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Eli Bridge
"Construction Zone"
Kiddie

Construction Zone Manual

Ride Manual with Set Up, Maintenance,
Operation and Safety Instructions

Serial Number 3-98

VIN Number 1E9M00007VJ008003

Manufactured for

MARTY AND ELIZABETH BRADY



STATE OF NEW YORK
DEPARTMENT OF LABOR

DIVISION OF SAFETY AND HEALTH

Two World Trade Center
New York, N.Y. 10047

PREPARE
IN
DUPLICATE

STATEMENT OF LOAD TEST
FOR PASSENGER CARRYING AMUSEMENT DEVICE

1. TYPE OF AMUSEMENT DEVICE AND NAME DEVICE IS KNOWN BY "CONSTRUCTION ZONE" Dump Truck, T/M for Children	
2. NAME AND ADDRESS OF OWNER OF THE DEVICE Marty & Elizabeth Brady; 1507 Leon Ave.; Valdosta, GA 31602	
3. IDENTIFICATION NUMBER 3-98	4. DEVICE MANUFACTURER'S NAME AND ADDRESS ELI BRIDGE COMPANY 800 CASE JACKSONVILLE, IL 62650
5. NORMAL MAXIMUM SPEED 4.5 RPM	
6. CARRYING CAPACITY A. NUMBER OF PERSONS 48 B. WEIGHT 3,240	

7. STATEMENT OF PERSON MAKING TEST
On October 14, 1998 the undersigned conducted a load test of the amusement device described above, and such device satisfactorily withstood the test prescribed in Code Rule 45, without failure in any material respect.

a. Signature and title William C. Deem
William C. Deem, Registered Professional Engineer

b. Firm name and address Eli Bridge Company
800 Case; Jacksonville, IL 62650

c. Check appropriate box or boxes applying to signer.
 Manufacturer of device
 Insurance Carrier
 Professional Engineer

NOTE TO TESTER: Did a New York State Department of Labor Inspector witness the test described above?
 No
 Yes - Signature of Inspector _____ Date _____

*Forward original of this statement to the Director of Safety and Health, Division of Safety and Health, at the address above, and the duplicate to the owner of the device for his permanent record of test



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The Construction Zone Ride

Serial Number 3-98

Overview

The Construction Zone is a trailer-mounted six vehicle "kiddie ride." When unfolded, the ride is on a 32'X32' platform complete with attached scenery and fencing. The vehicles are "Dump Trucks." Each consists of a fiberglass cab and an aluminum dump bed. The vehicles are attached to sweeps that travel around a center.

The aluminum-decked platform consists of the trailer, a rear apron to which the scenery is attached and a front apron which angles down toward the queue line and midway. In the middle of the trailer portion of the platform is the center, which turns the ride and is powered by a 5 h.p. motor with gearbox and electronic motor control. The winch, most of the electrical boxes, and the mechanical light chaser are also attached to the center.

The rear apron has a hill built into it and the front apron has a "dump track" built into it. The "dump track" is designed to elevate a caster connected to the dump bed resulting in a gentle dumping motion for the passengers in the bed. These features in conjunction with the slant of the front apron give the ride lots of motion compared to a simple circular ride.

For traveling, the vehicles are removed from the sweeps, the sweeps fold up around the center, and the vehicles line up between the aprons on the trailer. The aprons of the platform are then winched up at right angles for a van appearance. The Construction Zone can be pulled with a 1-ton pick-up truck.

The electrical system includes 220v 3-phase 5 h.p. motor, 220v for the quartz lights, 110v for the chasing lights, and 12v for all lighting attached in the vehicles. The operator's station includes 1) an *On* button to turn the ride on, (there is an adjustable timer which automatically turns the ride off), 2) an *Emergency Stop* button which turns off power to the ride, the chasing lights, the horn and the 12v lights in the vehicles, (the quartz lights remain on to assist if there is an emergency, 3) an *On/Off* switch for the quartz lights and 4) an *On/Off* switch for the chasing lights.

The vehicles are built to hold a maximum of eight children: two in the cab and three each in the two seats in the dump bed. The rear seat in the dump bed is large enough to accommodate one or two adults as an alternative. The passenger restraints are nylon seat belts clasped with an adjustable buckle.

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Set Up and Dismantling Instructions

Place the Trailer on Location

- Choose a flat area approximately 32' X 40'
- Put the ride in the position where you will operate it. Level as much as possible, using blocking under tires, if necessary. Raise the front end of the ride with the front jacks and remove the towing vehicle.
- To make the trailer stable, extend the jacks at the four corners of the trailer until the weight of the trailer is not being supported by the tires. If this is not done, the remaining jacks under the ride will not give the proper support.
- Adjust landing gear until trailer is level. (Fig. 1)
- Remove the personnel door on the side of the trailer by pulling the two pins and placing the door inside the trailer. Climb into the middle where the jacks are.
- Adjust middle jacks until they hold weight equal to the front and rear jacks and they are level. (Fig. 2)
- Unpin the "CONSTRUCTION ZONE" sign hold down pins on the front apron of the ride. This will let avoid the necessity for personnel to be under the apron as it is being lowered. This pin is located above and to the left side of the personnel door.

Setting the steel frame

- Unpin the sub-frame pieces from beneath the trailer frame (Fig. 2).
- Put sub-frame pieces in place using proper jacks. The jacks are color-coded to go under the front apron or the back apron. One set of the sub-frames is all black, the other set is all gray. (Fig. 3 & 4)
- Check to be sure the framing is leveled properly. The rear framing should be level with the trailer and the front framing should have a 4 degree slant downward to the front. Make sure all leveling bubbles are centered. (Fig. 5)

Opening and Lowering the Aprons

WARNING: WHEN THE WINCH IS ATTACHED TO EITHER THE FRONT OR THE REAR APRON, ALWAYS HAVE IT SWITCHED TO FORWARD OR REVERSE POSITION, NOT IN THE NEUTRAL POSITION. OTHERWISE, THE SIDE WILL FALL AND WOULD CAUSE INJURY TO ANYONE UNDER THE RIDE AND DAMAGE THE RIDE SEVERELY.

FIG. 1

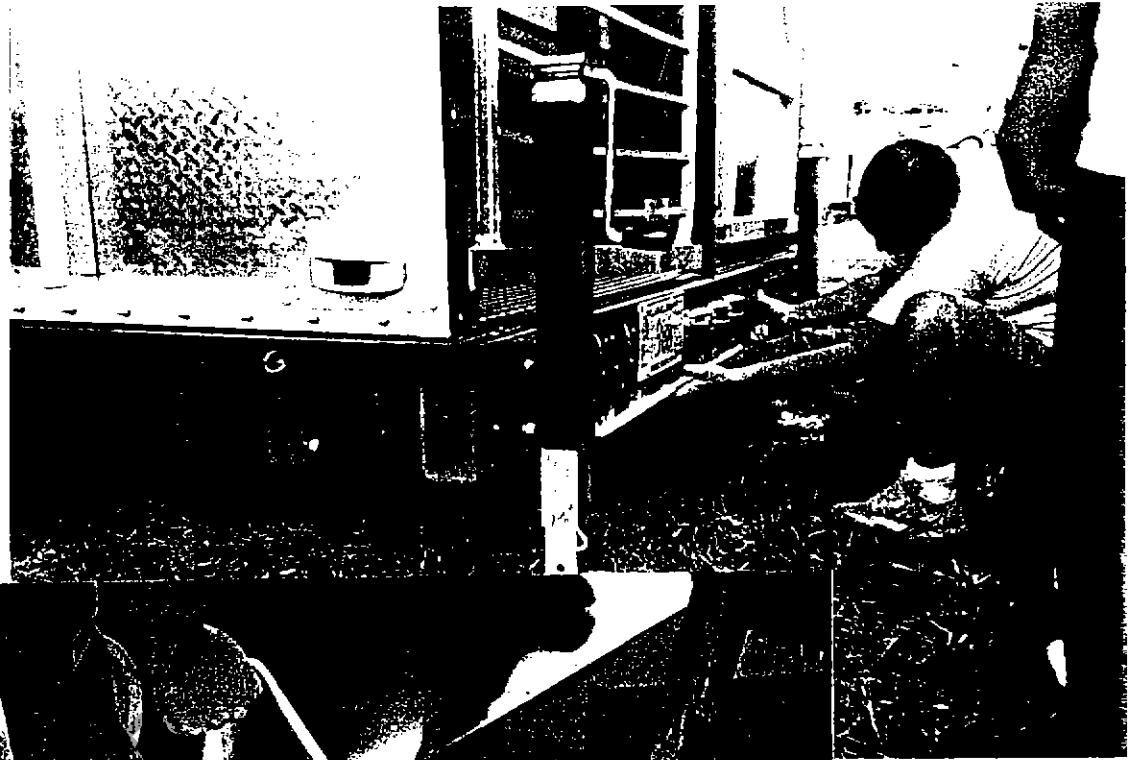


FIG. 2

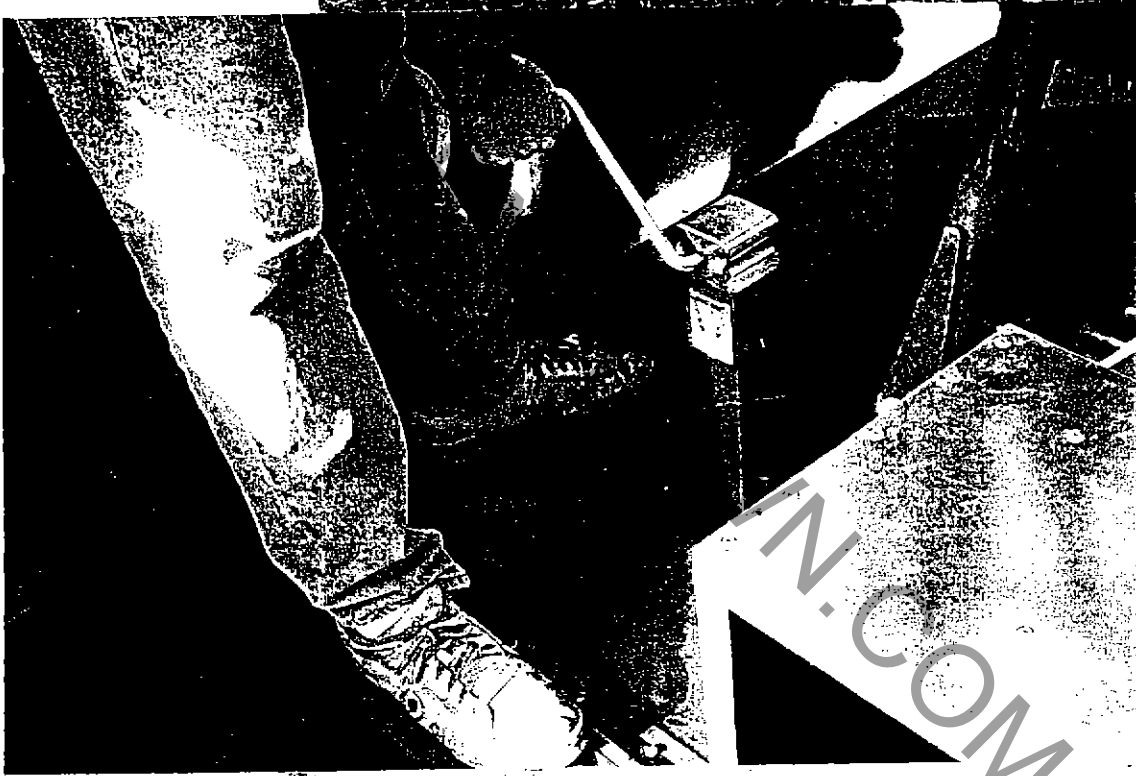


FIG. 3



FIG. 4



FIG. 5

FIG. 6



Check that both aprons are properly connected to the centerpole and that the winch lever is engaged - NOT in neutral (Fig. 7).

