MAN-CO MFG., INC.

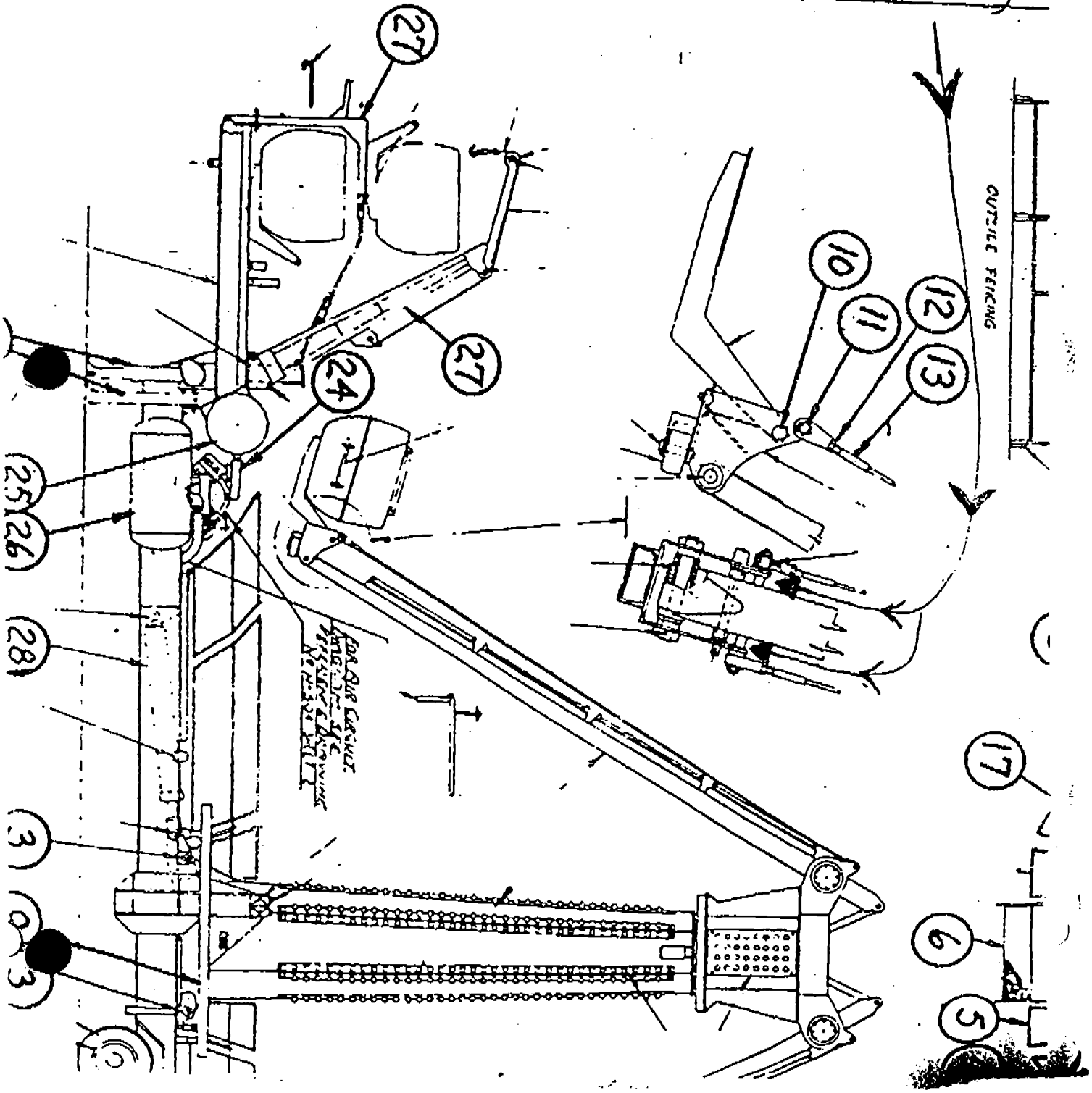
2725 19th Street S.E. • P.O. Box 13114 • Salem, Oregon 97309 U.S.A.
Office (503) 362-2341 • FAX (503) 362-2536

MFG: MANCO PRODUCTS, INC.
NAME: HURRICANE
TYPE: NON-KIDDIE

DAILY INSPECTION CHECKLIST - HURRICANE

1. Check blocking, outriggers and landing gears
2. Check leveling
3. Inspect steps, handrails, and safety gates
4. Inspect fence and fence jacks
5. Check snap keys on a.) tower pins; b.) platform fence and posts; c.) car locking pins; d.) car track pins; and e.) cable anchor pins
6. Inspect lap bar and check operation
7. Check for water condensation in air tanks
8. Check operation and level of oiler on main air line
9. Inspect all electrical connections and plugs
10. Check oil level in compressor
11. Inspect compressor drive belts and guards
12. Check operation of air regulators and pressure gauges
13. Check operation of compressor unloading valve
14. Inspect air hoses and hydraulic hoses for leaks
15. Check level of hydraulic oil tank
16. Operate Hurricane through one complete ride cycle of proper functioning. Ride should run at 15 RPM maximum

RECENTLY AN OHIO RIDE CO. DURRING RECONDITIONING
A 1973 MODEL HURRICANE RIDE FOUND THE CABLE
CHOR PIN TO BE CRACKED ON ALL SWEEPS. THE
RACKS OCCURED ON THE INSIDE OF THE ASSEMBLY
HERE THE PIN IS TACK WELDED TO THE FRAME. (SEE ARROW)



HURRICANE

OPERATION
&
MAINTENANCE
MANUAL

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INTRODUCTION

This manual is intended to be used as a general guide for the operation and maintenance of your ride. Man-Co Manufacturing, Inc. is constantly striving to improve performance, efficiency and safety; therefore, certain improvements may not be reflected in the text of the manual. Any major revisions or additions to the manual will be sent to you free of charge. Specially engineered features purchased for individual rides may not be incorporated in the manual.

MANUFACTURER'S LIMITED WARRANTY

Man-Co Manufacturing, Inc. warrants that purchased property is free from all defects in material and workmanship at the date of delivery and for 90 days thereafter. Man-Co Manufacturing, Inc. does not warrant that purchased property will meet or exceed federal, state and local design criteria or electrical codes. Man-Co Manufacturing, Inc.'s liability is hereby limited to the repair or replacement of any equipment, accessory or part which is defective due to material failure or workmanship. The cost of returning defective parts to Man-Co Manufacturing, Inc. and the cost of transportation of repaired or replaced parts to Purchaser shall be born by Purchaser. Man-Co Manufacturing, Inc. shall not be liable for down-time or loss of operating revenue or any other commercial consequential damages. Losses resulting from improper maintenance or failure to observe Man-Co Manufacturing, Inc.'s operating instructions are expressly excluded from this warranty. Purchaser hereby acknowledges receipt of current operating, maintenance and erection instructions, a copy of which is attached to this agreement and made a part hereof.

It is expressly understood between Man-Co Manufacturing, Inc. and Purchaser that all warranty is void and Man-Co Manufacturing, Inc. disclaims any and all liability or responsibility for failure, loss or damage if device is assembled, maintained or operated other than as recommended in the Manual provided with each device or is loaded or operated in excess of the operator's operating criteria set out in the appropriate manual.

THIS WARRANTY, AND THE OBLIGATIONS AND LIABILITIES OF MAN-CO MANUFACTURING, INC. HEREUNDER ARE IN LIEU OF ALL OTHER WARRANTIES, GUARANTEES, CONDITIONS OR LIABILITIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND SHALL NOT BE EXTENDED, ALTERED OR VARIED EXCEPT BY WRITTEN INSTRUMENT SIGNED BY MAN-CO MANUFACTURING, INC. AND PURCHASER.

TABLE OF CONTENTS

NOTE: The ticket booth is now optional equipment. The Hurricane cars pictured in this manual are old style Frank Hrubetz cars. Newer style cars are now used on all new rides built, but are assembled as per instructions in this manual.

GENERAL DESCRIPTION OF THE HURRICANE

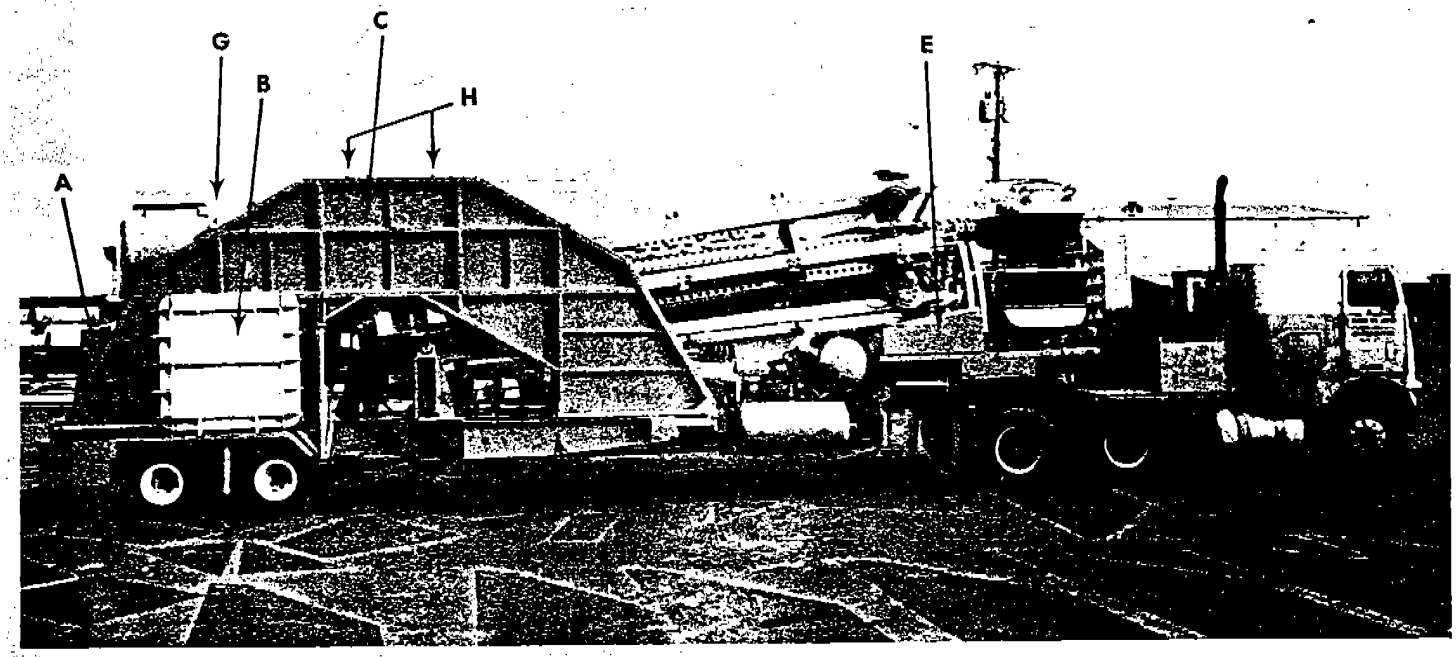


Fig. 1

a. Control Stand
b. Ticket Booth Top (Optional)
c. Main Platform
d. Trailer Stabilizer and Front Outrigger
e. Small Platform Fence Sections
f. Gooseneck
g. Spreader Bar
h. Turnbuckles

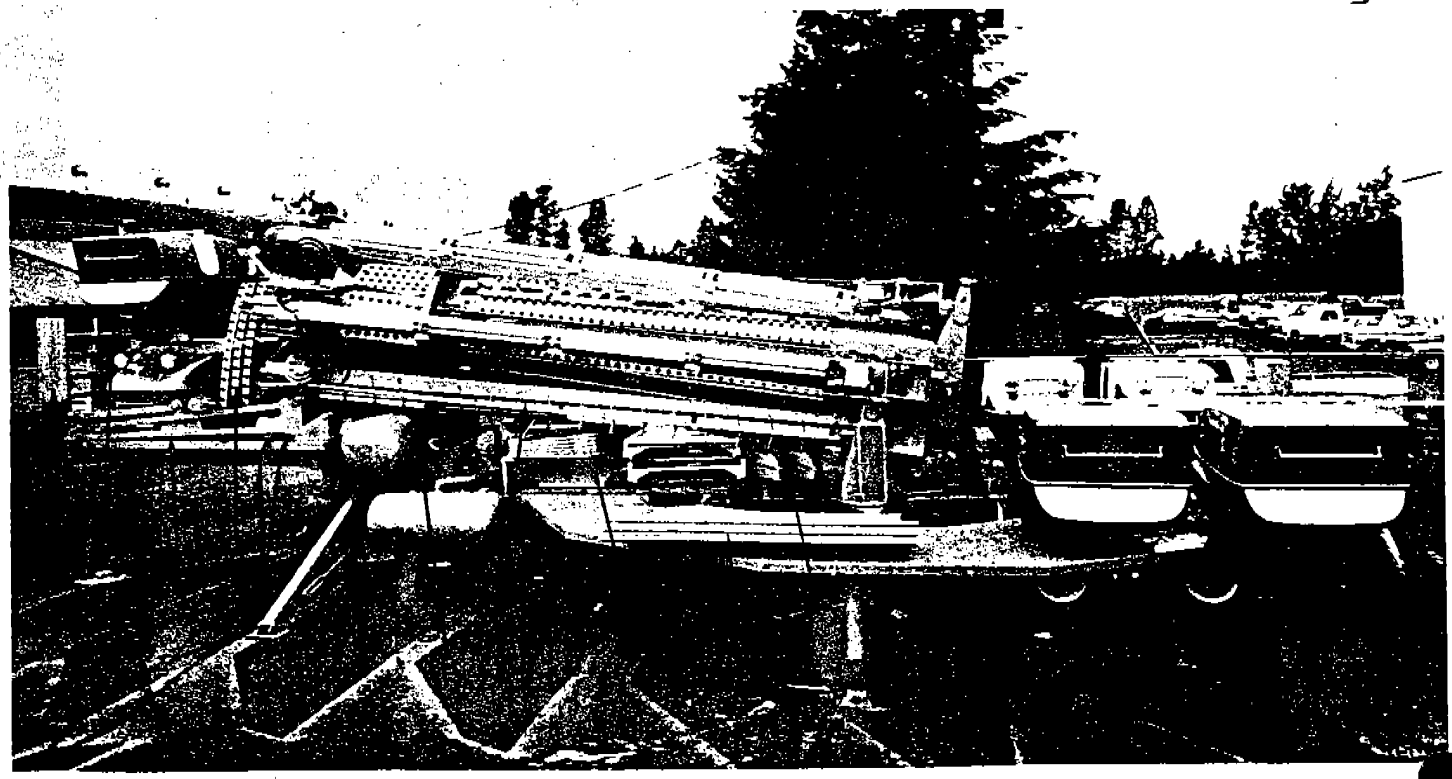


Fig. 2

a. Outside Fence Sections
b. Car Rack
c. Jib Crane
d. Petal Lights
e. Air Tanks and Compressor
f. Steps, Handrails, Ticket Booth Bottom
g. Track
h. Large Platform Fence Sections
i. Aluminum Service Ladder

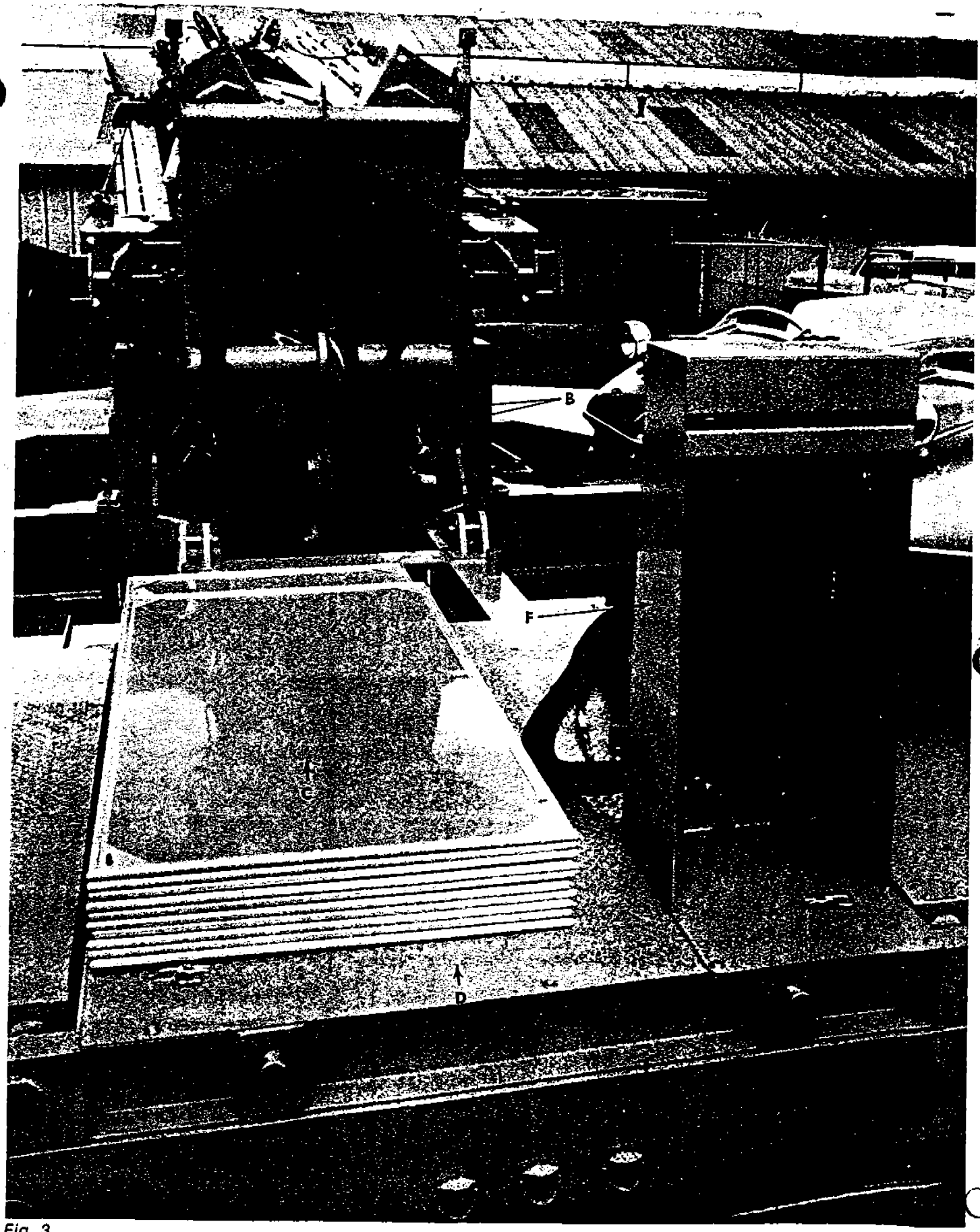


Fig. 3

a. Tower Interior
b. Arm Locks and Cranks
c. Ballys
d. Rear Trailer Deck Lid (Location of Inside Hydraulic Compartment)
e. Control Center
f. Control Stand

