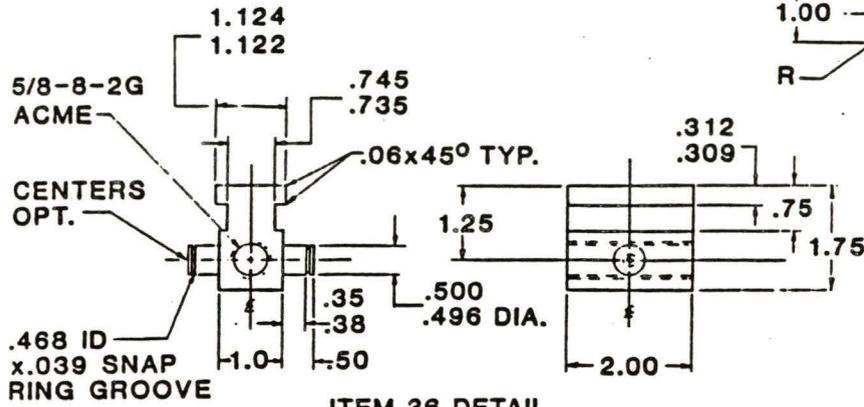


ITEM 31 DETAIL

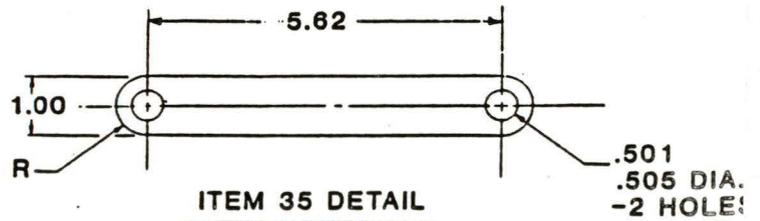


BAR DETAIL

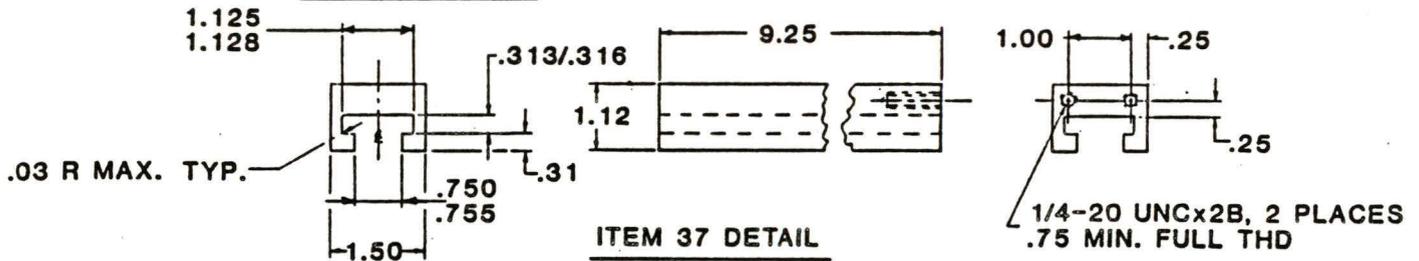
ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 5. - Container/workstation		
Sheet No: 4	Of: 6	DRAWING NUMBER 3096-50-4