- Remove the two pins from the top of the trailer that connect the front and rear aprons together. (Fig. 6)
- Lower rear apron by running the cable out of the winch. In the folded position, the weight of the apron is over center. Because of this, the apron will have to be pushed out by hand for the first few inches.
- When the apron comes down to shoulder level, unpin the apron jack stands located around the outside of the aprons, repinning them in their shortest position. They will fall into place as the apron is lowered. Unpin the "rock pile" hold-down pins. Make sure all jack stands are in position before aprons are completely lowered. (Fig. 8)
- FOR SAFETY, PERSONNEL SHOULD ALWAYS STAND AND WORK OUTSIDE THE PERIMETER OF THE APRON, NOT UNDERNEATH.
- Pin the steps into place and lock them to the apron with a large klik-pin on each of the step pins extending inside the front apron. If the steps are not installed at this point, the klik pins will be much more difficult to attach.
- Lower the rear apron until it is level with main trailer deck. DO NOT LOWER BEYOND THE LEVEL POINT OR YOU MAY DAMAGE THE STRUCTURAL TUBING OF THE APRON.
- Remove the cable hook and attach it to the eye on the front apron. ((Fig. 9) Tighten the cable to take pressure off the dead hook.
- Unpin the dead hook.
- Begin lowering the apron. When the apron comes down to shoulder level, stop the winch and unpin the apron jack stands located around the outside of the aprons. (Fig. 10) They will fall into place as the apron is lowered. Make sure all jack stands are in position before aprons are completely lowered. (Fig. 11)
- Lower apron to 4 degree slant toward ground on top of steel sub-frame. DO NOT LOWER BEYOND THE 4 DEGREE POINT OR YOU MAY DAMAGE THE STRUCTURAL TUBING OF THE APRON. If the sub-frame has been properly leveled, this cannot happen.

▪ **Setting the Apron Jacks and Steps**

- Jacks should swing into position as each apron is lowered. Make sure all of the jack stands land into position before continuing.
- Lower jack stands to the ground when apron is level, then pin. (Fig. 12)

▪ **Setting the Fence and Front Marquee Upright**

WARNING: UNTIL THE BRACING TUBES ARE PINNED IN PLACE, FRONT SIGN MAY FALL IF LEFT UNATTENDED.

FIG. 7 →



← FIG. 8

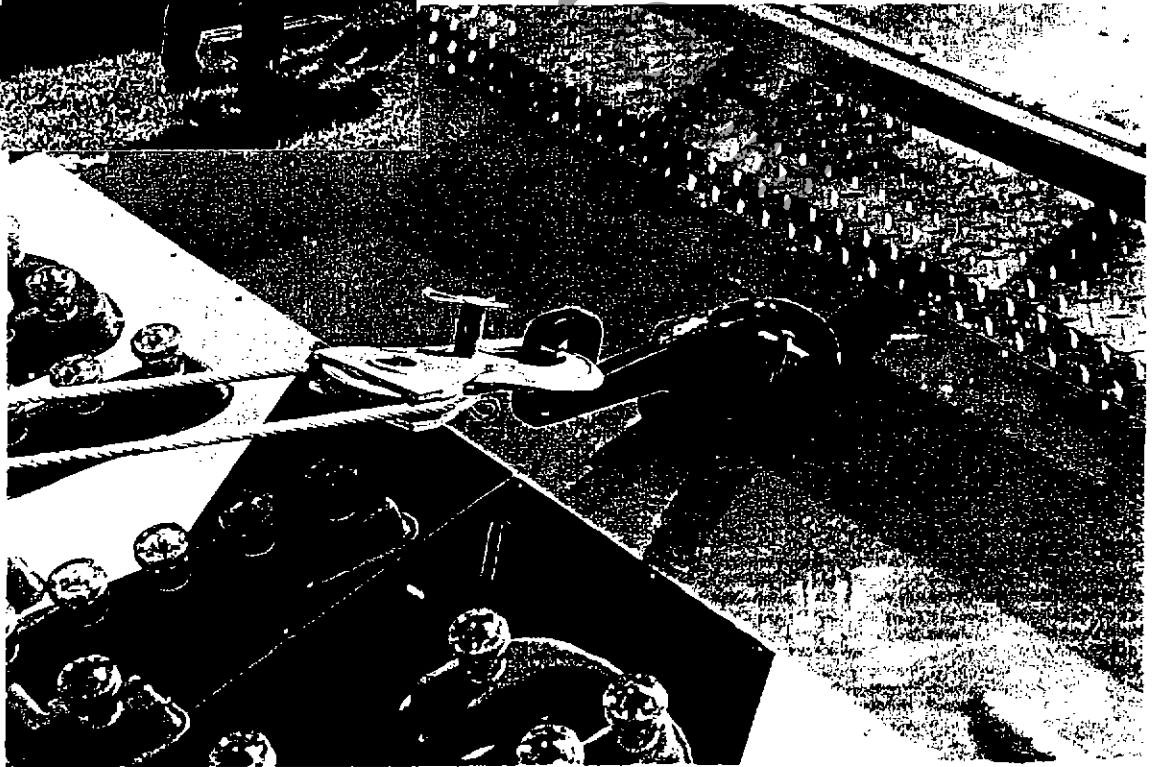


FIG. 9 →

FIG. 10

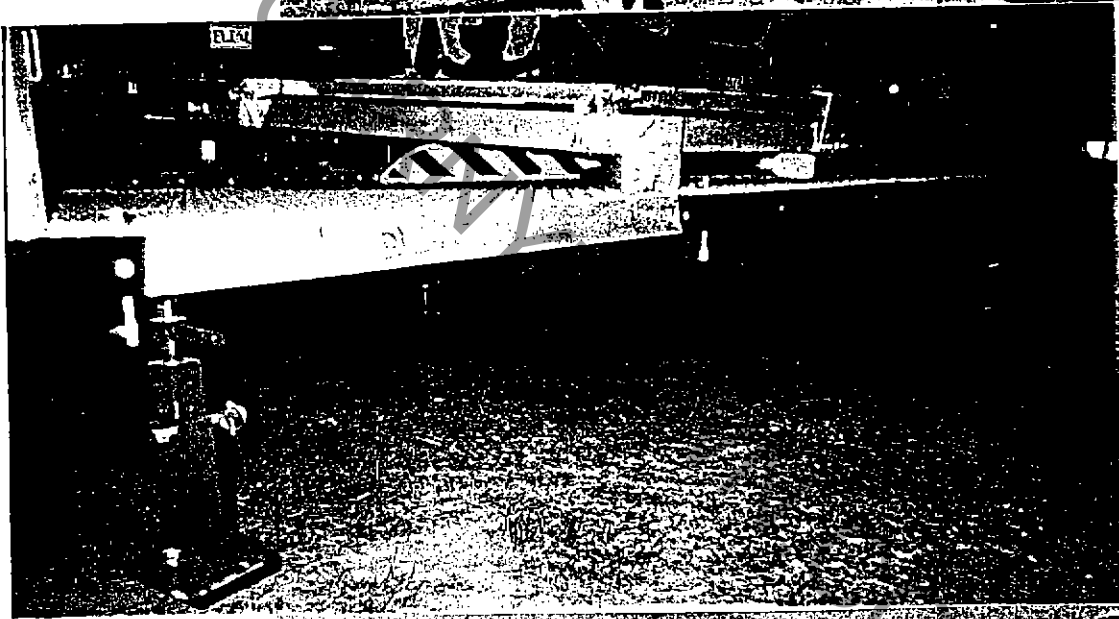
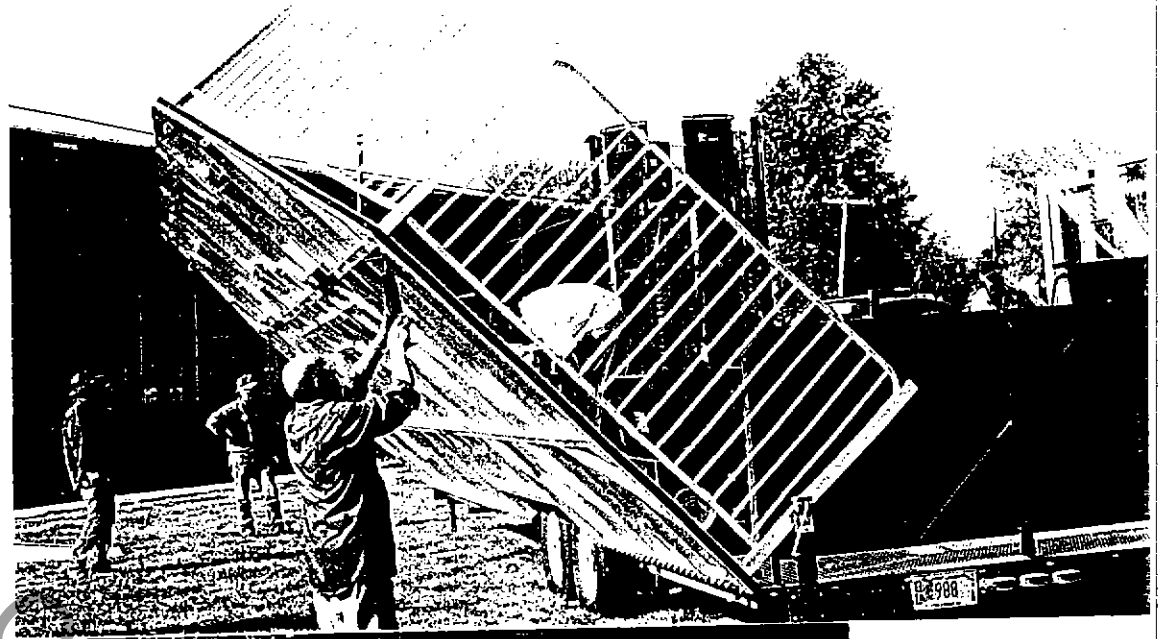
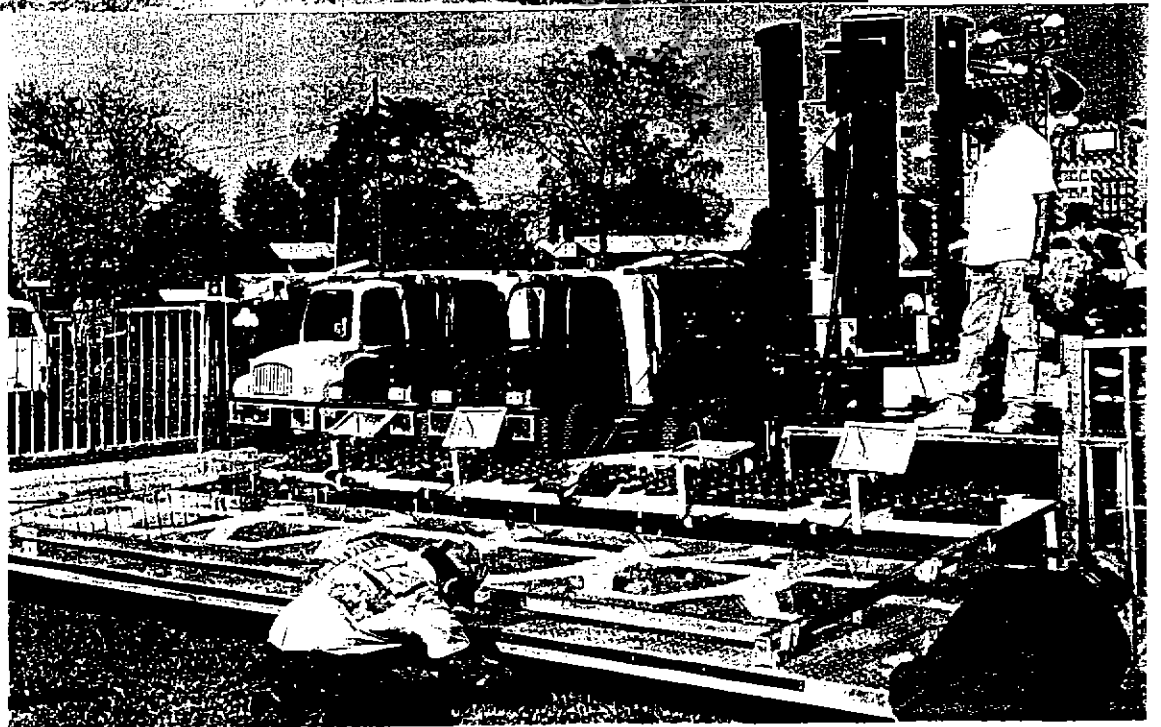