SPECIFICATIONS

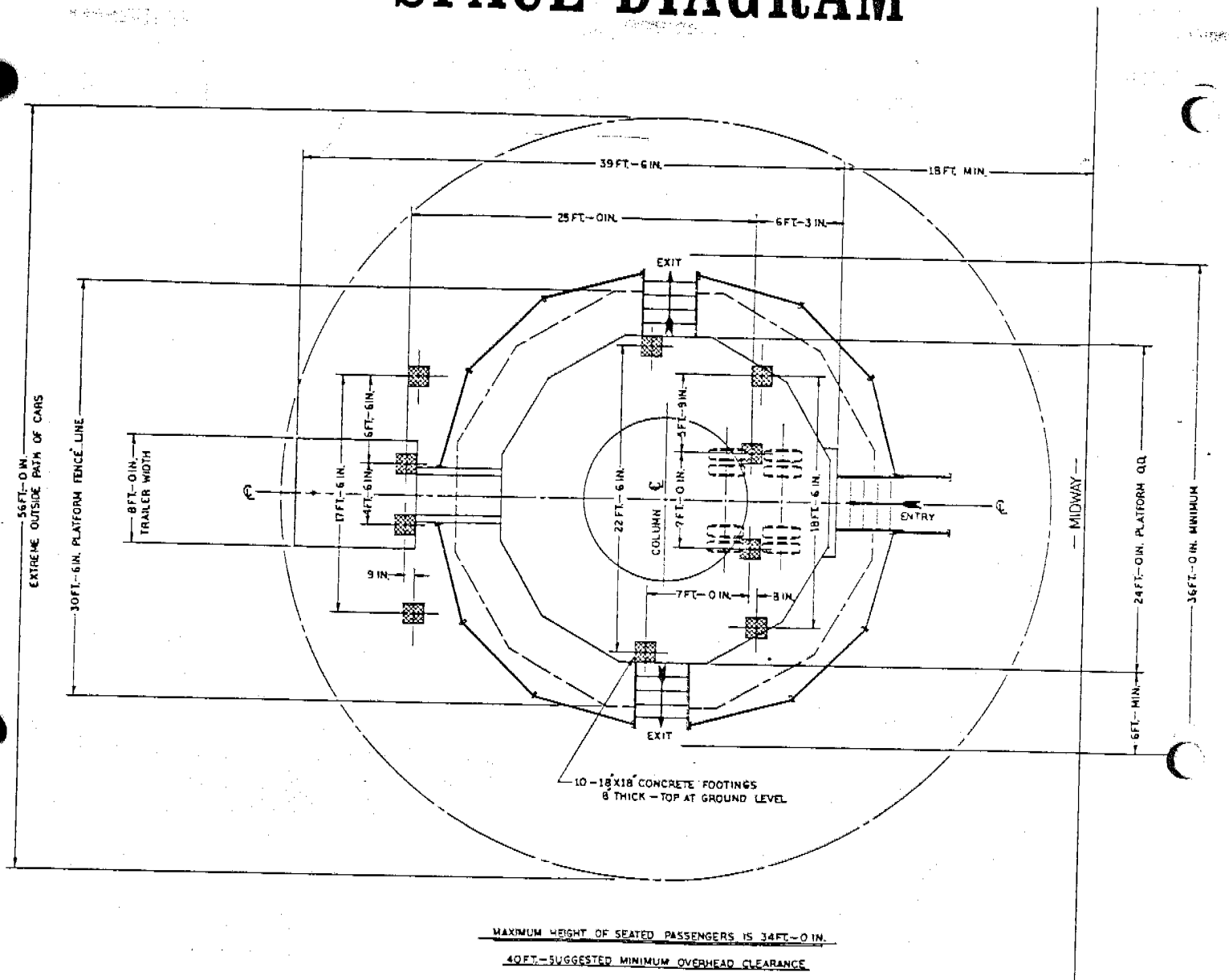
CAPACITY	500-600 customers per hour
SEATING	Six four-passenger cars
LIGHTING	678 - 11 watt incandescent lamps 48 - 40 watt fluorescent lamps
TOTAL POWER AND LIGHT REQUIRED	40 KW
POWERED BY	One 25 HP and one 15 HP motor
MAXIMUM HEIGHT (seated passenger)	34 feet
MINIMUM OVERHEAD CLEARANCE	40 feet suggested
SPACE REQUIRED	36 foot front and 56 foot back
GROSS WEIGHT	40,000 pounds
TRAILER LENGTH	40 feet

POWER SUPPLY REQUIREMENTS

1. The maximum power needed for the Hurricane is 40 KW.
2. The Hurricane requires 220 volt 3 phase *with ground.*

CAUTION: Failure to supply an adequate ground to the frame can cause serious electric shock hazard. Proper grounding prevents the metal parts of the Hurricane from being energized (to high voltage) in the event of a short circuit. The leads supplied with the Hurricane contain a ground wire that may be connected to ground at the power supply. Another means of grounding is with a ground rod. Check local regulations for ground rod requirements and specifications.

SPACE DIAGRAM



MINIMUM SPACE NEEDED FOR SAFE OPERATION OF THE HURRICANE

The Hurricane must have a clearance of at least 56 feet in diameter and 40 feet for overhead clearance. The passengers must not be able to reach out and touch trees, buildings, light or telephone poles, signs or power lines at any point during the operation of the ride.

HURRICANE SET-UP

1. PREPARE HURRICANE FOR SET-UP

a. Set the ride in an area 60 feet X 60 feet minimum.

b. Align the center of the trailer with center line of the space.

c. Position the back of the trailer 18 feet from the midway. (Refer to Space Diagram)

2. UNLOAD MISCELLANEOUS ITEMS

a. Unload the items inside the tower:

Cranks	Ticket booth seat
Rear landing gear shoes	Money box
Ticket booth shelf	Tool box
Service ladder base	Ticket booth sign

b. Store the ticket booth sign, ticket booth shelf, seat and money box in the area where you plan to assemble the ticket booth.

3. LEVEL THE FRAME

a. Install the rear landing gear shoes and the cranks on the landing gears.

b. Support the ride on the front and rear landing gears, making sure that some of the weight is off the tires.

c. Utilizing the four landing gears, level the frame fore and aft (Fig. 4), and at the tower pivot shaft. (Fig. 5)

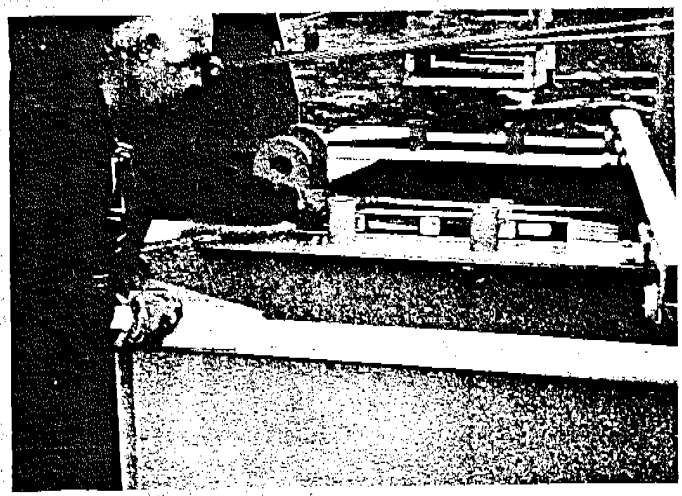


Fig. 4

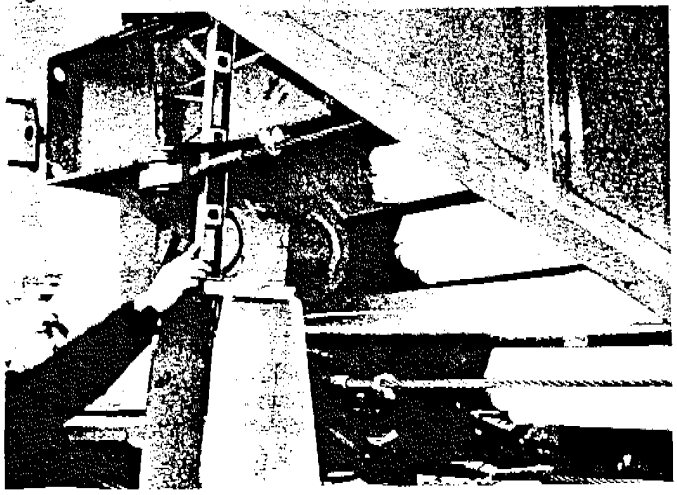


Fig. 5

4. TICKET BOOTH

a. Remove the ticket booth from the fenders and set it in the spot where you plan to assemble the ticket booth.

b. The top stores on the right fender (Fig. 6), and the sides store on the left fender. (Fig. 7)

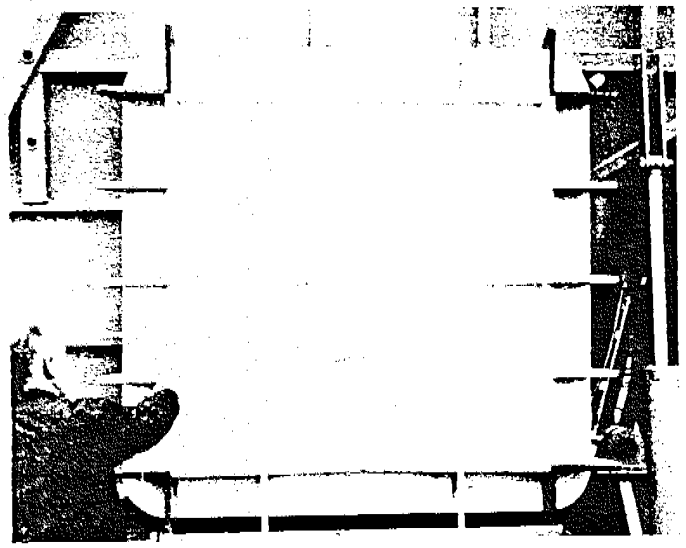


Fig. 6

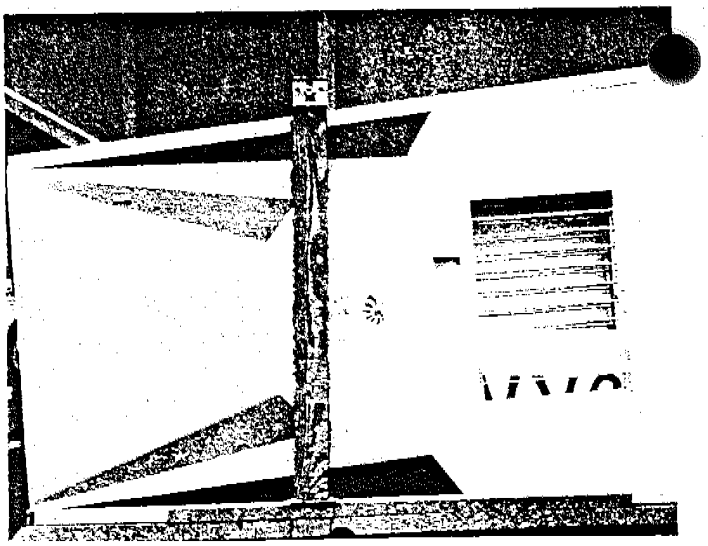


Fig. 7

5. TRAILER STABILIZERS

a. Unlock the trailer stabilizers from storage position. (Refer to Fig. 1-d)

b. Swing the trailer stabilizers out. (Fig. 8) PIN IN PLACE. (Fig. 9)

c. Fold the landing assemblies down into position. PIN IN PLACE. (Fig. 10)

d. Install a crank on the folding landing gear and crank the folding landing gear to the ground.

e. Remove the crank handle and store under the ride.

NOTE: Use the trailer stabilizers *only* to stabilize the ride.

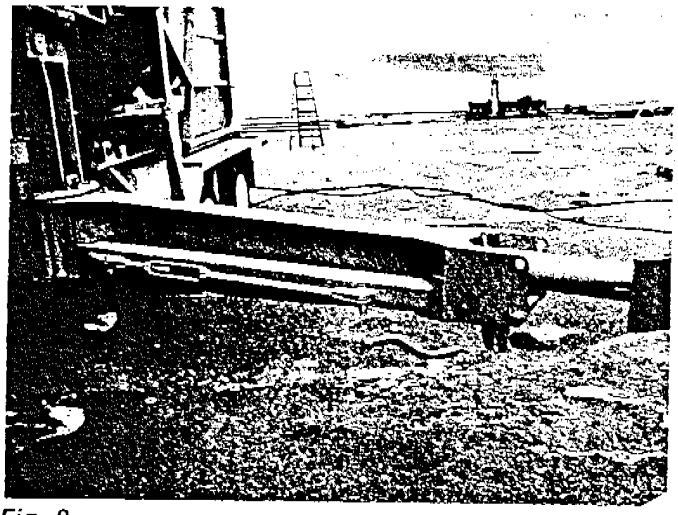


Fig. 8

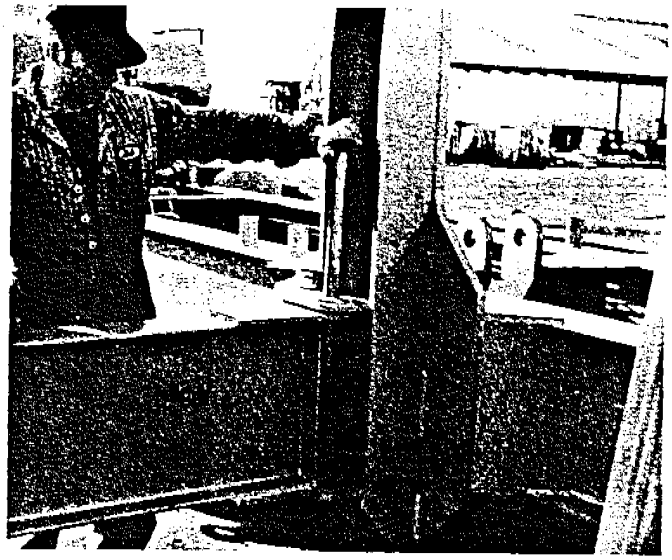


Fig. 9

Fig. 10

6. **OUTRIGGERS**

a. Remove the front outriggers from storage on the trailer stabilizers. (Refer to Fig. 1-d)

b. Install outriggers on the front of the trailer. PIN AND SNAP KEY (a) Remove the turnbuckle pin from the outrigger and swing the turnbuckle down and pin to the ear on the trailer frame (b). (Fig 11)

Fig. 11

c. Remove the rear outriggers from the side of the main trailer frame. (Fig. 12)

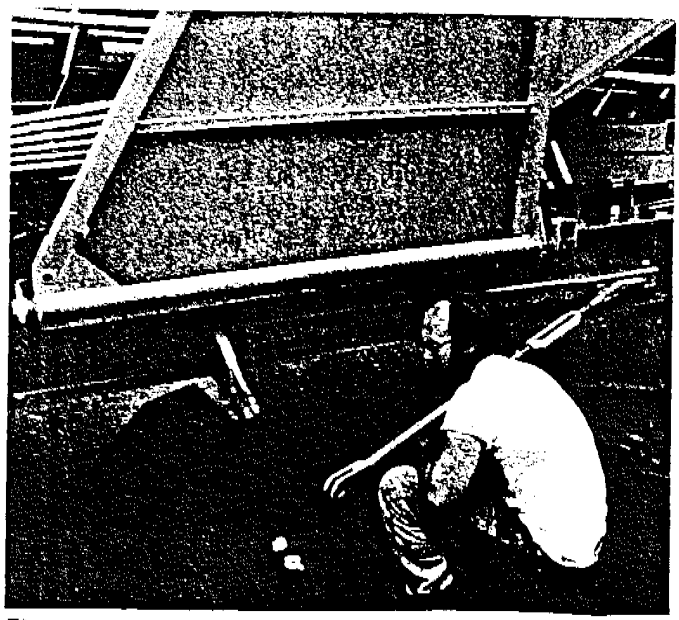


Fig. 12

d. Install the rear outriggers under the trailer fenders behind the rear landing gear. PIN AND SNAP KEY (a). Swing the turnbuckles up and pin to the ears on the trailer frame (b). (Fig. 13)

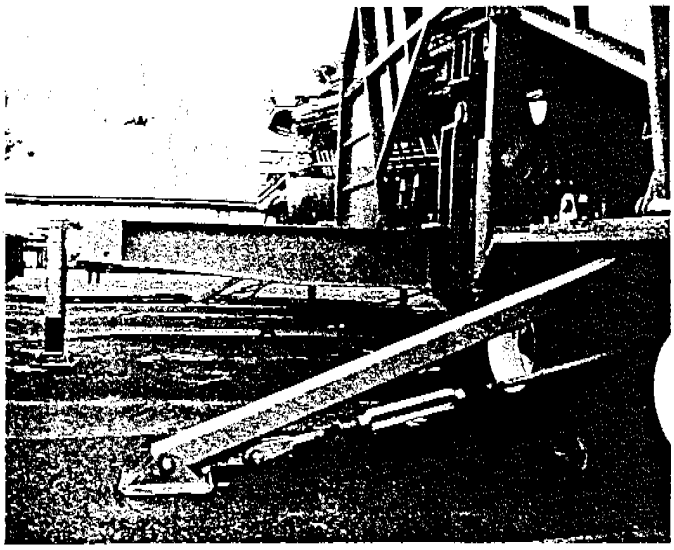


Fig. 13

7. MAIN PLATFORMS

a. Working from the upper area of the folded platforms, prepare the platforms to lower into place.