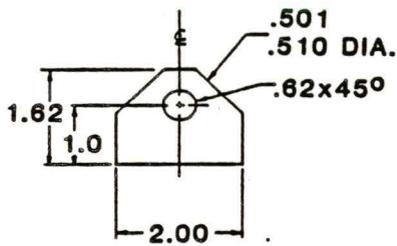
ITEM 36 DETAIL



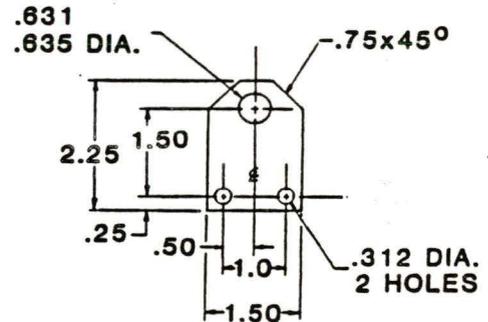
ITEM 35 DETAIL



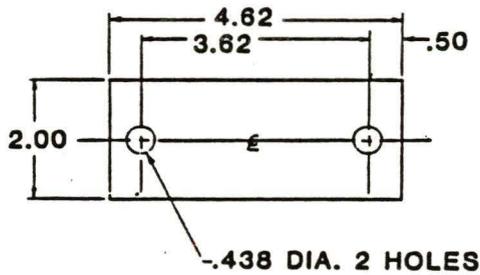
ITEM 37 DETAIL



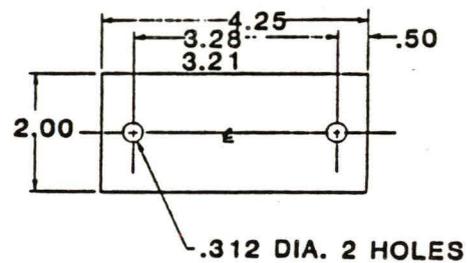
ITEM 39 DETAIL



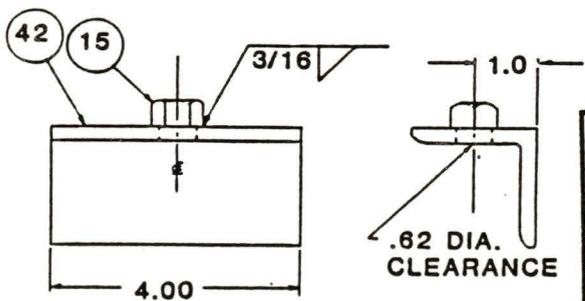
ITEM 38 DETAIL



ITEM 41 DETAIL

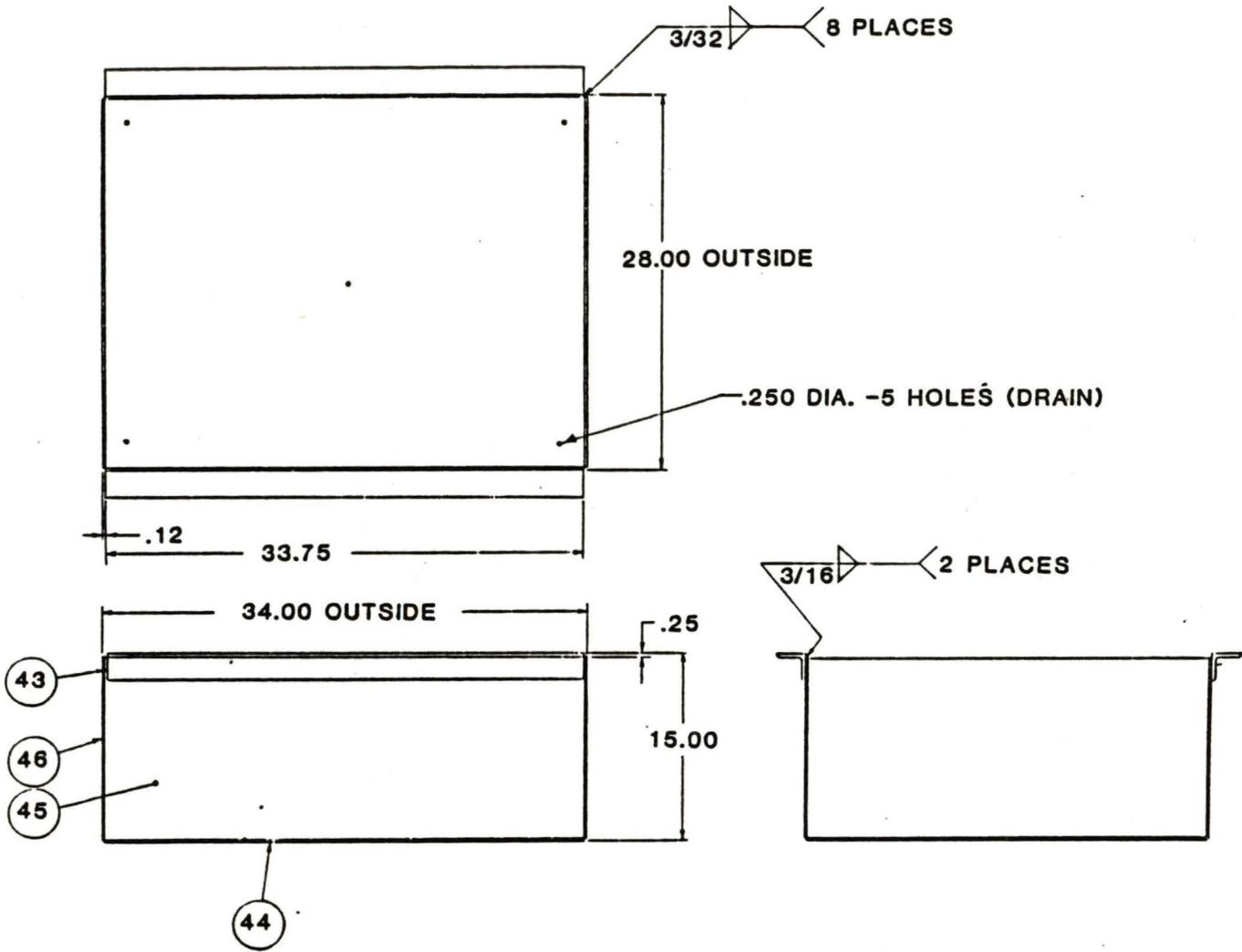


ITEM 40 DETAIL



STOP DETAIL

ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 5. - Container/workstation		
Sheet No: 5	Of: 6	DRAWING NUMBER 3095-50-5