FIG. 11

FIG. 12



- Set fence and sign upright. (Fig. 13)
- Remove quartz lights from front of sign by unpinning and pulling out of the tube. Turn light around and reinsert in same tube on the back of the sign. Pin in place. (Fig. 14)
- Raise the sign to correct height and pin in place. (Fig. 15)
- Place hook end of brace poles into hook socket , rotate pole up to the sign and pin. (Fig. 16 & 17)
- Plug the marquee lights into the cord coming out of the floor.

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FIG. 13

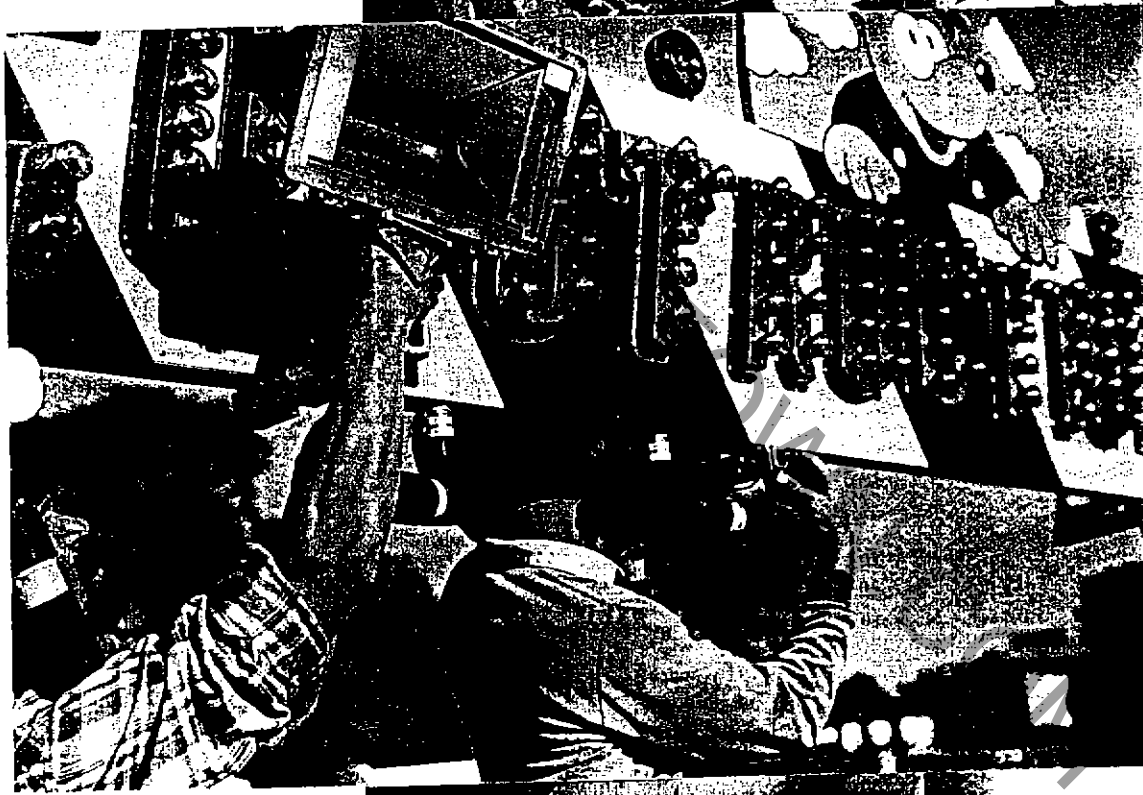


FIG. 14

FIG. 15



FIG. 14

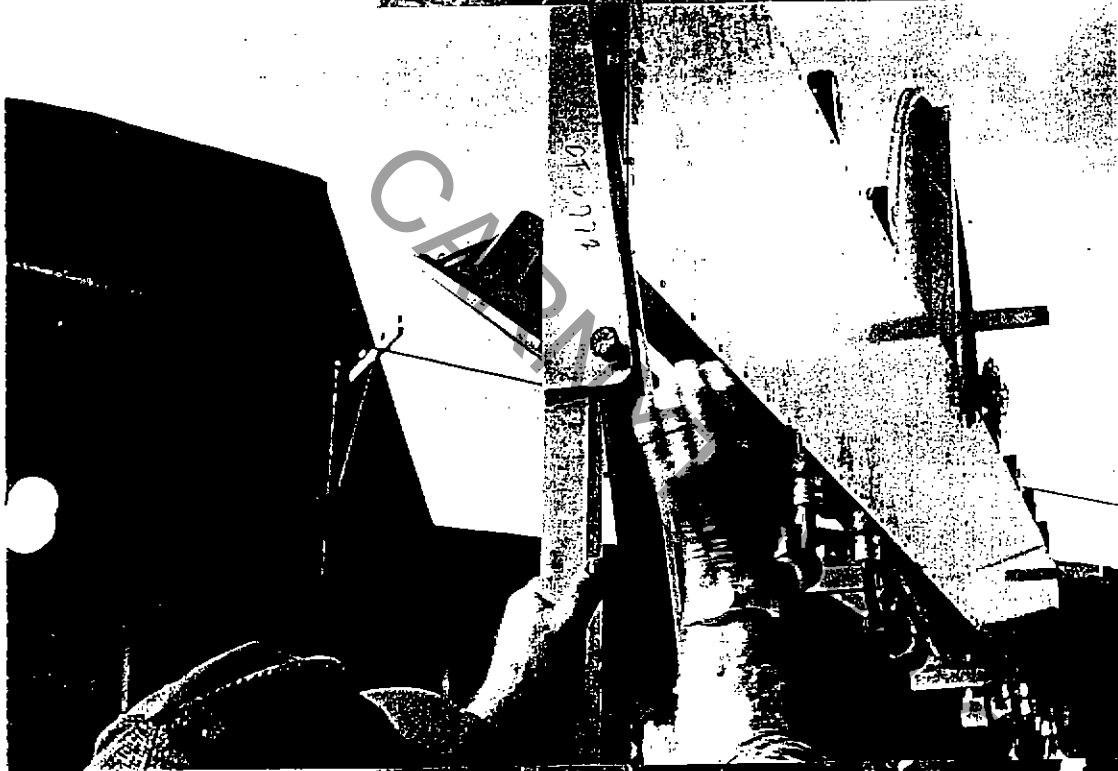
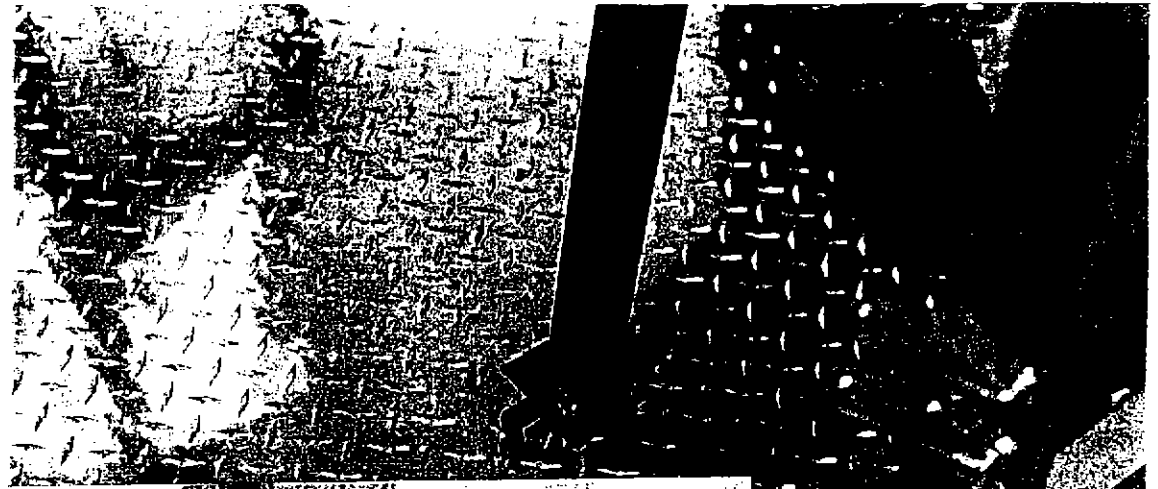


FIG. 17

FIG. 18



Preparing Backdrop and Deck

- Unpin and swing out side flaps from the rear scenery.
- Re-pin in position over the fence.
- Unpin wheel wells (pull up – the pins are attached to the underneath side) and drop them into position. If this is not done, the sweeps will hit when the ride is turning. Check that the wheel well will go all the way down and rest on the trailer tire.
- Place the wheel well walkway cover over the hole next to the wheels. (NOTE: be sure to remove this when dismantling the ride or you will bend it when the aprons are folded up.)