(1) Remove the turnbuckles that secure the main platforms in the folded position. (Fig. 14)

(2) Remove the spreader bar. (Fig. 15)

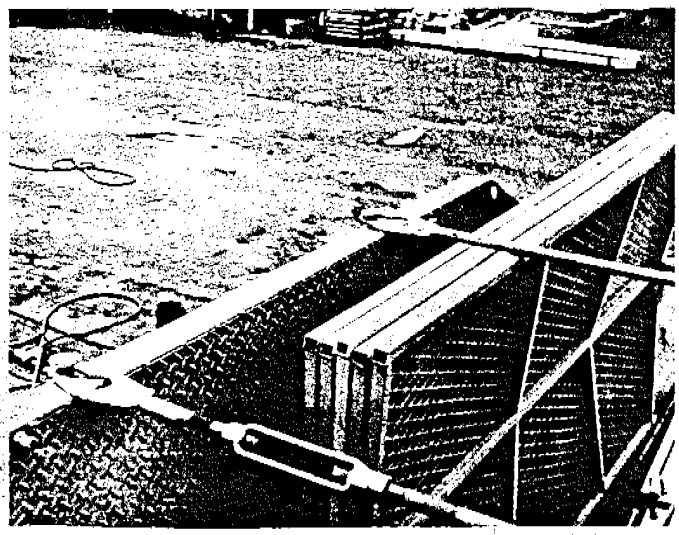


Fig. 14

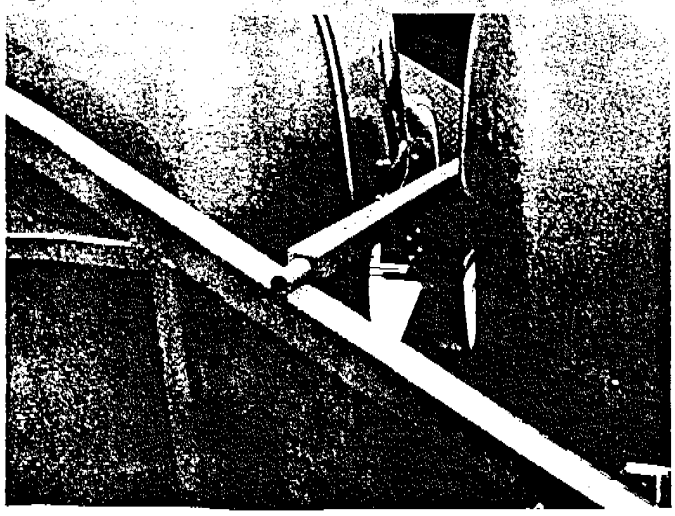


Fig. 15

(3) Store the turnbuckles and the spreader bar under the ride.

(4) Push the platforms slightly apart to start lowering them.

b. NOTE: The control center is located on rear of the trailer frame. The lever on right (a) operates the platforms and the lever on the left (b) operates the tower. (Fig 16)

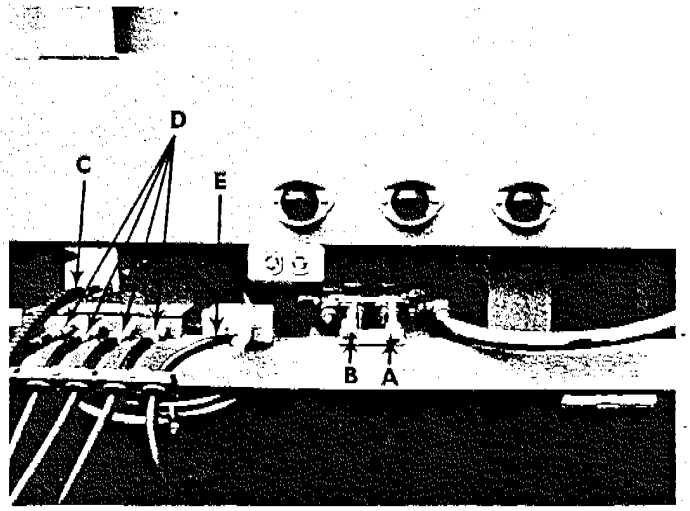


Fig. 16

c. Push down on the right lever to lower the platforms until they rest on the trailer stabilizers.

8. CONTROL STAND

a. Remove the control stand from storage on the rear of the trailer deck. (Refer to Fig. 3-f)

b. Connect the control cable (c), air hoses (d) and power cord (e) to the control center. (Refer to Fig. 16)

e. CAUTION: Be sure all air hoses are tightly plugged in.

9. ALUMINUM SERVICE LADDER

a. Remove the aluminum service ladder from storage on the side of the tower. (Refer to Fig. 2-i)

b. SPECIAL MAINTENANCE NOTE: The service ladder is used to work on the top of the tower once the ride is in operating position. *If the ride is up for more than 10 days, the fittings at the top of the tower must be greased.*

To set up service ladder for maintenance use:

(1) Slip the ladder base on the bottom of the center pole. Insert a pin through the holes in the base and the pole. (Fig. 17)

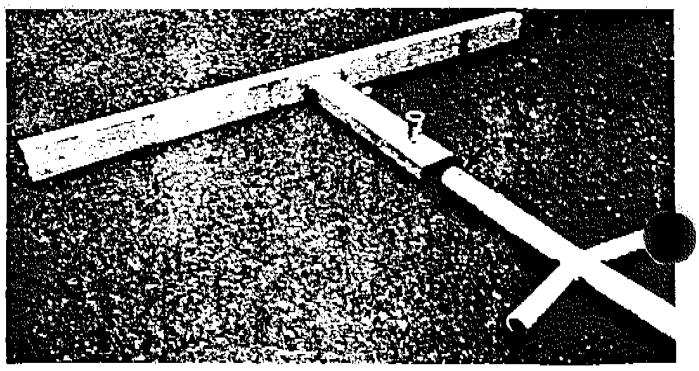


Fig. 17

(2) Hook the top of the ladder over the ears at the top of the tower. (Fig. 18)

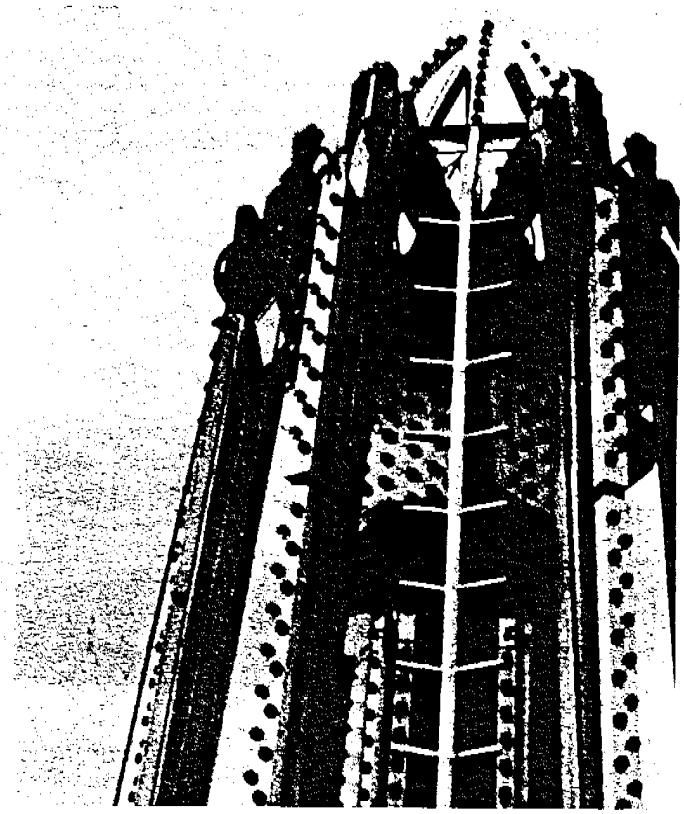


Fig. 18

10. **BALLYS**
    a. Remove the ballys from the loading rack at the rear of the trailer. (Refer to Fig. 3-c)
    b. Install the ballys on the mounting ears around the bottom of the main platforms. SNAP KEY IN PLACE. (Fig. 19)

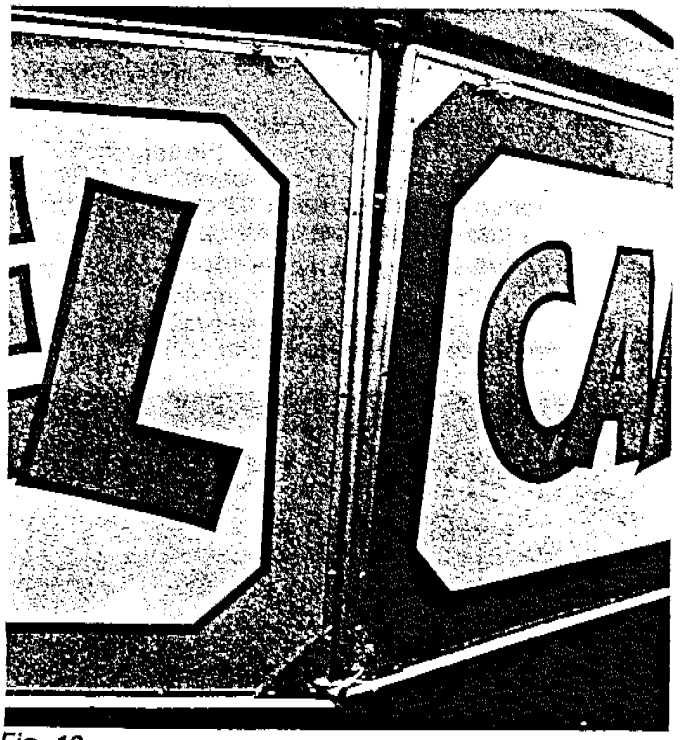


Fig. 19

    c. Tie the ballys at the bottom with the nylon cord supplied with the ride.
    d. Remove the bally storage rack from the trailer and store under the ride.

11. **CHECK THE HYDRAULIC UNIT**
    a. Remove the rear trailer deck lid and inspect the hydraulic unit. CAUTION: Be sure the drive pump is in neutral. (Fig. 20)

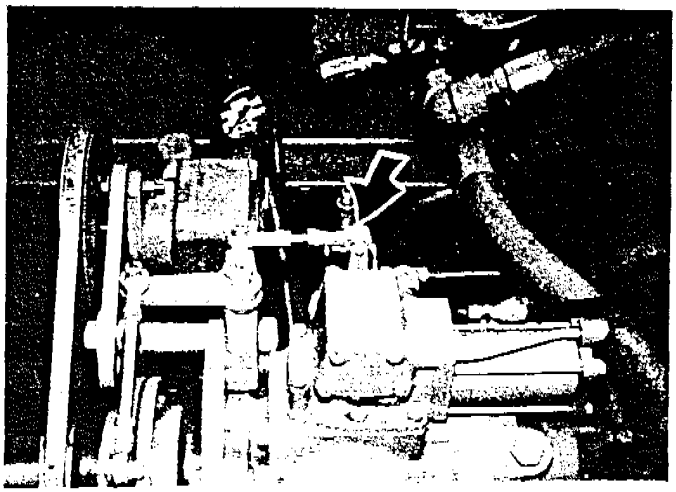


Fig. 20

    b. Connect the electrical supply and start the drive motor. CAUTION: Be sure the direction of the pump is correct. (Fig. 21)

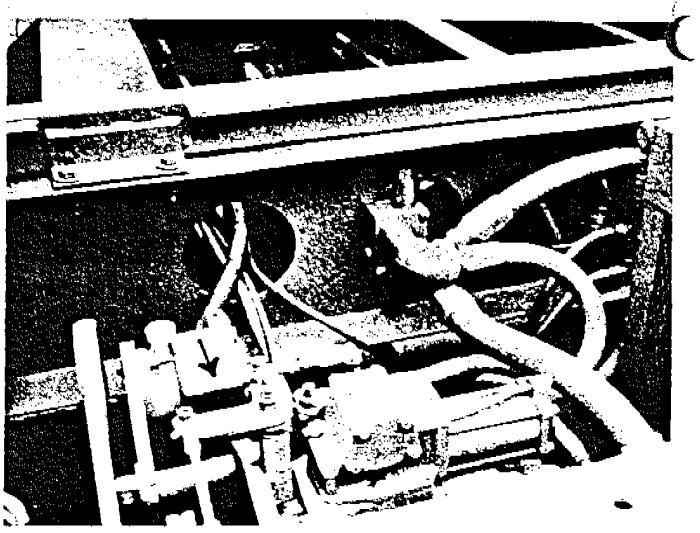


Fig. 21

12. **RAISE THE TOWER AND INSTALL THE PETAL LIGHTS**
    a. CAUTION: Remove the 3 lock pins stored in the mounting ears at base of the tower before raising the tower. (2 pins are located at the back and 1 pin is at the front of the tower.) (Refer to Figs. 24 & 25)
    b. To raise the tower, lift up on the left lever on the control center. (Refer to Fig. 16-b)
    c. Raise the tower just far enough to install the petal lights which are stored on the gooseneck. (Fig. 22)
    d. CAUTION: Be sure to tighten the petal lights in place with the set screws.

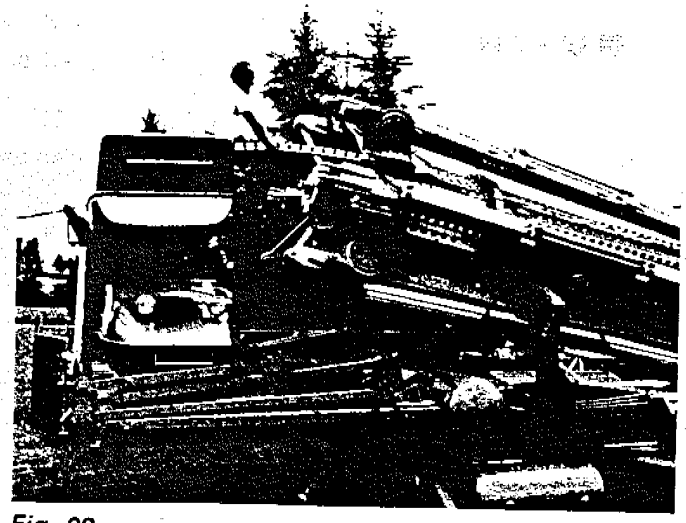


Fig. 22

e. Plug in lights.

f. Complete raising the tower.
CAUTION: Be sure the bottom crank handles, which are located on the arms at the base of the tower, are turned in a position not to hit the trailer frame as the tower is raised. (Fig. 23)

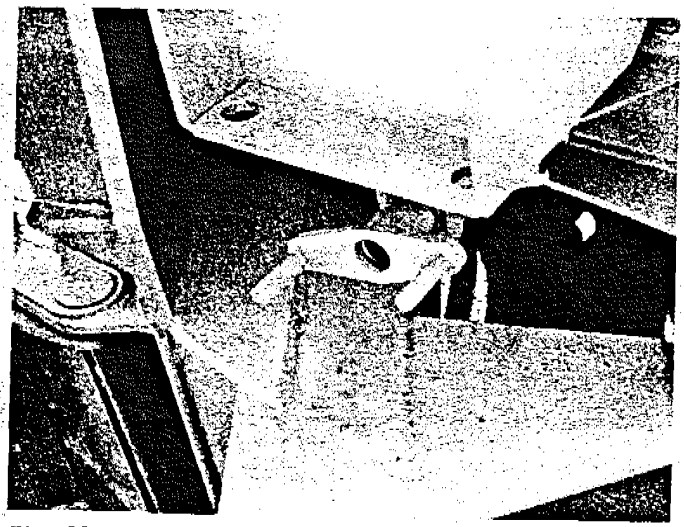


Fig. 23

g. Install the 3 lock pins to the mounting ears. KEY IN PLACE. (Figs, 24 & 25)
IMPORTANT: Be sure the area is free of obstructions before raising the tower.