ESSEX CORPORATION/CANYON RESEARCH GROUP		
SCALE: Inches	APPROVED BY:	DRAWN BY Elliott
DATE: 7/3/83		REVISED
FIGURE 5. - Container/workstation		
Sheet No: 6	Of: 6	DRAWING NUMBER 3095-50-6

TABLE 5. - Container/workstation parts list

ITEM	QTY.	DESCRIPTION	MATERIAL	SIZE
1	1	Eye Ring	M/C 3024T26	Note 1
2	1	Handwheel	M/C 6022K37	5 Inch Dia
3	3	Coupling	M/C 6410K38	3/8 Shaft
4	1	Set Screw	M/C 91375A242	10-24 X 1/2
5	2	Guide	ASTM A36	1/4 Thk
6	2	Screw, Hex Hd	Gr. 5	3/8-16 x 3.0
7	6	Nut, Self Lock	Steel	3/8-16
8	1	Gear Drive	M/C 6456K13	3-Way
9	3	Screw, Hex Hd	Gr. 5	10-24 x 1 1/2
10	3	Lockwasher	Steel	3/16 ID
11	2	Screw Jack	See Note 2	1000
12	8	Screw, Hex Hd	Gr. 5	1/4-20 x 1.0
13	4	Nut, Self Lock	Steel	1/4-20
14	2	Hand Knob	M/C 6085K17	Trim to 1 Inch
15	2	Nut, Plain	Steel	1/2-13
16	2	Bearing, Split	M/C 6359K36	15/16 Shaft
17	4	Screw, Hex Hd	Gr. 5	3/8-16 x 1.5
18	2	Nut, Self Lock	Steel	3/4-10
19	2	Washer, Hard.	M/C 98029A036	3/4 ID
20	2	Wheel	See Note 3	8 x 7.0
21	2	Tire	See Note 4	18 x8.50-8
22	4	Snap Ring	M/C 98410A122	External
23	2	Pin, Clevis	M/C 98306A387	1/2 x 1 27/32
24	2	Pin, Cotter	Steel	5/32 x 1.0
25	2	Stand Off	ASTM A500 Gr.B	2 x 2 x 3/16 Tube

TABLE 5. - Container/workstation parts list - continued

ITEM	QTY.	DESCRIPTION	MATERIAL	SIZE
26	2	Carry Arm	ASTM A500 Gr.B	2 x 2 x 3/16 Tube
27	2	Cross Beam	ASTM A500 Gr.B	2 x 2 x 3/16 Tube
28	2	Trailing Arm	ASTM A500 Gr.B	2 x 2 x 3/16 Tube
29	1	Cross Shaft	CF 1018 Bar	15/16 Dia
30	2	Axle Shaft	CF 1018 Bar	1 1/4 Dia
31	1	Gussett	ASTM A36	1/4 Thk
32	2	Guide	ASTM A36	1/4 Thk
33	1	Mount	ASTM A36	3/16 Thk
34	1	Pipe	Sch 40 Steel	1 1/2 Pipe
35	4	Link	ASTM A36	1/4 Thk
36	2	Runner	ASTM A36	As Req'd.
37	2	Track	ASTM A36	As Req'd.
38	2	End Plate	ASTM A36	3/8 Thk
39	2	Lug	ASTM A36	1.0 Thk
40	2	Mount	ASTM A36	1/4 Thk
41	2	Mount	ASTM A36	1/4 Thk
42	2	Brace	Steel Angle	2 x 2 x 1/4
43	2	Rail	Steel Angle	2 x 2 x 1/4
44	1	Bottom	Steel Sheet	10 Gage
45	2	Side	Steel Sheet	10 Gage
46	2	End	Steel Sheet	10 Gage
47	8	Flat Washer	SAE	1/2 ID
48	4	Lockwasher	Split Type	1/4 ID
49	1	Shaft	CF 1018 Bar	3/8 Dia

TABLE 5. - Container/workstation parts list - continued

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Note 1: Items marked M/C are listed in McMaster-Carr Catalog 88.

Note 2: Order from Joyce Dayton Corp. (513) 294-6261.  
Specify Model Wj1000 Worm Gear Screw Jack,  
9 inch Travel, keyed for traveling nut.

Note 3: ARCO Wheel Part Number 70886, 8 x 7.0.  
Available through Armstrong Rubber (Note 4).

Note 4: Order from Armstrong Rubber Company, (203) 562-1161.  
Specify Ultra Trac 18 x 8.50-8, Part Number 429331, with  
rim shown in Note 3.

**\*\*\*ADDITIONAL INFORMATION**

For additional information on the above devices, contact--

U S Bureau of Mines  
Bruceton Mining Research Center  
Cochran Mill Road  
Pittsburgh, PA