▪ Attaching Dump Trucks to Sweeps

- Remove dump trucks from storage saddles and remove saddles from the floor.
- Roll trucks from storage positions into a circle. Block tires where necessary.
- Remove bottom center pole brace from the trailer and the center ring. Remove the top centerpole brace from the center ring and the "horsehead" pulley section. (Fig. 18 & 26)

WARNING: DO NOT ROTATE THE RIDE WITH ANY SWEEPS IN THE FOLDED POSITION. DOING SO WILL DAMAGE THE TABS ON THE CENTERPOLE.

WARNING: DO NOT ROTATE THE RIDE WITH BOTTOM CENTERPOLE BRACE OR TOP CENTERPOLE BRACE IN PLACE. DOING SO WILL CAUSE DAMAGE TO THE RIDE.

- Unpin the sweeps from the sweep storage link. Repin the link to the centerpole. (Fig. 19 & 20)
- Carefully lower the sweep down into position.
- Hold the sweep up by the pivot handle and remove the sweep hitch pin.
- Open the sweep end by pushing down on the leg handle.
- Lower the sweep to the floor, letting it rest on the bumper on the sweep end leg. (Fig. 21 & 22)
- BE CAREFUL TO HOLD THE END BY THE SIDE HANDLES. DO NOT PUT YOUR FINGERS IN OR AROUND THE END CONNECTOR AS IT IS CLOSING.
- Roll the dump truck into place, lining the truck tires up with the running pattern on the decking.
- Unpin the truck hitch and lower it into the sweep end. (Fig. 23)
- Roll the truck into alignment with the sweep end and set the brass bushing in the connecting slot. (Fig. 24)

FIG. 19

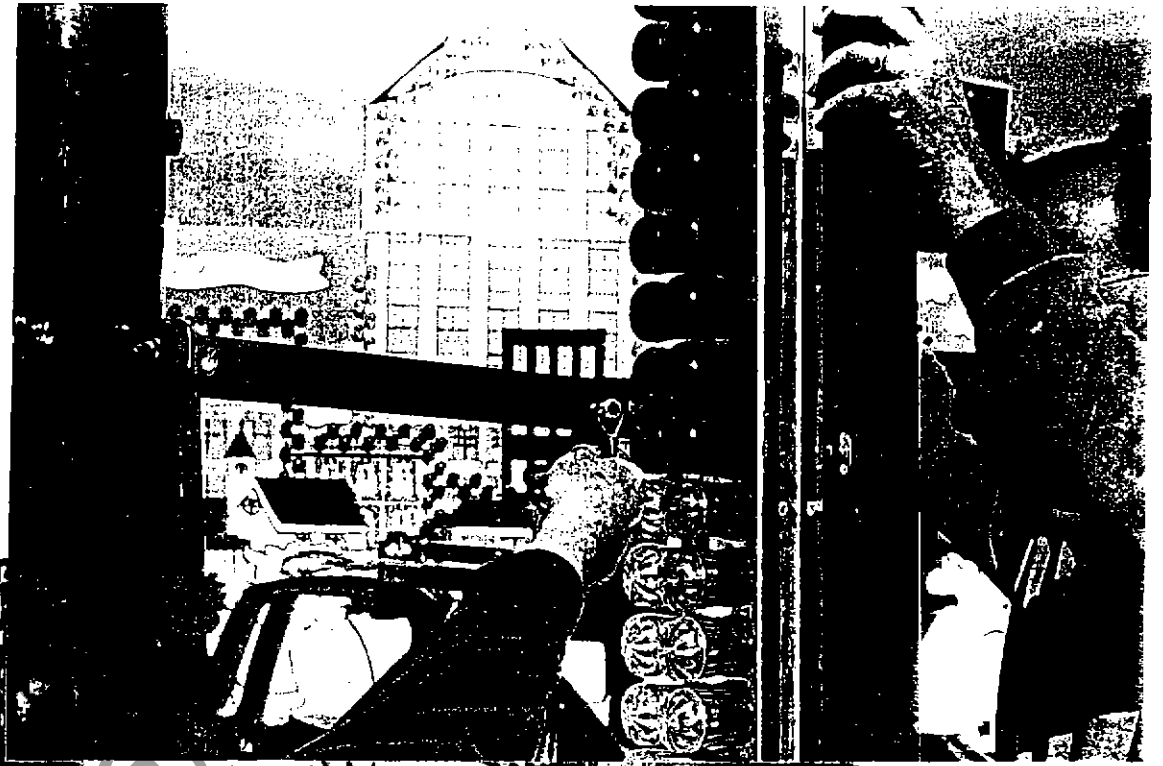


FIG. 20

FIG. 21



FIG. 22

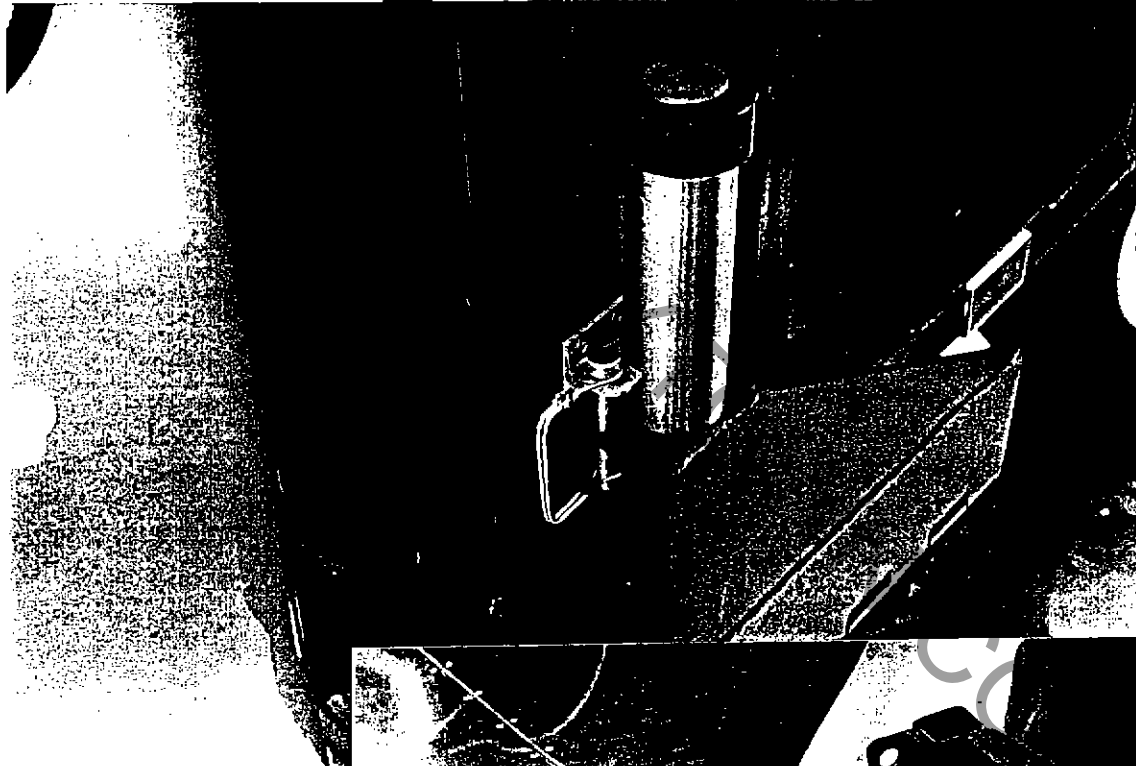
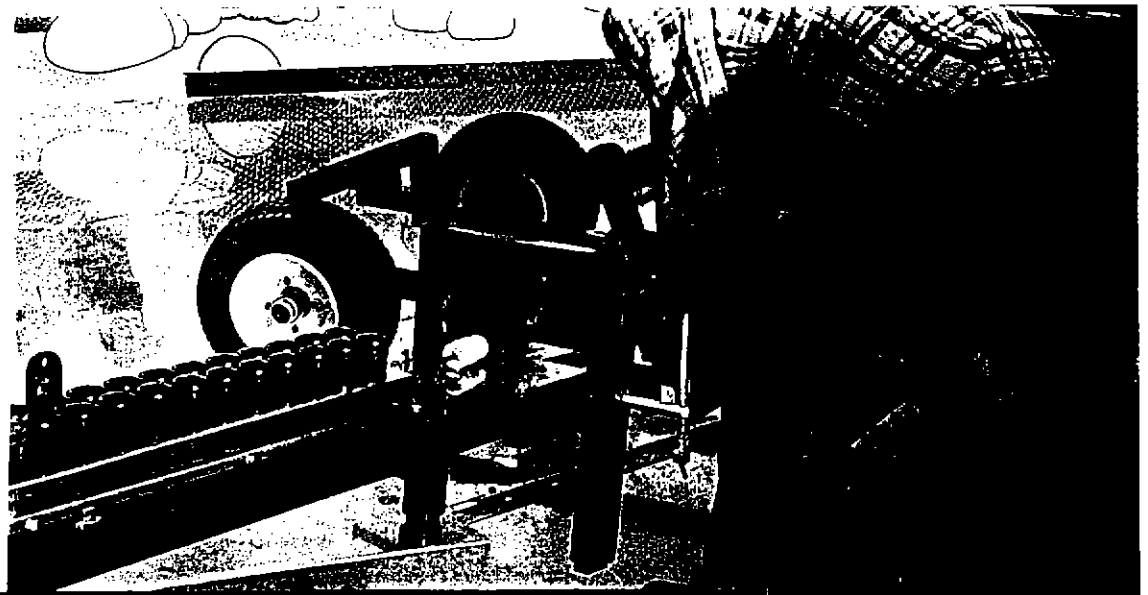