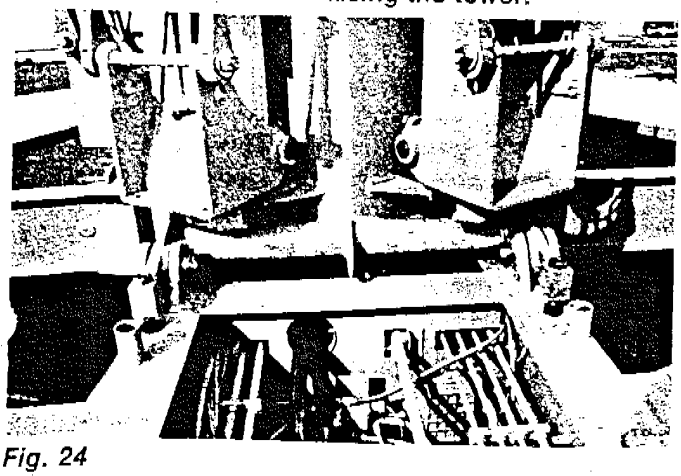


Fig. 24

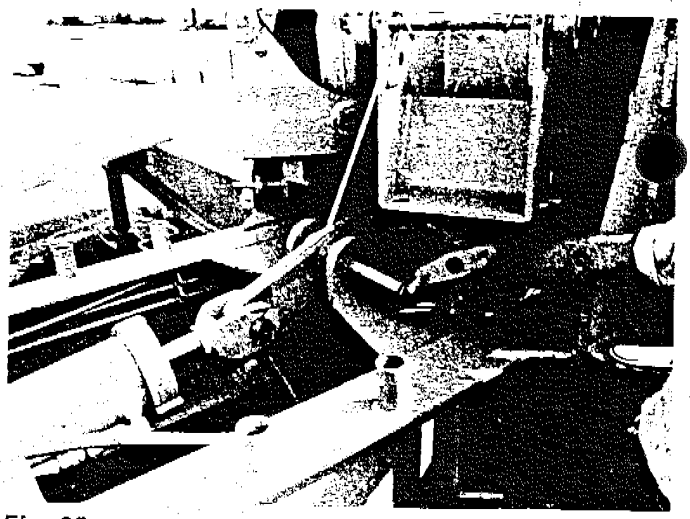


Fig. 25

13. UNLOAD TICKET BOOTH BOTTOM, HANDRAILS, HANDRAIL LOADING RACK

a. Unload ticket booth bottom (a) from storage on the steps, which are located on the trailer frame in front of the tower. (Fig. 26) Store it with the rest of the ticket booth until ready to assemble.

b. Remove the handrails and the handrail loading rack (b) from the other steps. (Fig. 26)

c. Set the handrails aside for later installation and place the loading rack under the ride.

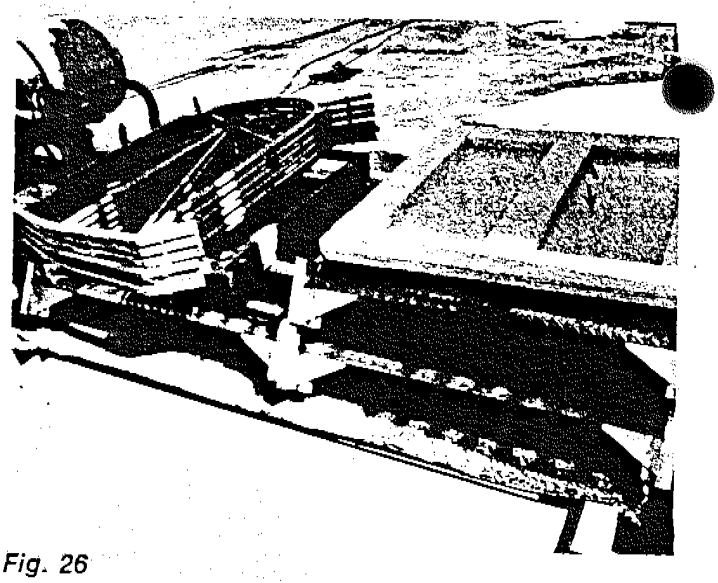


Fig. 26

14. MAIN PLATFORM FENCE

a. Remove the fence posts from their loading rack under the gooseneck.

b. Install the fence posts in the sockets around the main platform. PIN (a) AND SNAP KEY (b). (Fig. 27)

c. Unbolt the large fence sections from storage on the platforms. NOTE: There are 5 sections on the left and 4 sections on the right. (Refer to Fig. 47)

d. Install the large fence sections to the fence posts. SNAP KEY. (Fig. 28)

e. Store the mounting plates for the fence sections under the ride.

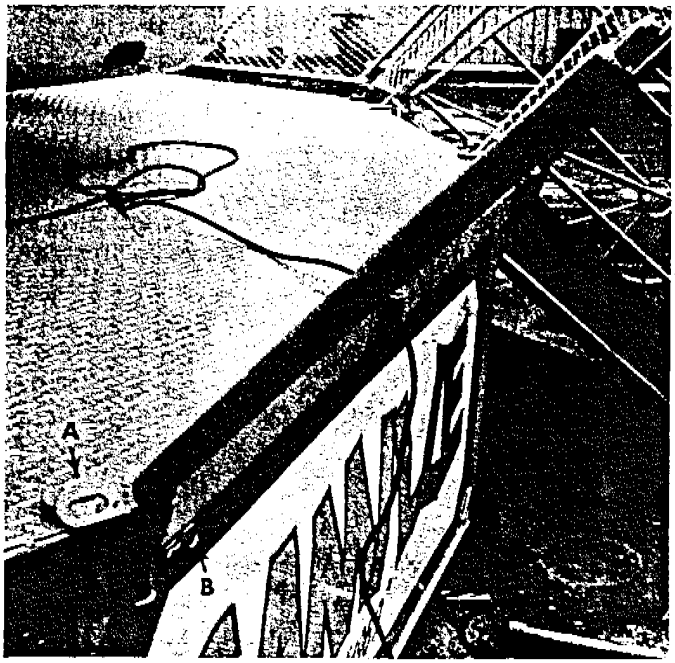


Fig. 27

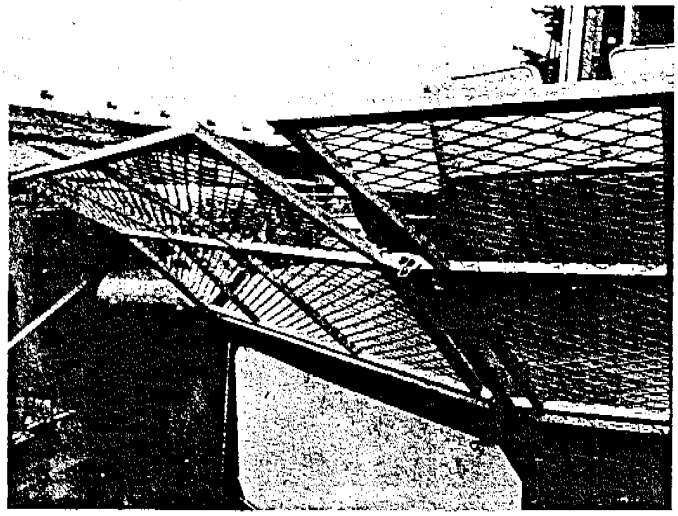


Fig. 28

f. Remove the 6 small fence sections (3 left and 3 right) from the storage box on the gooseneck. (Refer to Fig. 1-e or 48) NOTE: The 3 left sections and the 3 right sections cannot be interchanged.

g. Install the small fence sections on either side of each of the 3 platform step areas.
CAUTION: Be sure the small fence sections are snap keyed to the platform deck. (Fig. 29)

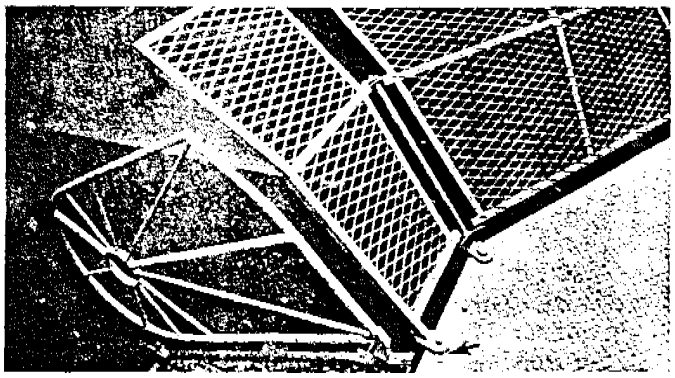


Fig. 29

15. PLATFORM STEPS, STEP FEET AND HANDRAILS

a. Unload the three sets of steps from their storage positions on the front platform.

b. Install the steps on the platform. (Fig. 30)

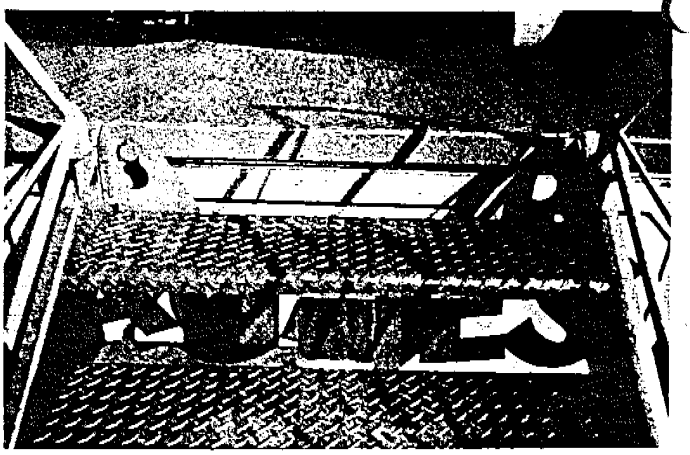


Fig. 30

c. Slide the step feet posts into the sockets at the base of the step frame. (Fig. 31)

d. Adjust the height of the bottom step by inserting pins into the holes in the step feet posts. The bottom step will rest on these pins. (Fig. 31)

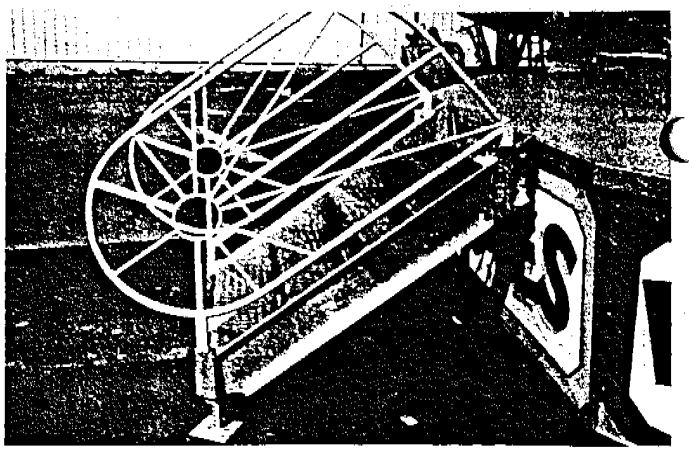


Fig. 31

e. Install the handrails by inserting the handrail legs in the sockets in the step frame.

16. OUTSIDE FENCE

a. Unload the 14 fence sections from the loading rack located at the front of the trailer. (Refer to Fig. 51)

b. Unload the fence jacks from the loading racks on each side of the main trailer frame. (Fig 32)

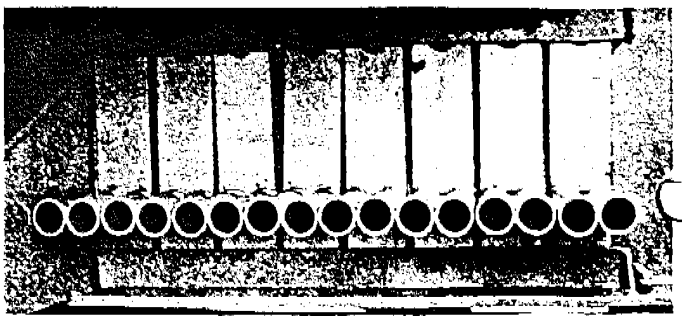


Fig. 32

c. Set up the fence according to the sketch. (Refer to Space Diagram)

17. **THE TRACK**

a. Unbolt the two inside cars on the platform and set them out of the way. (Fig. 33)

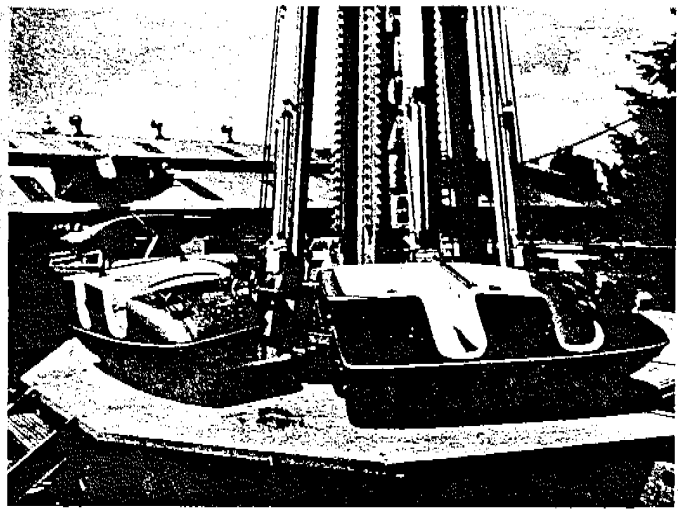


Fig. 33

b. Remove the track from the storage sockets and have them ready for installation. (Fig. 34)

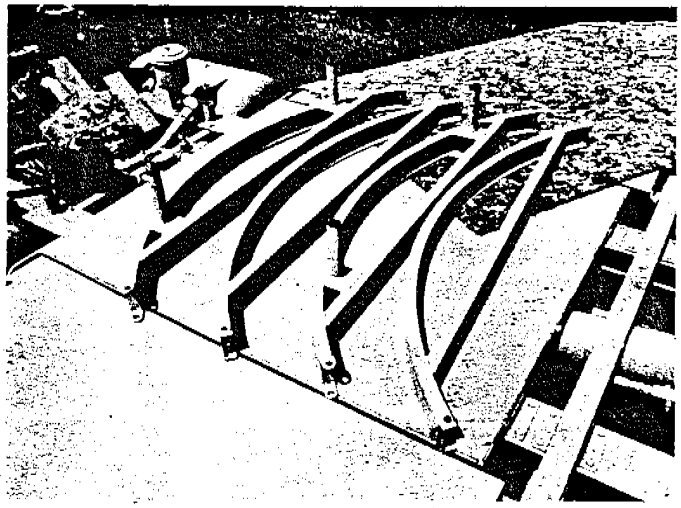


Fig. 34

c. Unlock the 4 cranks that hold the arms tightly against the tower. (Locked position - a, Unlocked position - b) (Fig. 35)

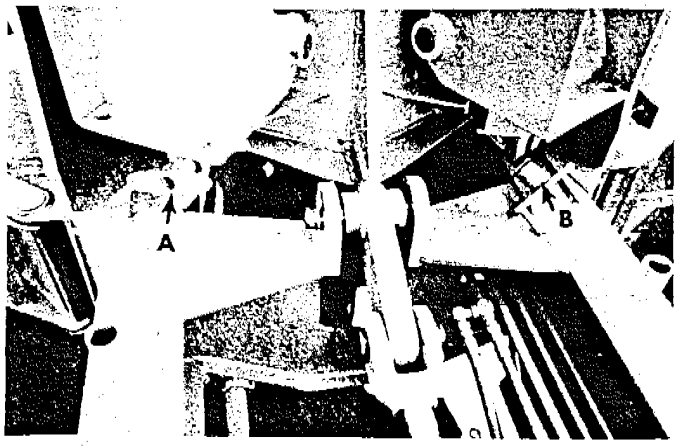


Fig. 35

d. Loosen the 4 arms with the cranks.

e. Push the arms away from the tower. (Fig. 36)

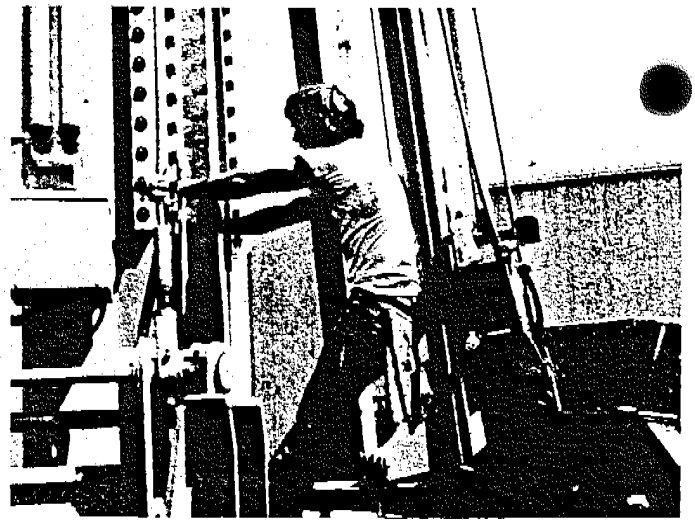


Fig. 36

f. Install the track. PIN AND KEY the track sections in place. (Fig. 37)

Fig. 37

18. **JIB CRANE AND THE TWO CARS ON THE GOOSENECK**

a. Set up the jib crane for handling the two cars stored on the gooseneck. Lock the jib crane in place with a pin. (Fig. 38)

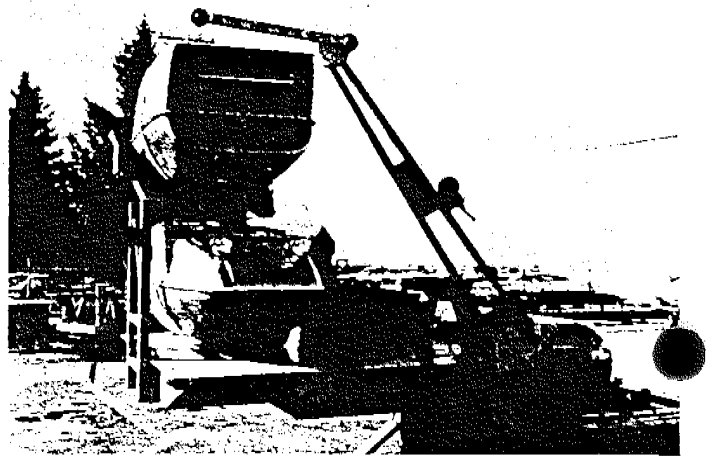


Fig. 38

b. Remove the turnbuckle from the car rack and store under the ride.
c. Wrap the nylon sling around the top car.
d. Unbolt the top car from the rack and lift it with the crane. Swing it around and lower it to the platform. (Fig. 39)

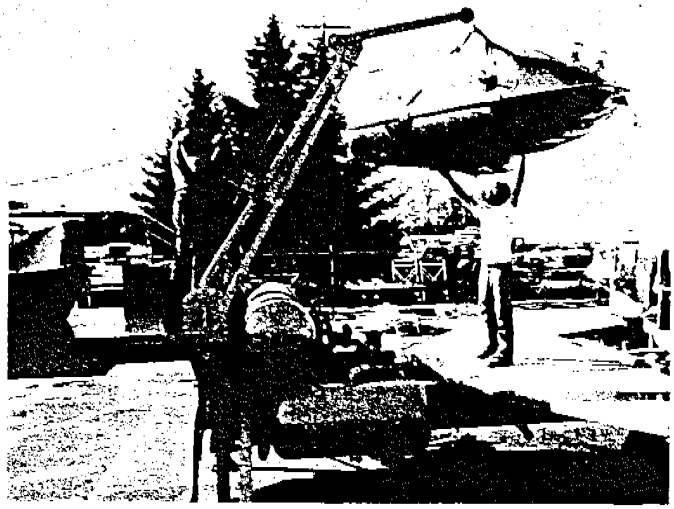


Fig. 39

e. Install the car onto an arm and PIN AND SNAP KEY IN PLACE. (Fig. 40)

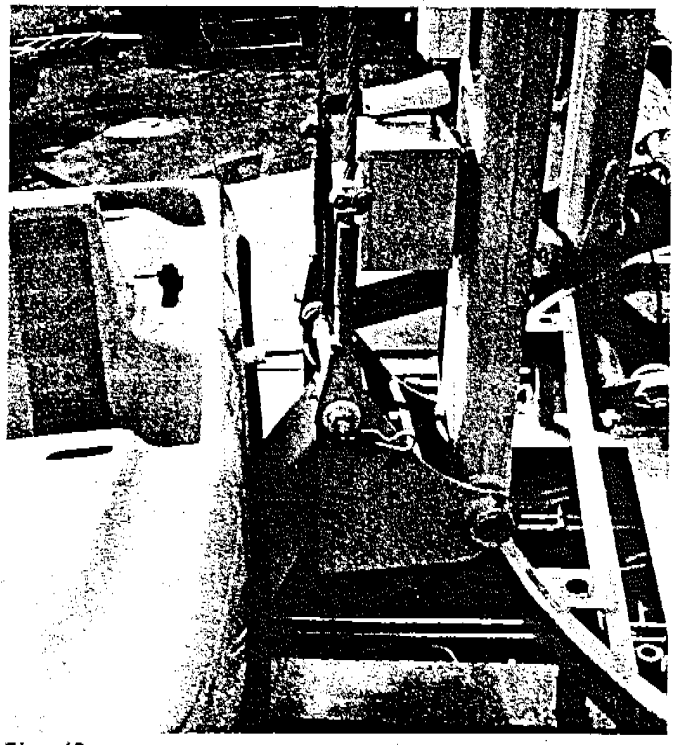


Fig. 40

f. Plug power cord into car and push the car out of the way so that the next car can be installed.
g. Unpin the car rack (a) and lower it to the ground. (Fig. 41)
h. Wrap the sling around the other car and swing it to the platform. Secure the car to an arm. PIN AND SNAP KEY IN PLACE. CAUTION: Be sure the jib crane (a) and the car rack (b) are in a down position while the ride is in operation. (Fig 41)

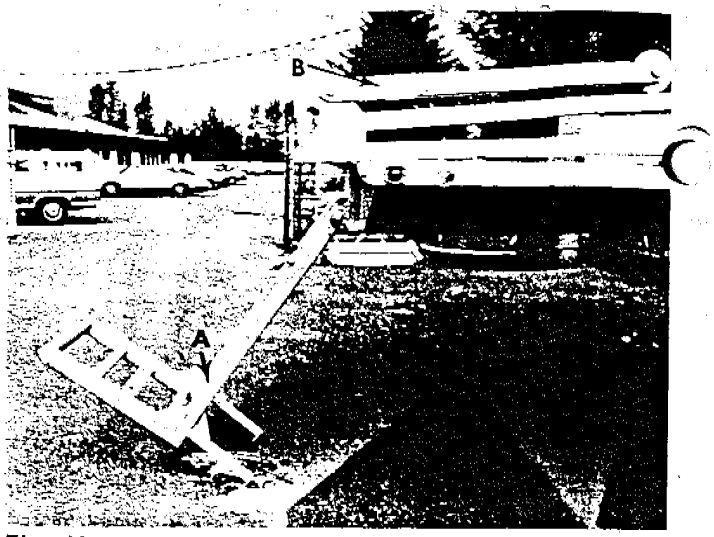


Fig. 41

19. **INSTALL ALL THE REMAINING CARS ON THE ARMS**

    CAUTION: Be sure to pin and key all cars.

20. **ASSEMBLE TICKET BOOTH**

HURRICANE OPERATING INSTRUCTIONS

After the ride has been assembled and all pins and connections are checked for safety pins, cotters, etc., the air compressor may be started. The air system consists of one large tank and two small tanks. The pressure in the high pressure tank is set at 155 to 160 pounds per square inch. The low pressure tanks are regulated at 115 pounds per square inch. Air is fed to the operating cylinder through a regulator which is set at 80 to 85 p.s.i. This pressure should never be increased under any circumstances.

Due to the way the inlet to the air cylinder is situated, the air cyclinder cannot be zoomed until the ride is rotating up to speed which is 15 r.p.m.

TO START THE RIDE CYCLE:

1. After checking the rotation start levers and free wheeling levers to be certain they are in neutral or forward postion, start the pump motor (black button).
2. Check all passengers seating and clear the deck.
3. Pull the rotation start lever to engage hydraulic pump. Ride will automatically come up to speed (15 r.p.m.) in about 12 to 15 seconds.
4. After ride reaches full speed, pull the free wheel lever to you.
5. Push the zoom button or lever down and arms will elevate about 10 degrees. Short bursts of air are all that is necessary, as long bursts waste air.
6. Immediately release the zoom button or lever and allow arms to drop.
7. When the arms reach the lowest part of swing, again pull the zoom button or lever down which will accelerate the zoom. When arms stop elevating, release the lever or button and again allow arms to drop.
8. Repeat the use of the zoom lever until the arms reach the horizontal position at which time the piston will pass exhaust ports in the cylinder to release the pressure and no more force can be applied to the piston. This condition can be heard when this exhaust occurs. With a light load, an experienced operator can achieve maximum elevation in three zooms and with a full load in four zooms.
9. After zooming has reached its maximum, we recommend that you allow the arms to swing two or three times. Then push the freewheel valve up and by using the air lever in the reverse manner from the starting procedure you can introduce air into the cylinder at the top of the swing rather than the bottom. This will stop the swinging of the arms in 8 or 10 seconds and will reduce the stop cycle. After the swing is stopped, simply place the pump in the neutral position and the automatic braking system will stop the rotation in the normal time.
10. It is not adviseable to stop the ride too quickly because this may cause the arms to strike the lower stop ring with a shock which is objectionable. Therefore, the coasting part of the cycle is very important and should be observed religiously.
11. It is also important that the zooming action be limited to the above procedure. Repeated zooms to the maximum are objectionable since some people might become ill from too much repetition.
12. There are two dial gauges on the operator control stand. The "high pressure" tank gauge should read 155 to 160 P.S.I. This is the pressure in the large reserve air tank. The "operating pressure" gauge should read a pressure of 85 P.S.I. maximum.
13. All air tanks accumulate water from condensation and should be drained daily.
14. An air lubricator is situated in the main air line to the cylinder. This should be checked daily to provide lubrication to the air cylinder. The amount of flow is adjustable and can be seen to drip thru a glass sight tube. It should be adjusted to use about ½ pint of oil per day.
15. CAUTION: DRAIN OFF THE AIR PRESSURE BEFORE CHECKING OR FILLING THE OILER!
16. "EMERGENCY STOP" In case of complete electrical power failure, the operator should place the freewheel valve into the freewheeling position and leave the pump control in the power on position. This will let the ride slowly coast to a stop. After the ride has stopped, place the pump control lever in the neutral position. After the power has been restored and before loading passengers, turn on the electric motor to the hydraulic pump and after waiting for approximately 15 to 20 seconds to let the pump right itself, then place the freewheel valve in the power on position.

HURRICANE RELOADING AND ASSEMBLY PART STORAGE

Take the Hurricane down and store the assembly parts for travel in the reverse sequence of the set-up procedure. To keep the Hurricane "like new" for years to come, *always* lock the assembly parts in their proper storage positions to prevent them from jarring loose during travel, causing possible damage to the ride.

Some of the storage information is found in the set-up section. Listed below are some additional reminders and tips for safe and easy reloading and storage.

1. **CARS AND LOADING POSITION OF ARMS**
   a. Note the position of the arms when they are folded against the tower. The arms with the rubber bumpers (a) go to the sides and the arms with the cable tightening screws (b) are to the rear (Fig. 42)

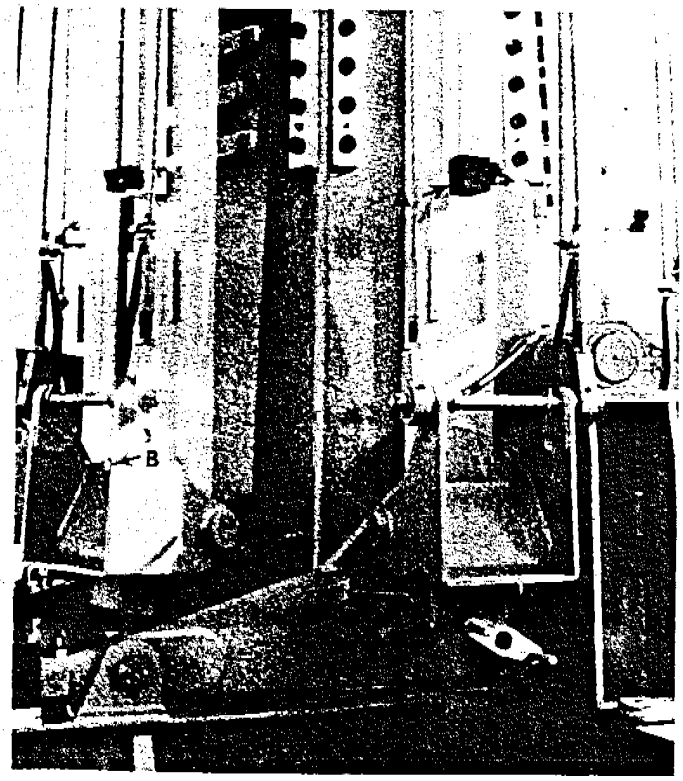


Fig. 42

CAUTION: The arms must be in this proper storage position before the cars are placed in their storage positions on the platforms.

   b. Open the drain valve on the base of the tower to allow the arms to fold tightly against the tower bumpers. (Fig. 43)
   c. Load the cars on the platforms with the noses pointing toward center.
   d. Be sure to bolt all cars in storage position from under the platform.

2. **THE TWO CARS ON THE GOOSENECK, JIB CRANE AND CAR RACK**
   a. Reassemble the jib crane to install the 2 cars that are stored on the gooseneck. (Refer to Figs. 38 & 39)
   b. Store one car on the deck of the gooseneck and bolt in place from under the deck.

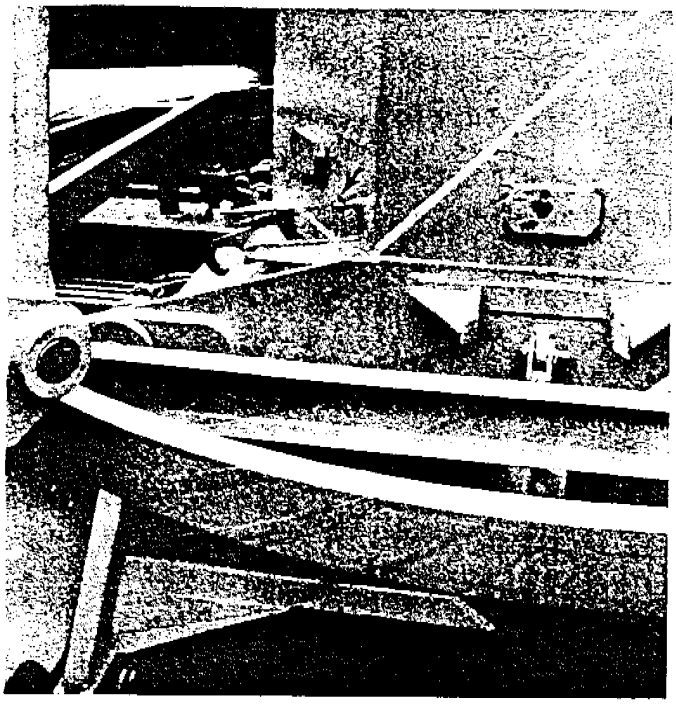


Fig. 43

   c. Raise the car rack and PIN AND KEY in place (a) (Fig. 44)

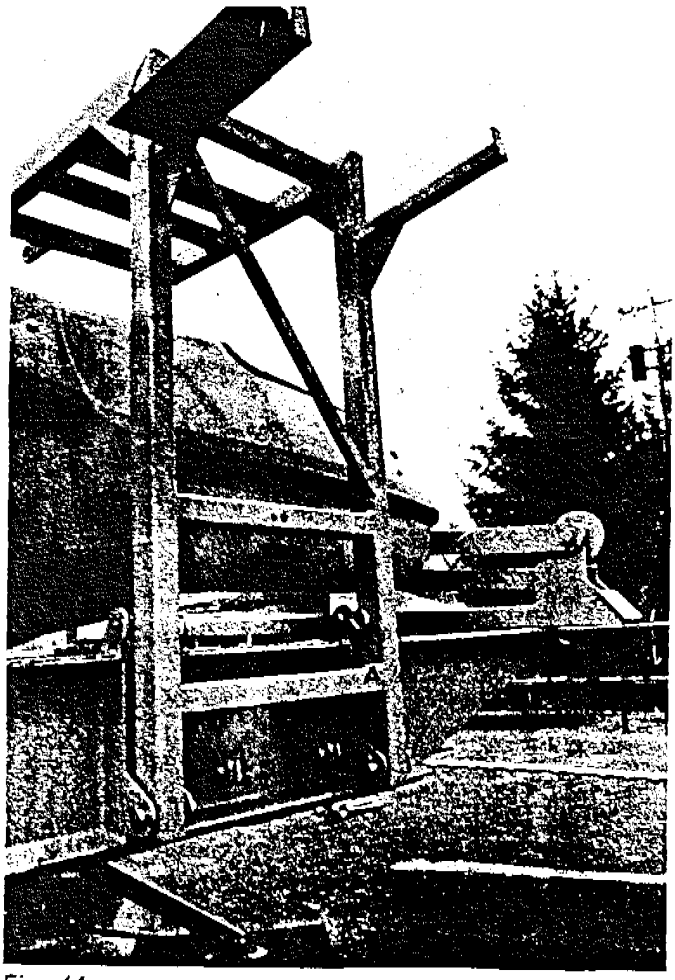


Fig. 44

d. Load the other car on the car rack. Bolt in place from under the rack. NOTE: The top car must point in the opposite direction from the car on the deck.

e. Secure the turnbuckle between the car rack and the tower rest. PIN AND KEY both ends. (Fig. 45)

f. CAUTION: The jib crane must be stored in a folded position and secured with bolt and nut (b). (Fig. 44)

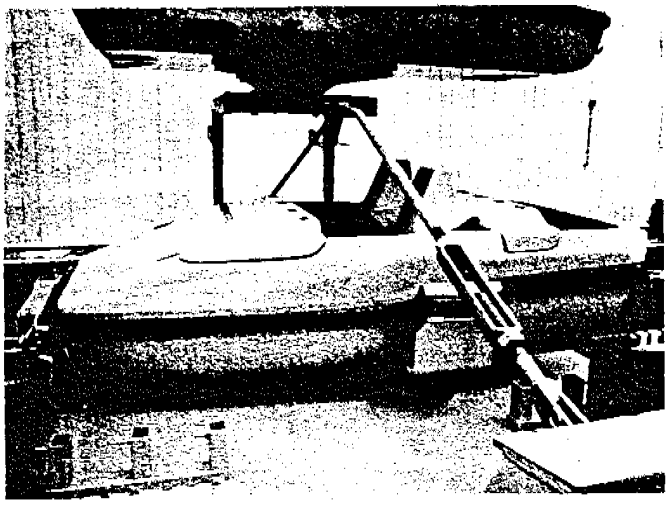


Fig. 45

3. **TRACK SECTIONS**

The track sections are stored on the trailer frame in front of the tower. (Fig. 46)

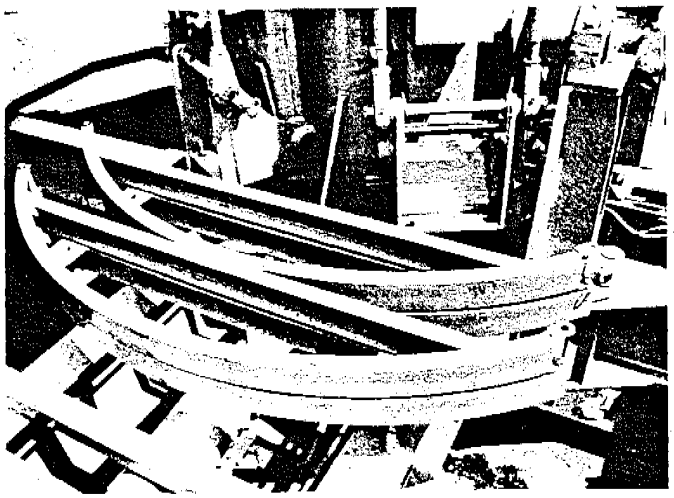


Fig. 46

4. **PLATFORM STEPS**

a. To protect the paint, place a piece of carpet on the front of the trailer deck. Place the platform steps on the carpet.

b. Place 2 sets of steps side by side. (Refer to Fig. 26)

c. Stack the third set of steps on the set of steps that are closest to the track sections.