FIG. 23

FIG. 24



FIG. 25

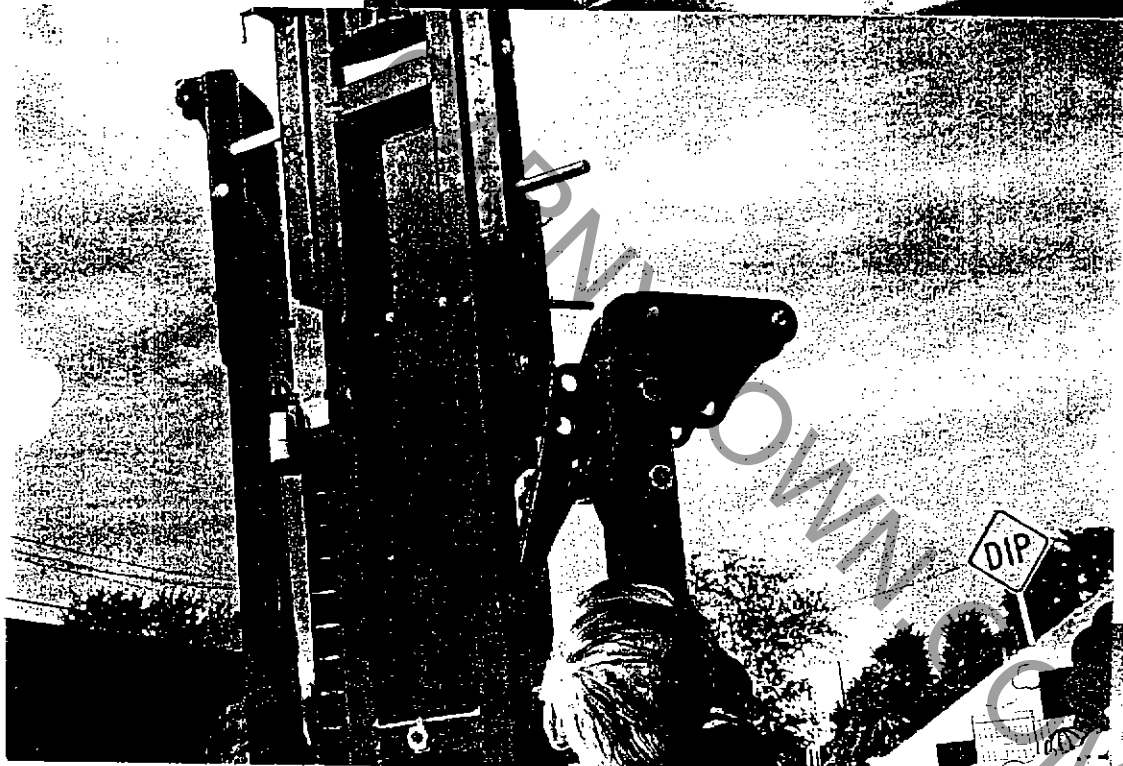
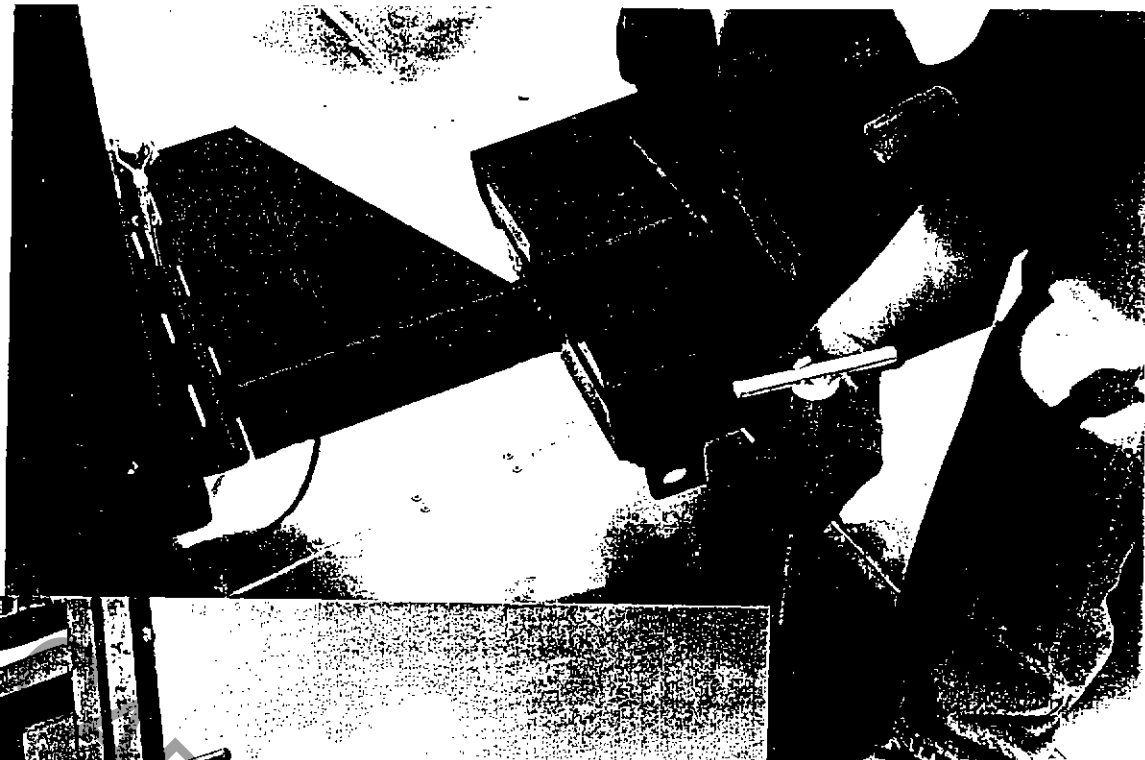


FIG. 26

FIG. 27



- Fold the sweep end closed and pin in place, being careful to hold the side handles. Secure with klik pins. Repeat for each vehicle. (Fig. 25)
- Plug in each vehicle.

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▪ **Attaching Scenery**

- Unpin and place all signs in receptacles right-side up (they are stored upside down facing out pinned in the same receptacle in traveling position).
- Pin in place.
- Unpin folded-down scenery. Swing up in place and re-pin securely. (Fig. 28)
- Unpin the "rock pile" and carefully place it over the centerpole. Set the four (4) pins down into the proper holes around the outside circle and pin in place. (Fig. 29)
- Put the BIG ELI Critter's neck holder ring over the top of the centerpole. It will sit on the flange. (Fig. 30)
- Carefully place the BIG ELI Critter over the centerpole and set it to face the front of the ride. It remains stationary while the rock pile turns with the ride. (Fig. 31 & 32)
- Attach sweep canvas to the sweeps and turn fasteners $\frac{1}{4}$ turn to secure them. (Fig. 33) Alternate black and yellow.
- Place skirting around the front three sections of the ride and the gooseneck, being careful not to let the Velcro touch the ground.
- Test all lights to be sure they are working. Replace any burned out bulbs or broken covers.

FIG. 28



FIG. 29



FIG. 30

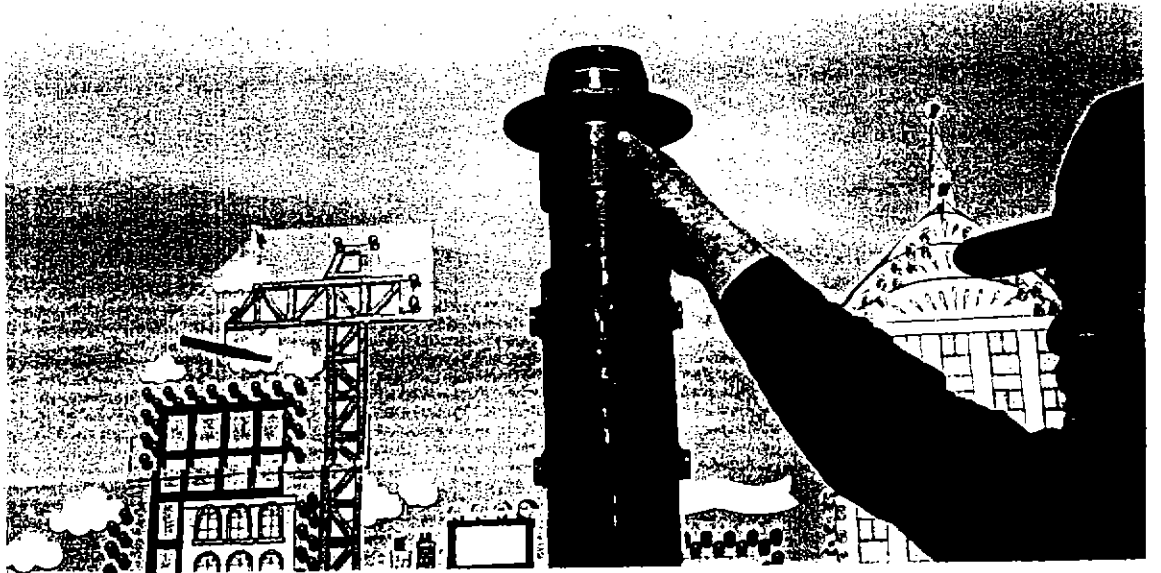


FIG. 31

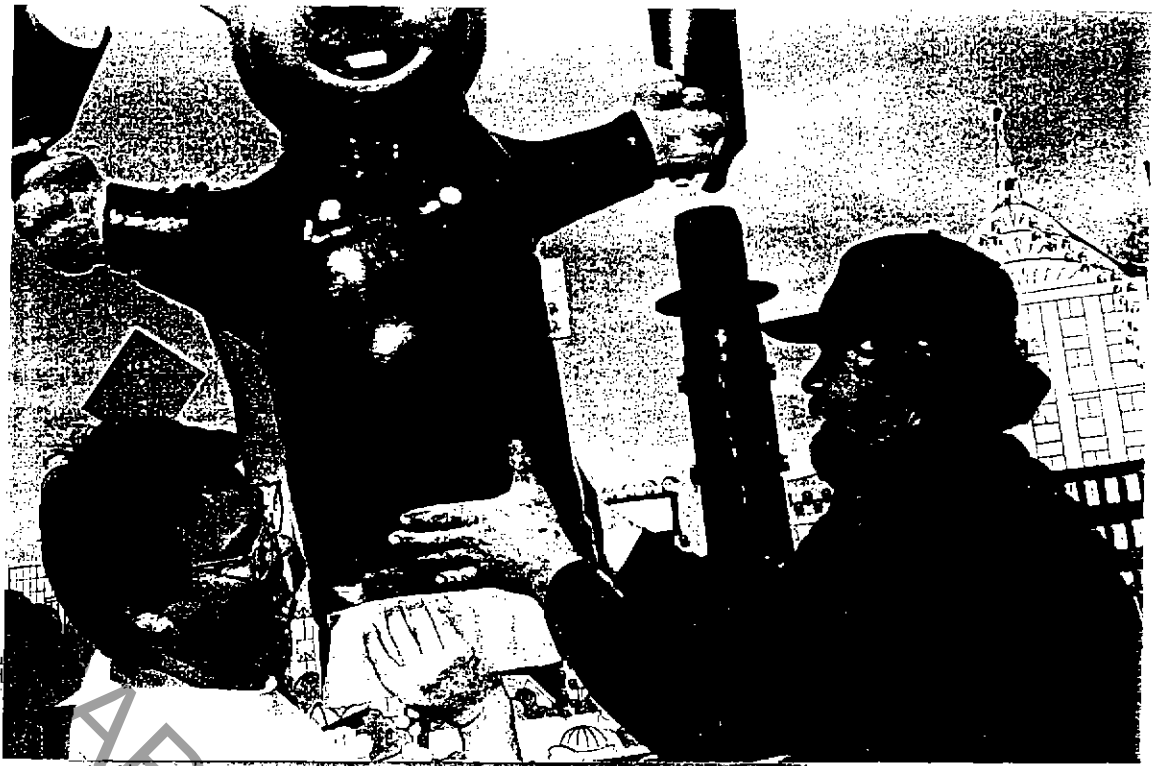


FIG. 32

FIG. 33



▪ **Dismantling the Construction Zone**

- Remove Balleycloth and canvas, fold and stow in canvas storage bag and place in seats.
- Unpin the scenery, fold it down in traveling position and re-pin.
- Unplug all electrical cords from dump trucks.
- Remove the BIG ELI Critter and the rock pile and store.
- Rotate the ride so that the winch is in front, directly opposite to the rear scenery. **IF you fail to do this before attaching the sweeps, you will have to reattach them and start over.**
- Attach the top of the centerpole with the pulleys and pin in place properly.
- Unpin each vehicle from the sweeps.
- Fold the connecting wing shaft up and pin in place.
- Fold sweeps up and secure with bolts and pins. Be sure to use the cotter pins provided.
- Roll each vehicle to storage position and put storage saddles in place under the wheels.
- Unpin the telescoping sections of the front marquee and telescope it down to storage position and re-pin.
- Remove the quartz lights for traveling.
- Unpin and remove the third leg on each side of the marquee.
- Remove the marquee floor pins so that it rotates, fold it down VERY CAREFULLY and attach to receptacles on apron. Be sure that nothing is interfering on the way down.
- Remove the steps.
- Adjust the wheel covers up to travel position.
- Remove the wheel well walk way covers. **IF YOU NEGLECT TO DO THIS, YOU WILL BEND THEM WHEN THE APRONS FOLD UP.**
- Attach the three guides to the front apron.
- Attach the winch to the rear apron and start winching it up slowly.
- Have people on the ride ready to "catch" the apron as it approaches vertical position. It should
- NOT be allowed to go over center with any force or **YOU WILL DAMAGE THE RIDE.**
- Attach winch to rear apron and lift half way up.
- Pin jacks into storage position.