5. **HANDRAIL LOADING RACK, HANDRAILS AND TICKET BOOTH BOTTOM**

a. Place the legs of the loading rack in the sockets in the trailer frame next to the steps. The rack will rest over the single set of steps.

b. Load the handrails on the loading rack and secure in place with a flat plate, lock washer and nut. (Refer to Fig. 26)

c. Place the ticket booth bottom on top of the 2 stacked sets of steps. (Refer to Fig. 26)

6. **MAIN PLATFORM FENCE**

a. Stack the large fence sections on the platforms. (5 sections on the left and 4 sections on the right.)
CAUTION: Position the fence sections so that the legs point in toward the center of the ride.

b. Drop the mounting plate bolts down through the holes in the fence sections and in the platforms. Secure in place under the platforms with locks and washers. (Fig. 47)

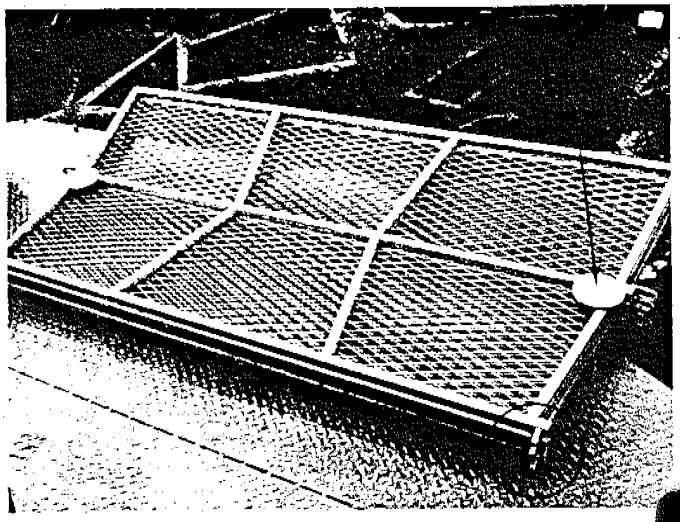


Fig. 47

c. Store the small fence sections in the storage box on the gooseneck. (Fig. 48)

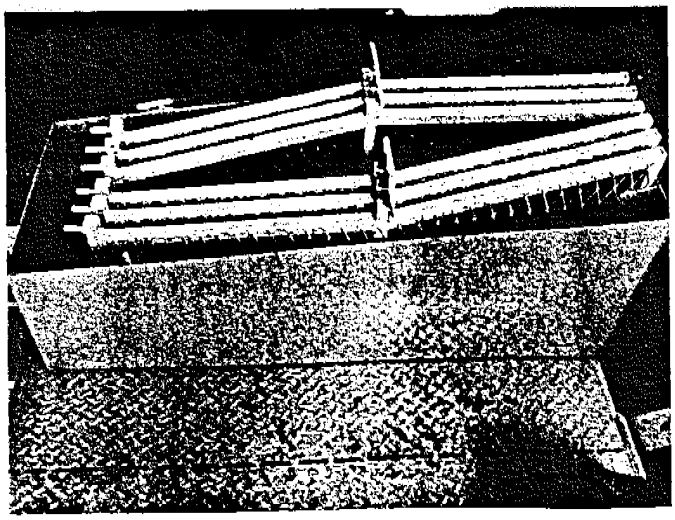


Fig. 48

7. **LOWER THE TOWER AND STORE THE PETAL LIGHTS**

a. Turn on the hydraulic pump at the control center. (Refer to Figs. 20 & 21) CAUTION: Be sure the pump is in neutral before turning on.

b. CAUTION: Be sure to tighten the 4 arms in place with the cranks. Adjust the crank handles so that they will not hit the trailer frame as the tower is lowered. (Refer to Fig. 23)

c. CAUTION: Be sure to remove the 3 lock pins at the base of the tower before lowering. (Refer to Figs 24 & 25)

d. IMPORTANT: Be sure the area is free of all obstructions before lowering tower.

e. Push down on the left lever at the control center to lower the tower. (Refer to Fig. 16-b)

f. Lower the tower just enough to be able to remove the petal lights.

g. Store the petal lights in the storage sockets on the front of the trailer. (Refer to Fig. 2-d) CAUTION: Be sure to tighten the petal lights in place with set screws.

h. Continue to lower the tower. Once the tower is in storage position, replace the 3 lock pins in the mounting ears at the base of the tower.

8. BALLY STORAGE RACK AND BALLYS

a. Set the bally rack over the pin on the left side of the rear trailer deck lid (a). SNAP KEY in place. (Fig. 49)

b. Load the 2 short ballys first by slipping the holes in the ballys over the loading pin on the rack (b). (Fig. 49)

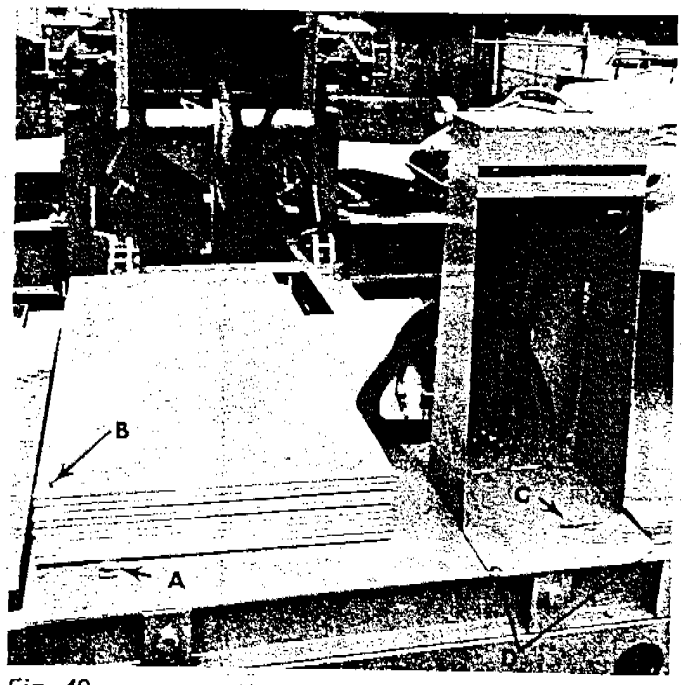


Fig. 49

c. Load the remaining ballys.

d. Place a lock washer and nut over the loading pin.

9. CONTROL STAND

a. Fit the bottom plate of the control stand over the pin on the right side of the rear trailer deck lid (c). SNAP KEY in place. (Fig. 49)

b. Secure the control stand plate to the rear trailer deck with 2 bolts and nuts (d) (Fig. 49)

0. RAISE THE MAIN PLATFORMS

a. Lift up on the right lever at the control center to raise the platforms to the full folded upright position. (Fig. 50)

b. Working from the top of the folded platforms, install the spreader bar in the sockets in the platforms. The spreader bar spans between the two platforms.

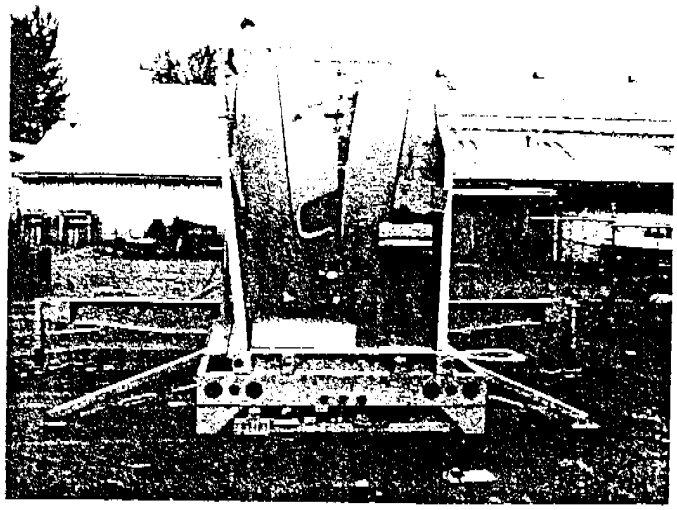


Fig. 50

c. Install the two turnbuckles between the platforms. (Refer to Fig. 14) CAUTION: Be sure to tighten the turnbuckles *only* so that the platforms are snug against the spreader bar. DO NOT TIGHTEN TOO MUCH. Damage will occur to the cars from too much pressure against them.

11. OUTSIDE FENCE SECTIONS

a. The outside fence sections are stored on the rack in front of the gooseneck. Hang the sections upside down.

b. Load the 2 small sections first.

c. Once all sections are hanging on the rack, secure in place with hook bar. Place the hook under the fence sections and pull back toward the ride. Insert the bar in the hole in the car rack frame. Secure in place with a nut. (Fig. 51)

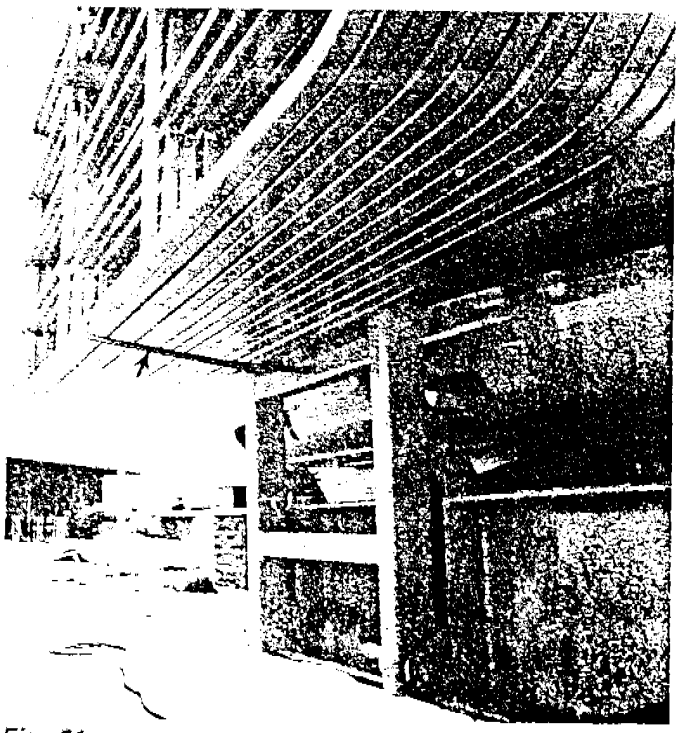
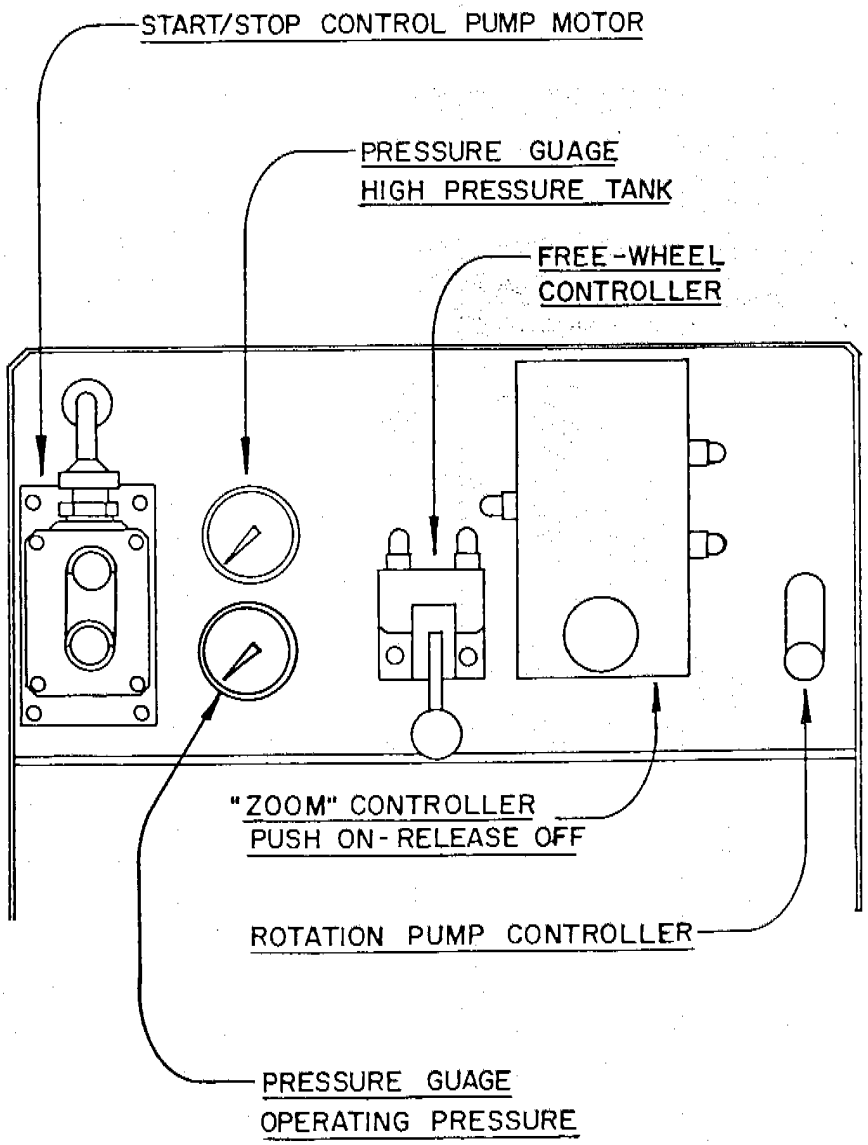
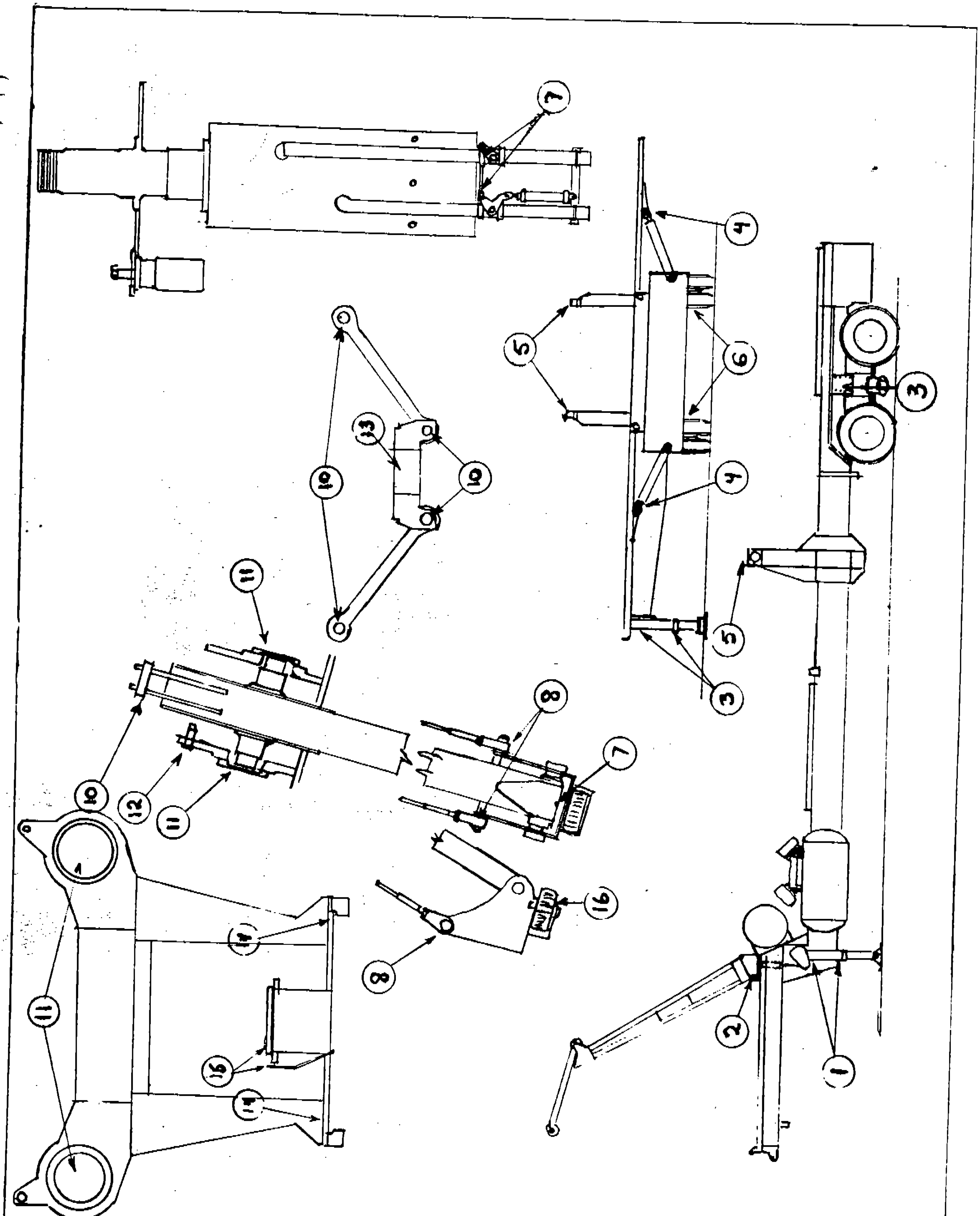


Fig. 51

HURRICANE HYDRAULIC OIL SYSTEM RECOMMENDATIONS

If any oil must be added to the hydraulic system, use 15W-40 motor oil such as Mobil Delvac Special 15W-40, Sinclair Triplex, Texaco Ursatex 15W-40 or Amoco Super Permalube 15W-40.

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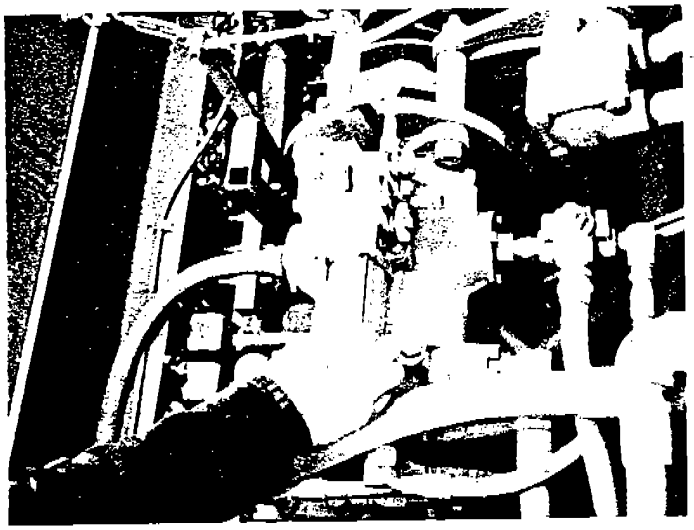


Figure 1

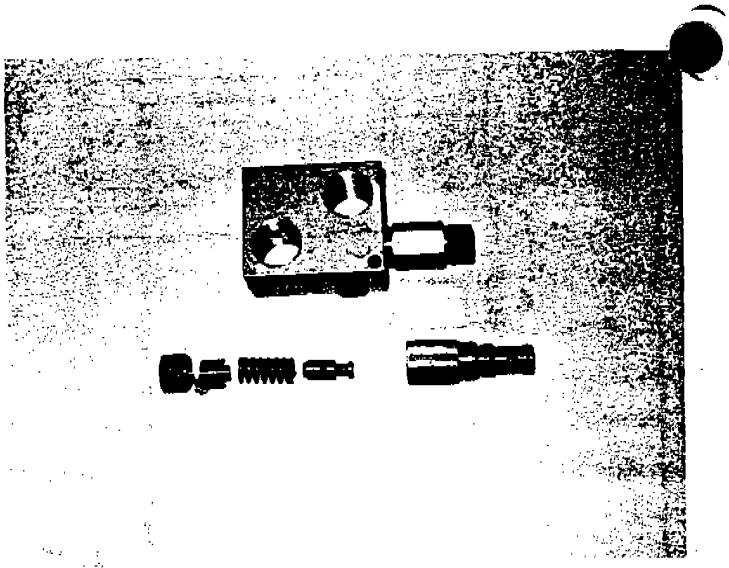


Figure 2

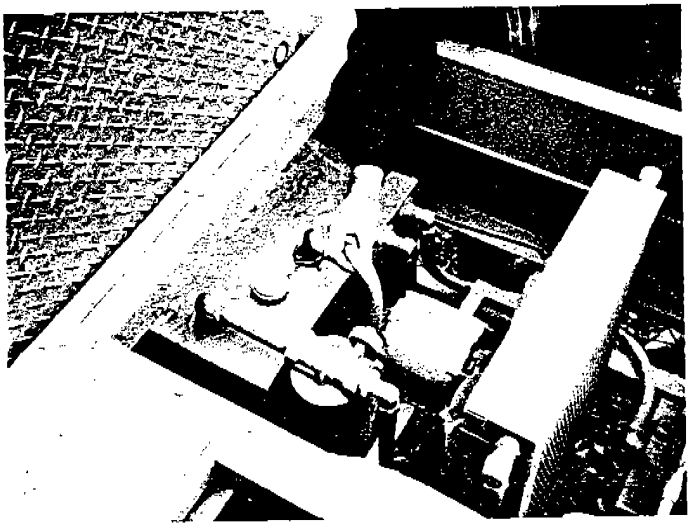


Figure 3

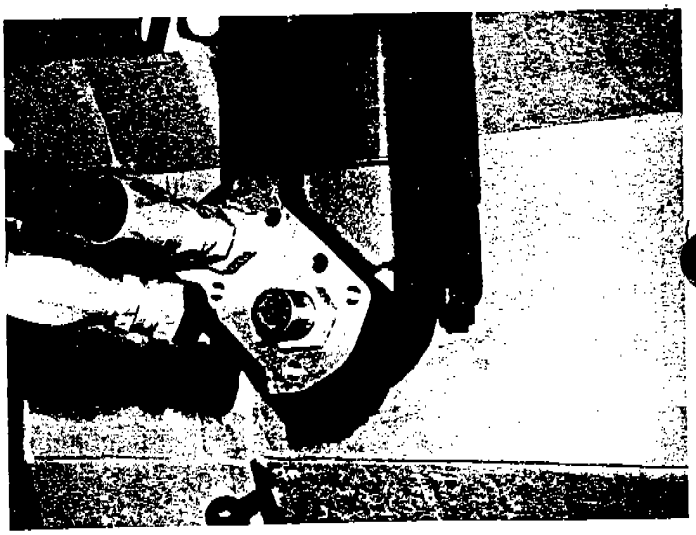


Figure 4

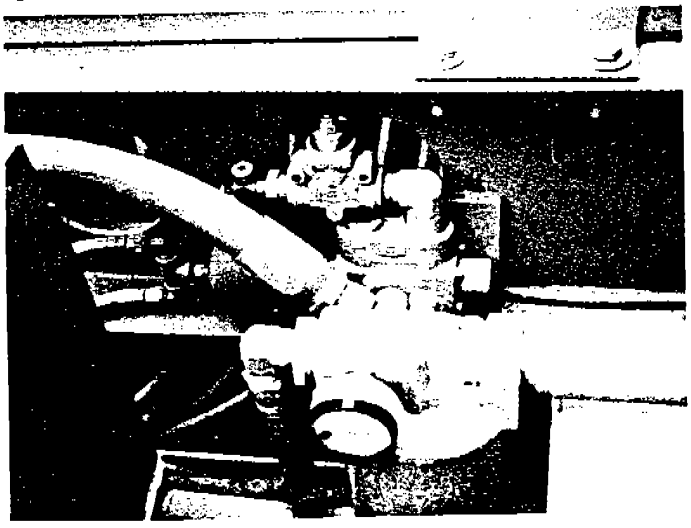


Figure 5

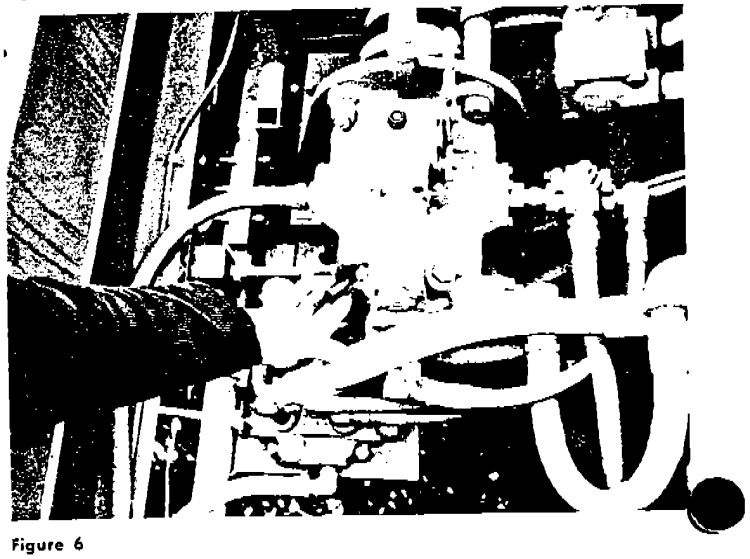


Figure 6

TROUBLE SHOOTING GUIDE
HURRICANE
Hydraulic System

A. RIDE WON'T ROTATE

1. *Orifice in the control head plugged.* Remove the orifice (Fig. 1) and clean it. DO NO OPERATE RIDE WITH ORIFICE REMOVED.
2. *Relief-valve malfunction.* Remove the valve cartridges and inspect for damaged or missing "O" rings or stuck plungers. (Fig. 2)
3. *Internal failure of the pump.* Install new pump. Drain and flush all pressure lines to eliminate contamination from the system & install new oil filter element.
4. *Hydraulic motor failure.* To determine positively that a motor is malfunctioning the case drain line should be disconnected at the tank. (Fig. 3) If there is excessive flow, this is a positive indication. In order to find which motor is defective use the following directions. Normally, both motors will not fail at the same time. To determine which motor is defective, remove the hoses from one motor at a time. (Fig. 4) Plug the hoses and try to operate. If the ride will not operate on one or the other motor, then the pump is probably defective. If the ride works with one motor only, replace the bad motor. Never operate with only one motor because it will rotate twice as fast as normal. *Isolating one motor is for test purposes only.* Drain and flush all pressure lines.
5. Check arrow on auxiliary pump or arrow on charge pump of dyna-power unit for correct rotation daily. Also check arrow on fly wheel of compressor daily. (Fig. 14 & 23)

B. WILL NOT ROTATE FULL SPEED OR SLUGGISH RESPONSE

1. *Restricted orifice. Remove and clean.* (See Fig. 1)
2. *Freewheel diverter valve not shifting.* Possible causes—valve sticking; air actuating cylinder not working, or hole in air line. (Fig. 5)
3. *Control linkage out of adjustment.*
4. *Main relief valve malfunction.* See section A-3, Fig. 2.
5. *Pump or motor failure.* See section A-3 & A-4.
6. *Spline on pump half or key on motor shaft sheared off.*

C. LOSS OF CONTROL

1. *Oil level low.*
2. *Plugged oil filter.*
3. *Malfunction of check valves in the pump.* Remove the check valve and clean and inspect them. (Fig 6)
4. *Creeps in neutral.* Detent plate not centered—loosen. DO NOT REMOVE.—two hold down screws and move the detent plate to a position where the creeping stops and noise is reduced to a minimum. Tighten the hold down bolts. (Fig. 7)
5. *Internal damage.* Replace the pump. See section A-4.
6. *Low charge pump pressure.* Install a 0-500 PSI gauge in the orifice port and take a reading. If the pressure is not 150 - 175 PSI, adjust the charge pump relief valve to this range. (Fig. 8)
7. *Control linkage malfunction.*

D. EXCESSIVE NOISE

1. *Dirty suction filter.* Replace the element.
2. *Check for a collapsed or restricted inlet hose.*
3. *Wrong weight of oil.* Always allow the system to warm up before operating.
4. *Water in the oil.* Drain the oil and replace it.
5. *Contamination.* Check return line for solid matter. Pump and/or motors probably damaged beyond repair. Flush the system before installing new equipment. (Fig 3)
6. *Air in the oil.* Check oil level in the reservoir and for leaks in the suction lines.

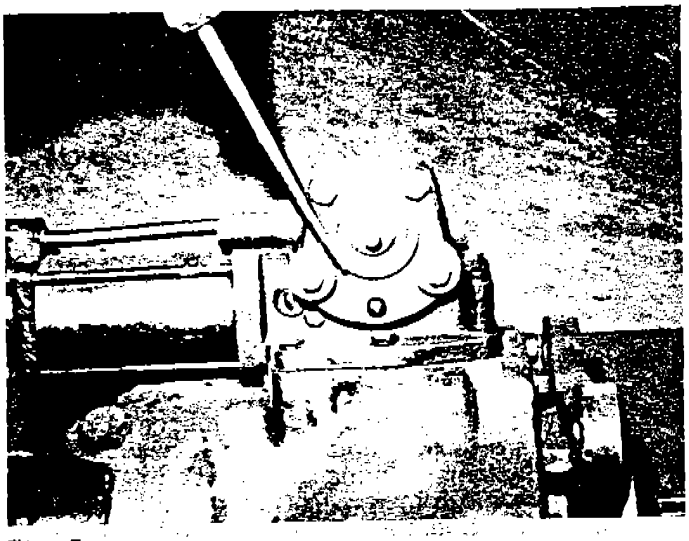


Figure 7

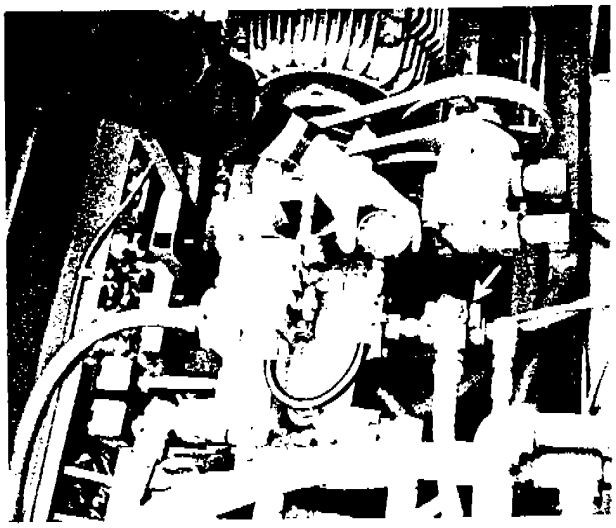


Figure 8

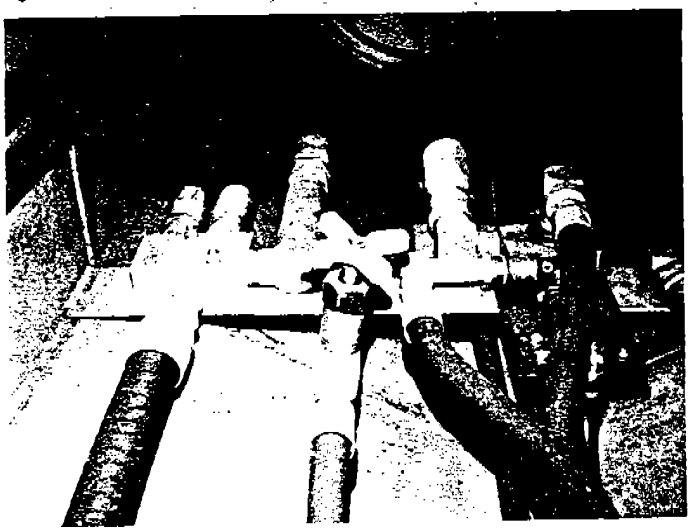


Figure 9

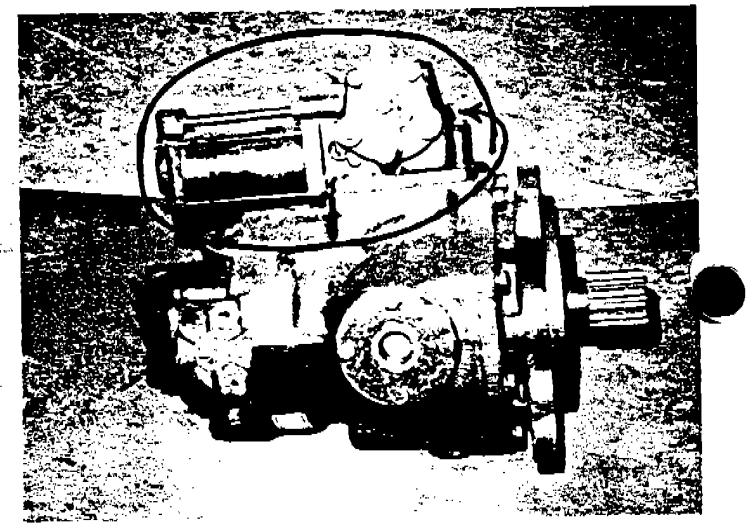


Figure 10

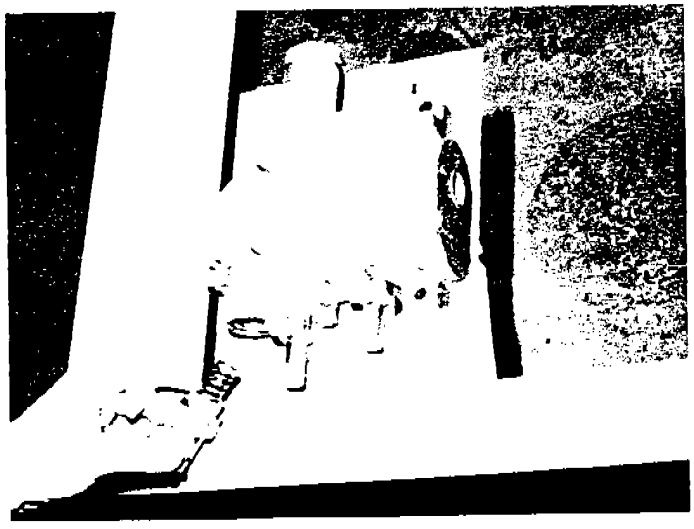


Figure 11

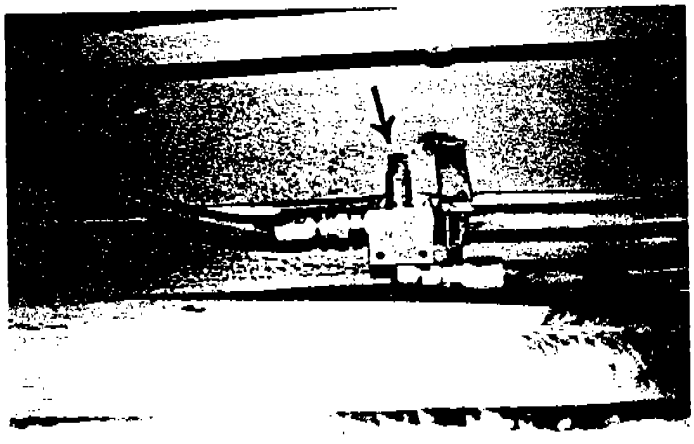


Figure 12

E. OVERHEATING

1. *Relief valves not working properly.* See A-3, Fig. 2
2. *Oil cooler fins plugged or dirty.*
3. *Cooling fan not working.*
4. *Unit excessively worn*—replace pump or motor or both.