- Have a spotter watching the sides to see there is no interference from the fencing, vehicles inside, signage, etc.
- Lift rear apron to vertical position.
- Repeat for front apron.
- Pin aprons together at top.

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Operation Instructions

Rules For Safe Operation of the Construction Zone Ride

- Always completely inspect and test-run the Construction Zone Ride before each operating period. Be sure the timer is set for the proper length of ride.
- If any unusual noises or conditions develop while the Construction Zone is in operation, stop the ride and correct the problem before continuing operation.
- Always grease, oil, or wipe the operating parts of your Construction Zone while the ride is stopped and turned off. Doing otherwise can cause very serious accidents.
- You, the operator, are very close to the Construction Zone while it is running. You may get into the path of the ride ONLY after it has stopped.
- Being under the influence of drugs or alcohol while operating the ride must be absolutely avoided.
- Operate the Construction Zone ONLY within the limits of the mandatory maximum speed of 5.5 revolutions per minute.
- Operate the ride ONLY after checking to assure that all pins are in place and properly locked and all bolts are in place and properly tightened.
- Operate the ride ONLY after the signs for rider restrictions have been posted in a prominent position at the entrance of the ride.
- Infants and children too small to sit upright and hold on by themselves or if they are unable to be restrained by a seat belt should not be allowed to ride the Construction Zone.
- Toddlers should not be allowed to ride unless accompanied by a responsible adult. The back seat of the Dump bed is large enough to accommodate most adults.
- Persons under the influence of alcohol or drugs are always prohibited from riding the Construction Zone.
- Smoking or other uses of tobacco by guests are always prohibited while on the Construction Zone because of the danger to themselves and other passengers.
- All seat belts must be properly locking before putting passengers in the seats.
- All passengers must be properly seated with the seat belts locked before starting the ride.

- Riders must stay seated with their arms, legs, hands and feet inside the vehicles at all times.
- The cab of the Construction Zone and the front seat in the dump bed are built and sized for children only. Seat Adults only in the rear seat of the dump bed.
- If a child is being forced to ride or is scared, prevent them from riding. A scared child may well panic on the ride.
- Always watch the passengers and the queue line during a ride.
- If a child appears to become frightened during the ride, STOP THE RIDE IMMEDIATELY and allow them to exit the ride.
- If any passenger misbehaves in any way, STOP THE RIDE IMMEDIATELY. Refuse rides to anyone who might endanger themselves or others.
- Be sure the Exit gates and Entrance gates are closed and locked before starting and during the ride.

Operating the Ride

- All seats may be loaded simultaneously and passengers may climb aboard on their own if they desire and are able.
- The operator must check each seat before starting to make sure the seatbelt is secure.
- Turn on the motor by pressing the green button on the operator's control panel marked "ON."
- The ride will turn off automatically according to the timer setting. If the ride needs to be stopped for any reason (passenger misbehaving, scared child, etc.) press the Stop button.
- Once the dump trucks come to a stop, open the Exit gate and help the passengers disengage from their seat belts and unload. The next group is now ready to be loaded.

Closing Down for the Night

Turn off the main service disconnect in the middle of the trailer.

Construction Zone: Dump Truck Model

Electrical Systems Description

The Dump Truck requires 208-240 3-phase VAC to operate. The drive system and the lighting system are described separately. Both systems derive their power from a main power input block located on the front of the trailer. Means of connection to the input power block is left to the discretion of the owner. A 100-foot cable of 8/5 SOWA type W cable is provided. This cable is rated for extra-hard usage, is suitable for use in wet locations, and is sunlight resistant, as required by the 1996 National Electric Code section 525-13 (a) for carnivals.

The drive system draws 3-phase power from the main input power block. From there current flows to a NEMA size 2 starter via a 100 Amp circuit breaker, both of which are located in the Control Relay panel located on the floor immediately adjacent to the center pole of the ride. The drive is a 5 HP 1160 rpm motor coupled to a variable frequency drive motor controller, which provides soft starting and stopping of the ride. The gear reducer (25 to 1) is chained to a larger sprocket that in turn provides rotational motion to the center pole.

The operator's control box is permanently mounted on the side fence. The box is also equipped with a key switch so that the ride cannot start without the key in the switch and turned on. There is also a foot pedal, which must be energized before the ride will start. There are five switches on this panel:

- (1.) A green extended button that starts the ride.
- (2.) A red mushroom head emergency stop button.
- (3.) A selector switch which turns all flashing lights on and off.
- (4.) A selector switch which turns the quartz lights on and off
- (5.) A push button on the side of the box which energizes the air horn (Mounted behind the marquee)

The green start button causes the motor starter to close for a preset length of time. An adjustable timer relay can be set for a ride time-length acceptable to the owner.

The emergency stop button, when pressed, causes a break in the hot line of the control logic circuit, which interrupts the control logic governing the operation of the motor starter. This causes an immediate stop of the ride. Additionally, the timer relay is reset to zero time and all flashing lights and truck lights are powered down. The overhead quartz lights, if on, will remain on. This feature is provided in the event that if the emergency stop button is used at night, riders will be able to see their way safely to the exit gate, if such action is warranted.

The lighting system is divided into four circuits. All components of the lighting systems are controlled by two 40 amp coil driven contactors located in the control/relay panel. The first contactor controls all 120 volt lighting. The second controls the 240 volt quartz lights. Both contactors have 120 volt coils.

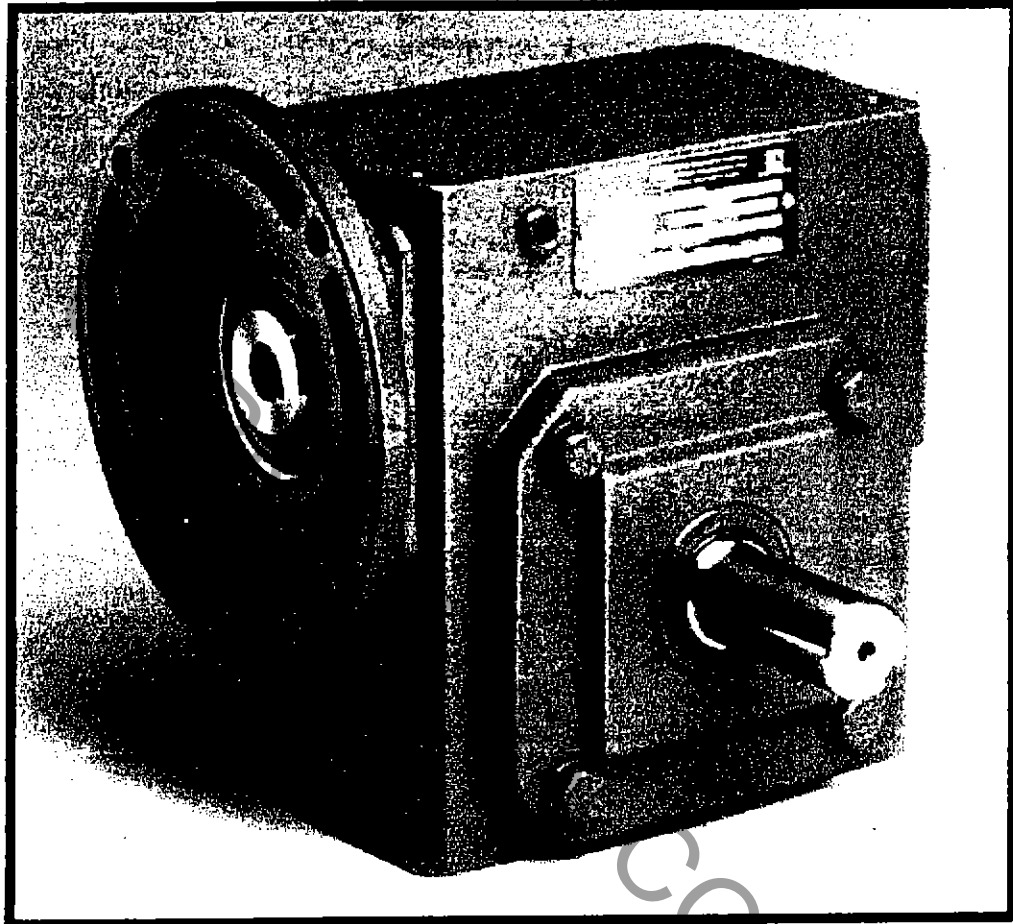
(1.) The flashing lights on the center pole are driven from an electrical box mounted on the center pole, which is powered via the commutator rings located on the base of the center pole. The operator panel provides the means of switching all flashing lights. A mechanical light chaser distributes power pulses to the lights themselves. Currently, only 3 channels of the 4 channel chaser are in use. This provides an extra contact that could be put into use in case of wear on one of the other contacts.

(2.) A mechanical light chaser located in the control/relay panel drives the flashing lights on the scenery panels and on the front sign. All four channels of this chaser are in use. Power is directed to the scenery panels via a cable running under the trailer. Two junction boxes, located on the rear wall of the scenery are used. This way, a section of weatherproof conduit protects the cable on its vertical climb. Lights on the marquee sign, at the front of the ride, are also cabled under the trailer. The cable plugs in to the bottom of the sign via a six pin snap-close receptacle.

(3.) The overhead quartz lights are controlled by means of the second coil-driven contactor in the control/relay panel. Two legs of three-phase circuit are joined here to provide the 220 volts required to operate the four quartz lights. Again the on/off status of these lights is controlled at the operator's panel via a selector switch, and will remain on under emergency stop conditions.

(4.) The lights on the trucks are on a 12-volt circuit. A 12v/200 Amp transformer is located in its own fan-cooled box on the rotating center pole. Power distributed to the trucks is all 12-volt. There is no 110-volt circuitry on the trucks.

EPT.



WORM GEAR SPEED REDUCERS MAINTENANCE INSTRUCTIONS

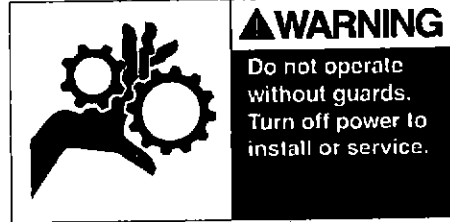
CENTER DISTANCES 3.75, 4.50, 5.16, and 6.00



EMERSON POWER TRANSMISSION CORP.
620 SOUTH AURORA
ITHACA, NY 14850
PHONE: 607 272-7220

INTRODUCTION

The following instructions apply to Worm Gear Speed Reducers. When ordering parts or requesting information specify all information stamped on the reducer nameplate.



EQUIPMENT REQUIRED

In addition to standard mechanic's tools, the following equipment is required: arbor press, wheel puller, torque wrench, dial indicator, seal driver, bluing, adhesive sealant, snap ring pliers for internal and external rings.

GENERAL INSTRUCTIONS

Housings - Clean external surfaces of reducer before removing seal cages and end covers to prevent dirt from falling into the unit. Record mounting dimensions of accessories for reference when reassembling. If it is necessary to remove the reducer from its operating area, disconnect all connected equipment and lift reducer from its foundation.

Seals - Replacement of all seals is recommended when a unit is disassembled. However, if seals are not to be replaced, protect seal life by wrapping shaft with thin, strong paper coated with oil or grease before removing or replacing seal cage assembly. Clean the shaft but do not use any abrasive material on the shaft surface polished by the seal.

▲WARNING If the reducer is painted, extreme care should be taken to mask the shaft extensions and rubber surface of the seals. Paint on the shaft adjacent to the seal or on the seal lip will cause oil leakage.

TO CHANGE OUTPUT SHAFT DIRECTION

To change the hand of a unit from left hand to right hand, or vice versa, the following instructions apply:

1. Remove drain plug and drain oil from unit.
2. Remove end cover and seal cage capscrews; then while supporting output shaft remove end cover and shims from the unit.
3. Remove output shaft and seal cage together from extension side.
NOTE: Keep shims with their respective seal cage and end cover.
4. Reassemble unit per instructions on Page 5, Item 3.

CAPSCREW TIGHTENING TORQUE

Table 1

Capscrew Diameter	1/4-20 UNC	5/16-18 UNC	3/8-16 UNC	1/2-13 UNC
Torque (in. lbs.) Dry	96	192	348	840

UNIT DISASSEMBLY

1. Remove drain plug and drain oil from unit.
2. Low speed shaft (gear shaft) removal:
 - A. Remove end cover and seal cage capscrews.
 - B. With a firm hold on the output extension remove end cover and shims.
 - C. Carefully slide output shaft assembly and seal cage out extension side.
 - D. Slide seal cage off low speed shaft using caution to prevent damage to seal lips.
 - E. Wire or tie the shims to their mating end cover and seal cages. They will be available for reference when assembling the unit.

▲WARNING Disconnect all power while adjusting units

3. High speed shaft (worm shaft) removal:

- For C-Flange units 3.75 C.D. through 6.00 C.D.:
 - Remove motor flange. Remove seal cage opposite motor face. Keep shims with seal cage for reassembly. Remove bearing nut and washers from end opposite motor. Using a plastic hammer, gently tap the shaft on the motor end. Push shaft assembly through housing until rear bearing outer race is free. Slide bearing inner-races off of shaft and remove worm through front of housing. If a press is available, pressing the shaft out is preferable.
- For Basic units 3.75 C.D. through 6.00 C.D.:
 - Remove front and rear seal cages. Keep shims with seal cages for reassembly. Remove bearing nut and washers from end opposite extension. Using a plastic hammer, gently tap the shaft on extension end. Push shaft assembly through housing until rear bearing outer-race is free. Slide rear bearing inner-race off shaft. Reverse direction and push shaft through extension end of housing and out. If a press is available, pressing the shaft out is preferable.

PARTS SERVICE

1. **Housing** – Clean inside of housing with kerosene or solvent and then dry.
2. **Seal cages and end cover** – Remove dirt from joint faces, wipe clean and dry.
3. **Air vent** – Wash in kerosene, blow clean and dry.
4. **Seals** – To replace seals without dismantling reducer refer to steps C through F below. To replace seals when the entire reducer is dismantled and coupling hubs, sprockets, pulleys, pinions, keys, etc. have been removed the following instructions apply:

Note: Replacement of all seals is recommended when a unit is disassembled.

▲WARNING New seals will leak if the seal lips are damaged or if seal's rubbing surface on the shaft has been altered. Protect seal lips at all times. Clean the shaft but do not use any abrasive material on the shaft surface polished by the seal.

- A. Block up seal cages and press or drive out seal.
- B. Remove old sealing compound from seal seat in cage if it is present. If a seal with rubber coating on the outside diameter is used, no sealant is necessary. If no rubber coating is on seal outside diameter, coat seal cage bore with adhesive sealant immediately before assembly.

To prevent possible damage to seal lips, do not reassemble seals until high speed and low speed shafts have been reassembled to the housing. Then see steps E and F below.

- C. See Figures 1 through 4 – To replace seals without dismantling reducer, proceed as follows:

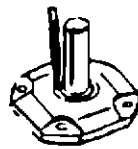
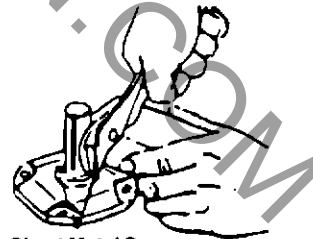


Figure 1



Sheet Metal Screws

Figure 2

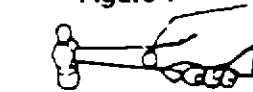


Figure 3

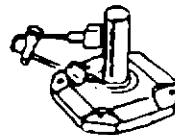


Figure 4

▲WARNING Disconnect all power while adjusting units

▲WARNING Do not damage shaft; new seals will leak if seal contacting surface is marred. Use punch and place two or more holes in steel casing of seal, Figure 1. (The steel casing may be rubber coated) Insert sheet metal screws, leaving the heads sufficiently exposed so they can be pried up or grasped with pliers, Figure 2. Do not drill holes because chips may get into the unit.

D. Work seal loose. Be careful to keep all metal or dirt particles from entering unit. Remove old sealing compound from seal seat if it is present. Also remove burrs and sharp edges from shaft. Clean with rag moistened with solvent.

Do not use abrasive material on shaft seal contacting surface.

▲WARNING E. Protect seal lips when handling; seal leakage will result if these are damaged. If a seal with rubber coating on the outside diameter (O.D.) is used, no sealant is necessary. If no rubber coating is on seal O.D., coat seal cage bore with adhesive sealant. Coat seal lips with oil and carefully work seal into position. Before sliding seal into position, protect seal lips from shaft keyway edges by wrapping shaft with thin, strong paper coated with oil. Position garter spring toward the inside of the unit. Place a square face pipe or tube against the seal O.D. and drive or press seal until fully seated as shown in Figure 3. Do not strike seal directly.

F. For best performance, seat the seal square with shaft within .005" at 180°. Check with dial indicator as shown in Figure 4, Page 3, or with a straight edge and feelers; or square and feelers. To straighten a cocked seal, place tubing over the seal and tap the tube lightly at a point diametrically opposite the low point on the seal. Do Not strike seal directly.

5. Bearings –

A. Wash all bearings according to bearing manufacturing recommendations and then dry.

B. Inspect bearings carefully and replace those that are worn or questionable.

Note: Replacement of all bearings is recommended.

C. Use a wheel puller or press to remove worm shaft bearings. Apply force to inner race only – not to cage or outer race.

D. Use a wheel puller or press to remove tapered bearing inner races.

E. To replace tapered bearing inner races and all ball bearings, heat bearings in an oil bath or oven to maximum of 290° F (143° C). Slide high speed shaft bearings onto the oiled shaft until seated against the shoulder or snap ring of the shaft. Slide low speed shaft bearing onto the oiled shaft against the gear spacer.

F. Thoroughly coat all bearings with lubrication oil.

6. Worm, gear and shaft –

A. Worm and high speed shaft – since all worms are integral with the high speed shaft, any wear or damage to the worm will necessitate replacing both.

B. Press shaft out of bronze worm gear. To reassemble gear and low speed shaft, freeze shaft or heat gear. Do not exceed 200° F (93° C). Insert key into the shaft keyway and press shaft into oiled gear bore.

Note: It is advisable to replace both the worm and worm gear should either of the assemblies require replacement.

UNIT REASSEMBLY

1. Preliminary

A. Check to see that all worn parts have been replaced, gear and bearings coated with oil and all parts cleaned. Remove all foreign matter from unit feet. The feet must be flat and square with each other.

B. Before starting to reassemble reducer, clean old shims or replace with new shims of equal thickness.

▲WARNING Disconnect all power while adjusting units

- For C-Flange units 3.75 C.D. through 6.00 C.D.:
 - Apply adhesive sealant to both housing input faces. Subassemble the two bearing inner-races onto rear of worm shaft and secure with locknut and washers. Insert shaft assembly into rear bore of housing along with the first bearing outer-race. With plastic hammer gently tap end of shaft until bearing outer-race is seated against shoulder in housing bore. If a press is available, pressing the assemble in is preferable. Press the final bearing outer-race in and install the rear seal cage. Adjust endplay per instructions on Page 5, Item 3. Install motor flange.
- For Basic units with C.D. of 3.75 through 6.00:
 - Apply adhesive sealant to both housing input faces. Press extension side bearing inner-race onto worm. Insert worm shaft into extension side bore of housing. Hold worm shaft in place and slip rear bearing inner-race onto shaft until seated against shoulder. Press rear bearing outer-race into housing bore opposite extension until seal cage can be installed. Install rear seal cage. Press extension side bearing outer-race into housing until extension side seal cage can be installed. Install seal cage. Adjust endplay per instructions on Page 5, Item 3.

3. Low Speed Shaft (Gear Shaft) Assembly

- Determine output shaft direction.
- Assemble low speed shaft assembly, seal cage, and end cover with shims on both seal cage and end cover. Torque capscrews to torques listed in Table 1. Rotate the input shaft to seat output bearings.
- Moving the shaft back and forth by hand, check axial float with dial indicator as shown in Figure 5. Axial float must be .0005 - .003" with .0005 being the absolute minimum. Do not preload bearings. If the axial float is not as specified, add or subtract required shims under end cover.

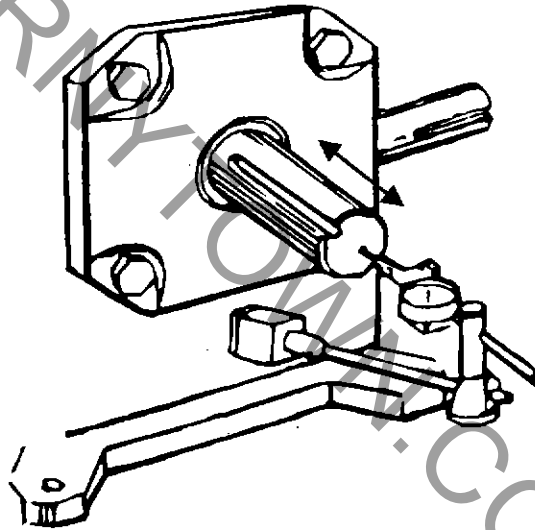
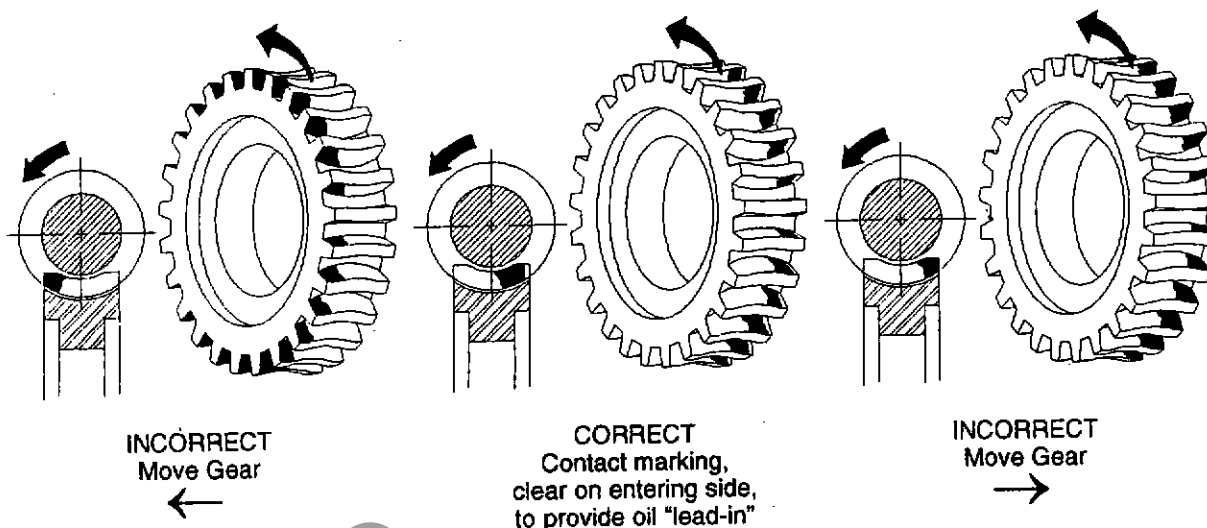


Figure 5 Checking Axial Float

- Remove output shaft with seal cage and apply bluing to several teeth on the gear. Worm thread and gear teeth must be clean of oil. Reassemble output shaft and seal cage with output key facing up.
- Use a rag to apply hand pressure to the output shaft and rotate the high speed shaft both directions until the gear teeth with bluing have gone through gear mesh several times. Return output shaft to original position. Remove output shaft and seal cage to inspect contact. Compare with Figure 6. If contact is not correct, move assembly in the direction shown in Figure 6 by adding shims to the side to which the arrow points after removing them from the opposite side. Repeat Steps D a E until contact pattern is correct.
- Recheck axial float with dial indicator.
- When contact pattern is correct, tighten seal cage and end cover capscrews to torques listed in Table 1.

▲WARNING Disconnect all power while adjusting units

Figure 6 Gear Contact Pattern



4. **Seals** - To reassemble seals to unit, see Parts Service Steps 4E and 4F, Page 4.

5. **Motorized Coupling Adapter**
 Certain mounting dimensions should be adhered to when removing motor and coupling assembly for service. When ordering replacement coupling halves (metal gear), specify correct bore diameter. See Table 2 for mounting dimensions.

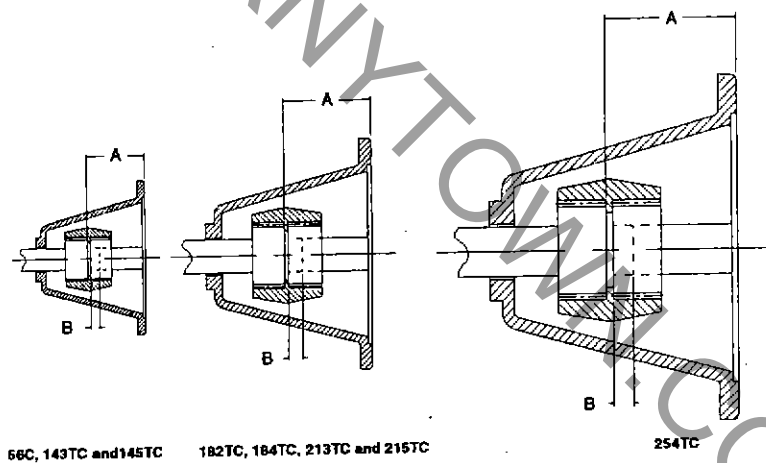


Figure 7 Motorized Coupling Adapter
 C.D. 3.75 through 6.00

COUPLING ADAPTER DATA

Table 2

CENTER DISTANCE	56C		140TC		180TC		210TC		254TC	
	A	B	A	B	A	B	A	B	A	B
3.75	2.58	.38	2.69	.42	3.66	.66	3.91	.41	-	-
4.50	-	-	2.41	.15	3.40	.40	3.65	.15	-	-
5.16	-	-	-	-	3.25	.25	3.50	.0	-	-
6.00	-	-	-	-	4.33	.70	4.58	.45	5.03	.28

▲WARNING Disconnect all power while adjusting units

6. Final Inspection

- A. Turn gear train over by hand as a final check.
- B. Re-install reducer and accessories.

▲WARNING Discard motor key. Use only special key provided with reducer. Failure to use special key will make assembly impossible.

- C. Fill reducer with the recommended oil to proper level. See Figure 8 for standard oil levels.
- D. Spin test for three minutes and check for noise, leakage and rapid temperature rise.

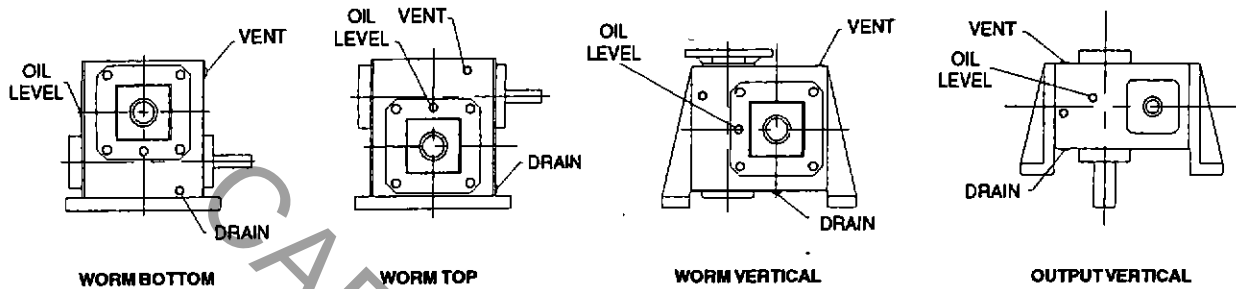


Figure 8 Standard Oil Levels

PREVENTATIVE MAINTENANCE

1. After first week, check all external capscrews and plugs for tightness.
2. Periodically, check oil level when gears are at rest. Add oil if needed. Do not fill above mark indicated by level because leakage and overheating may occur.

STORED AND INACTIVE UNITS

1. All units are shipped with oil that will protect parts against rust for a period of four (4) months in an outdoor shelter or twelve (12) months in a dry building after shipment from the factory. Indoor dry storage is recommended.
2. If a unit is to be stored or is to be inactive after installation beyond the above periods, fill the unit completely with oil.

▲WARNING Before starting a stored unit or re-starting an inactive unit, the oil level should be returned to the proper value as indicated by the oil level.

▲WARNING Disconnect all power while adjusting units

LUBRICATION

Normal operating temperature of a worm gear reducer is less than 200°F but during initial break-in the temperature may exceed 200°F. After break-in is completed the temperature will fall below 200°F. If temperature exceeds 200°F for greater than 100 hours consult the factory.

1. Reducer shipped filled with oil for worm top operation.
2. Change initial oil fill after 500 hours service or 5 weeks.
3. Change oil every 2500 hours service or 6 months. If severe operating conditions exist, change the oil every 1 to 3 months.
4. **90 weight oil and EP oil are not recommended.**
5. For ambient temperatures -40° F to 15° F use Mobil SHC634.
6. Units running at slow speeds (less than 100 RPM input) should carry high oil level and in ambient temperatures of 15° to 125° F use an AGMA #8C lubricant.
7. See Table 3 for list of recommended lubrication manufacturers.

Lubrication Manufacturers

The companies and oil shown are typical. Any other make of oil meeting American Gear Manufacturers Association (AGMA) standards #7C and #8C will be satisfactory.

Table 3

Ambient Temperature	15 to 60° F	50 to 125° F
Viscosity Range cSt at 40°C	414 - 506	612 - 748
ISO Grade	460	680
SAE Gear Lubricant (approx.)	#140	#250
Oil Company Name	AGMA #7C	AGMA #8C
Amoco Oil Co.	Amoco Worm Gear Oil	Amoco Cyl. Oil 680
Atlantic Richfield (ARCO)		Modoc 175
Chevron Oil Co.	Cylinder Oil 460X	Cylinder Oil 680X
Conoco Oil Co.	Inca Oil	
Exxon Oil Co.	Cylasstic TK460	Cylasstic TK680
Fiske Brothers	SPO 277	SPO288
Gulf Oil Co.	Senate 460	Senate 680
Gulf-Canada	Senate 460	Senate 680
Keystone-Penwalt	Keygear K-600	
Mobile Oil Corp.	Mobil 600W Super Cyl. Oil	Mobil Extra Hecla Super Cyl. Oil
Pennzoil	Cyl. Oil #8	Cyl. Oil No. 6
Phillips Petroleum Co.	Hector 460S	Hector 630S
Shell Oil Co.	Valvata Oil J460	Valvata Oil J680
Sohio	Energol DC-600C	Energol DC-600C
Texaco Inc.	Vanguard 460	Honor 680
Union Oil Co. of CA	Steaval B110	Steaval B165

Table 4

OIL CAPACITY (OZ.)					
CENTER DISTANCE	HOLLOW OPT. STYLE WORM TOP	ALL OTHER * WORM TOP ASSEMBLIES	WORM BOTTOM	WORM VERTICAL	OUTPUT VERTICAL
3.75	100	138	115	140	100
4.50	148	205	180	182	157
5.16	283	324	216	240	198
6.00	421	512	366	400	274

* Standard factory oil fill.



WARNING Disconnect all power while adjusting units