F. RIDE WON'T FREEWHEEL

1. *Freewheel diverter valve sticking.* Repair or replace this valve. See Fig. 5.
2. *Air actuating cylinder not working.* Repair or replace. See Fig. 5.
3. *Operator control valve malfunctioning.* Repair or replace.
4. *No air getting to control valve.* Check lines from control stand to compressor.

G. INCORRECT BRAKING ACTION

1. *Diverter valve not shifting.* Repair or replace. See Fig. 5.
2. See item 1, 2, 3, section F.
3. *Brake valve out of adjustment.* Screw brake valve clear closed then turn out four or five complete turns. Fig. 9.

H. DRIVE NOT IN NEUTRAL WHEN THE ELECTRIC MOTOR IS STARTED

1. *Motor stopped before pump is in neutral or while the ride is still turning.* Always have the ride stopped and the pump in neutral before shutting down the motor.
   A. In order to get pump back into neutral make sure the electric motor on the hydraulic system is turned off. Start the compressor and let the air build up to capacity, then engage the freewheel valve and start the electric motor on the hydraulic system making sure the control lever is in the neutral position. Let the hydraulic system run in this manner for about 30 seconds. The ride will try to start for a few seconds but the pump will center itself and then the freewheel valve can then be engaged back to normal.
2. *Pump shifted as a result of pushing the cars around by hand.* Do not move the cars by hand any more than necessary. Take same action as item 1-A above to correct the situation.
3. *Malfunction of the servo valve.* If the problem is continuous, replace the servo valve. Fig. 10. See pages 31 & 32.

I. AUXILIARY HYDRAULIC SYSTEM

1. *Tower and platform won't raise.* Pump damaged or V-belt slipping. Relief valve in the control valve malfunctioning. (Fig. 11) Low oil supply.
2. *Either the tower or the platforms work—but not both.* Malfunction probably in the cylinders. One spool of the control valve may be damaged, or the machine screw and washer and spring has become disassembled from the end of the spool.
3. *Tower won't lower.* Pins have not been removed or safety relief valve not working properly. (Fig. 12) DO NOT ARBITRARILY INCREASE THE PRESSURE ON THIS VALVE. *Extensive damage can easily be the result.*
4. *Cars dropping onto track with too much force.* See section G. 1, 2, & 3.

Air System

A. LOW PRESSURE & SLOW RECOVERY

1. *Clogged air filter.* Clean and re-oil.
2. *Leaking head valves.* Clean all parts, see compressor manual.
3. *Pilot valve or unloading mechanism not working properly.* See manual for repair. (Fig. 13)
4. *Air leaks.* Correct leaks when they start—DON'T DELAY.
5. *Slipping belts.* Re-adjust the belt tension and replace the belts if necessary.

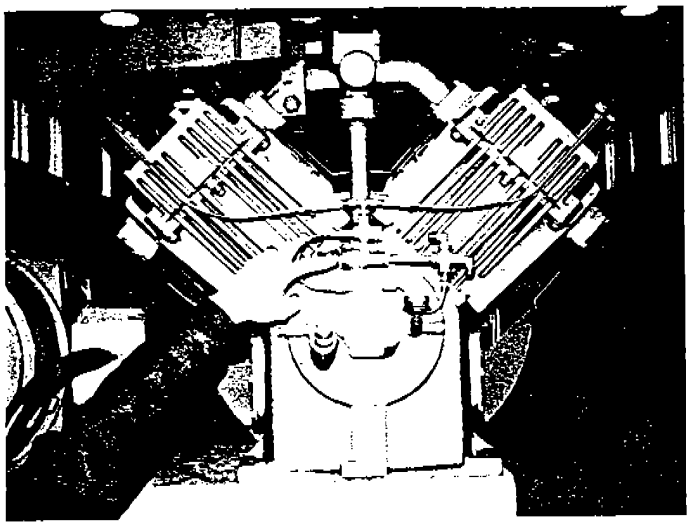
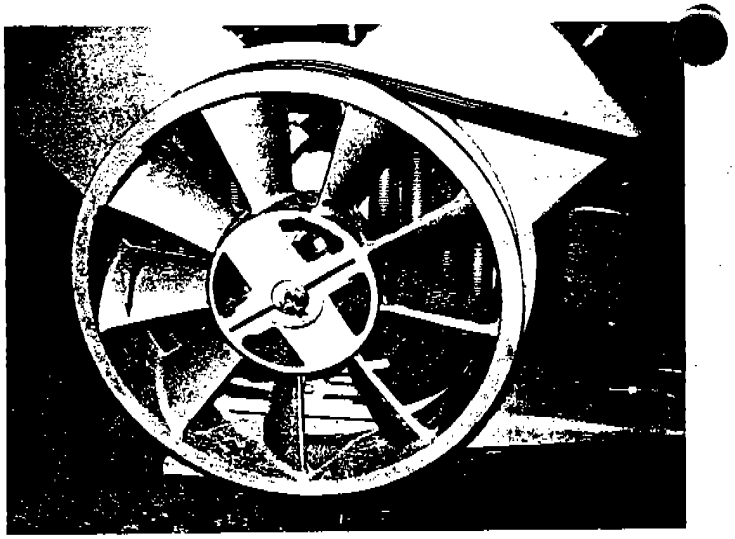


Figure 13



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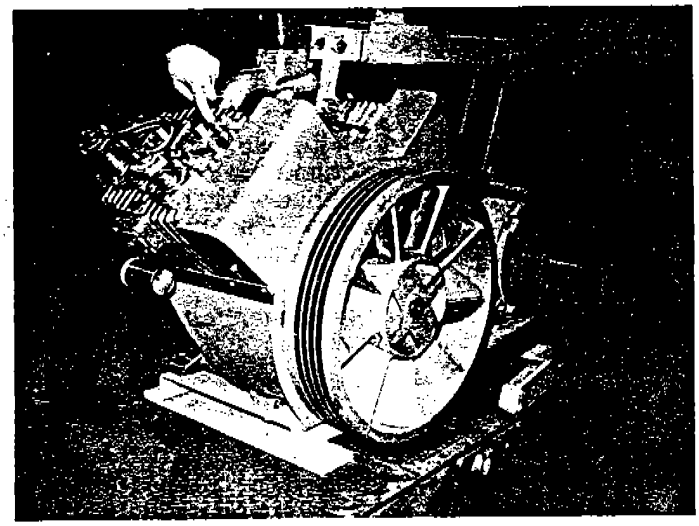

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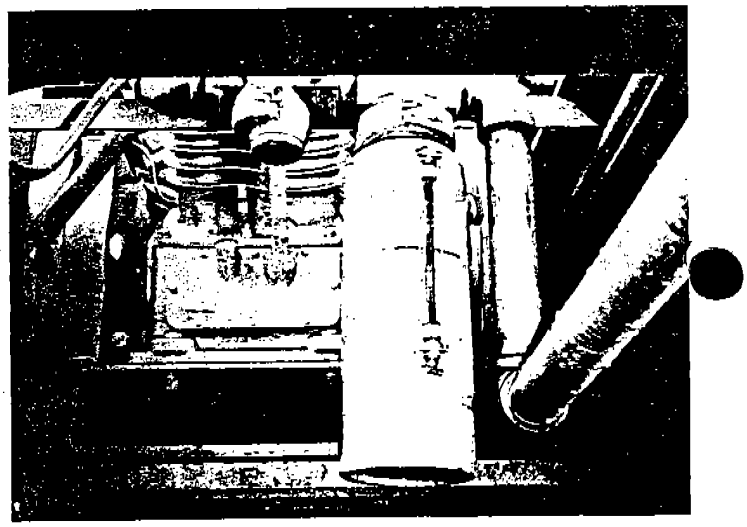

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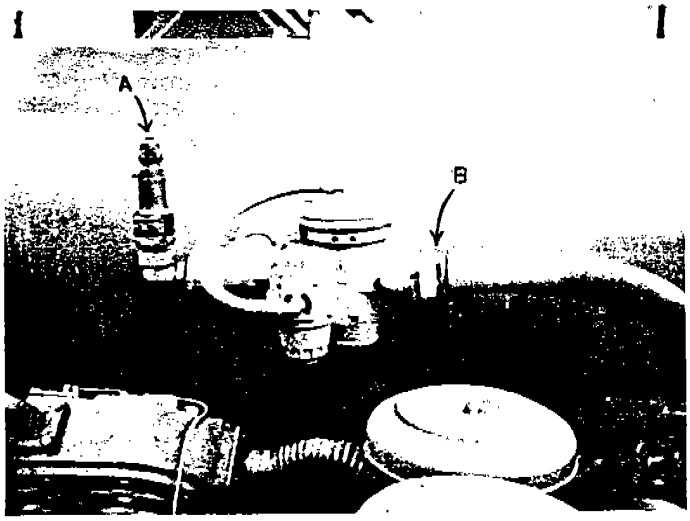


Figure 17

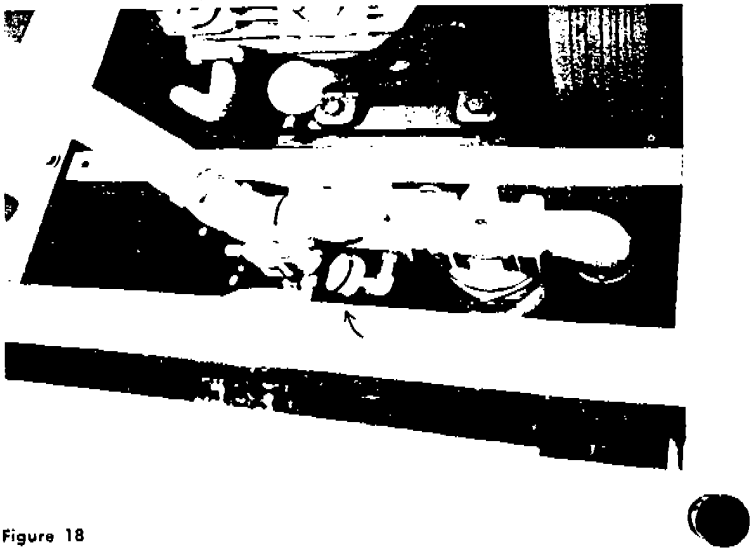


Figure 18

B. EXCESSIVE OIL CONSUMPTION

1. *Air intake restricted.* Clean the filters.
2. *Compressor crankcase over filled.* Drain to the full mark.
3. *Wrong viscosity of oil.* Check the specifications of your oil to the specifications given in the manual.
4. *Worn piston ring.* Recondition the cylinders, pistons, and install new rings.

C. COMPRESSOR OVERHEATING

1. *Outside of the compressor dirty.* Keep accumulations of dirt and oil washed off. Keep fins and shrouds clean. Also keep cooling fins and radiators clean.
2. *Running the compressor backwards.* If this happens, correct the situation immediately. If the compressor has been run backward, check the operator's manual for other areas of damage. Check arrow on flywheel. (Fig. 14)
3. *Valves not seating properly.* Remove and service the valves as necessary. See compressor manual.
4. *Blown cylinder head gasket.* Thoroughly clean the mounting surfaces and install a new gasket.
5. *Low oil level.* Fill to the proper level.

D. COMPRESSOR SAFETY VALVE POPPING—FIGURE 15

1. *High pressure discharge.* Valve leaking—service the valves. See compressor manual.
2. *Valve gaskets leaking.* Install valve gasket kit.

E. NOISY OPERATION

Check instruction manual for possible causes.

F. LUBRICATOR NOT WORKING

Adjust the delivery by opening or closing adjusting screw. Observe the drip rate through the sight feed glass. The lubricator can be adjusted only while air is being discharged through it. One or two drops per zoom is about right. If the reservoir is full, and after turning the adjustment screw, oiler doesn't function, *drain off* all air pressure and disassemble the lubricator. Inspect all parts and replace faulty ones. (Fig. 16)

G. NO FLOW FROM THE AIR TANKS OR PRESSURE NOT MAINTAINED PROPERLY

1. *Regulators not working properly.* The main regulators are controlled by small pilot regulators. Turning the knob on the pilot regulator changes the main regulators. The regulator joining the big tank to the side tanks controls the pressure in them. This pressure should be 115 PSI. (Fig. 17-B) The other regulators near the lubricator controls the zoom cylinder working pressure. This pressure is 85 PSI maximum. (Fig 18) If the regulators cannot be adjusted, then disassemble and service them. DRAIN OFF ALL AIR PRESSURE BEFORE WORKING ON ANY OF THE COMPONENTS.
2. *Ball valve assembly inoperative.* (Fig 19).
3. *Drain valve in bottom of tanks open.*
4. *Check all air hoses from control stand to ride.* (Fig. 20)

H. NO FLOW OF AIR FROM THE AIR TANKS—BUT PRESSURE IN TANKS IS ADEQUATE

1. *Air leakage.* Check all air hoses from control stand to ride for leaks or proper connection.
2. *Zoom valve malfunction.* Replace valve. (Fig. 21).
3. *Check ball valve actuating cylinder for correctoperation.*
4. *Check linkage on ball valve for correct adjustment.* See Figure 19.
5. *Check the condition of the stems on ball valves.* If they are sheared off—replace. (Fig. 19 & 22)

I. AIR TRAPPED IN CYLINDER AND WON'T LET ARMS COME DOWN

See section H — 1, 2, 3, 4, & 5

J. SAFETY VALVES ON TANKS BLOWING—Figure 17 & 25-A

1. See section G—1.
2. *Safety-valve malfunction*—replace valve.

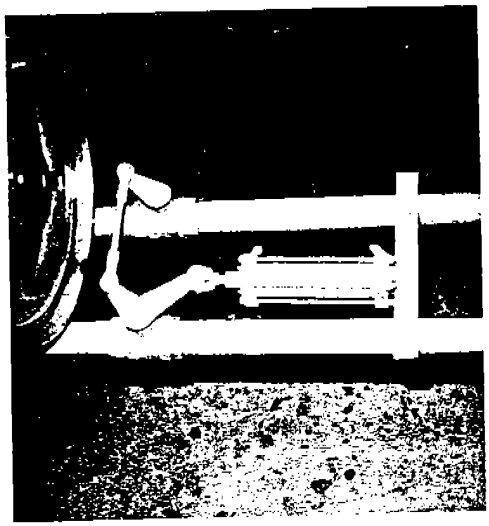


Figure 19

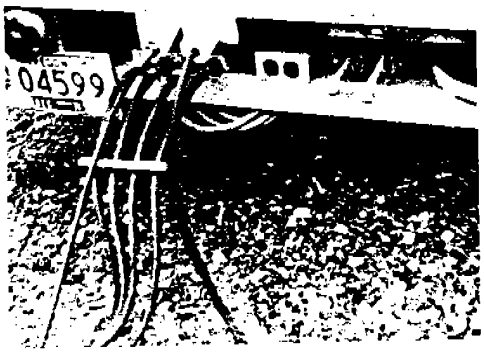
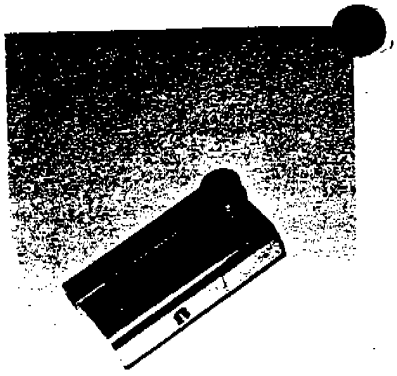


Figure 20



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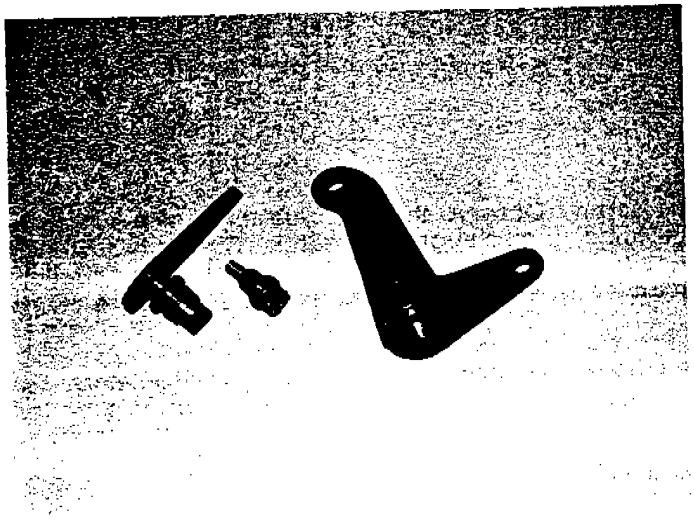

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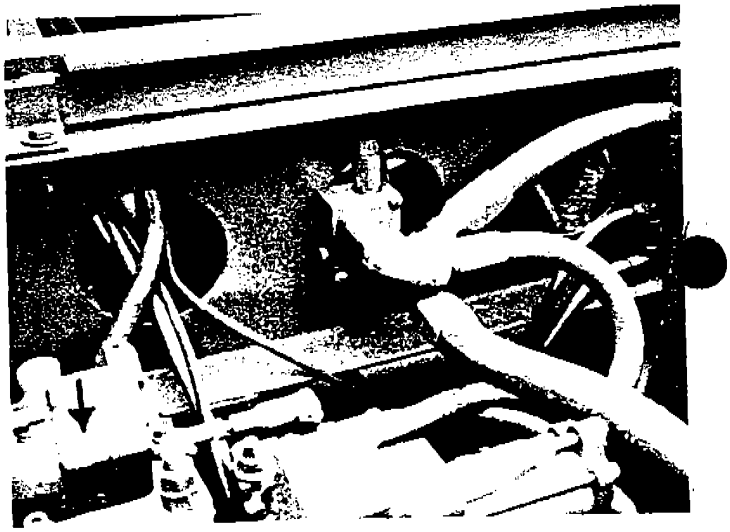

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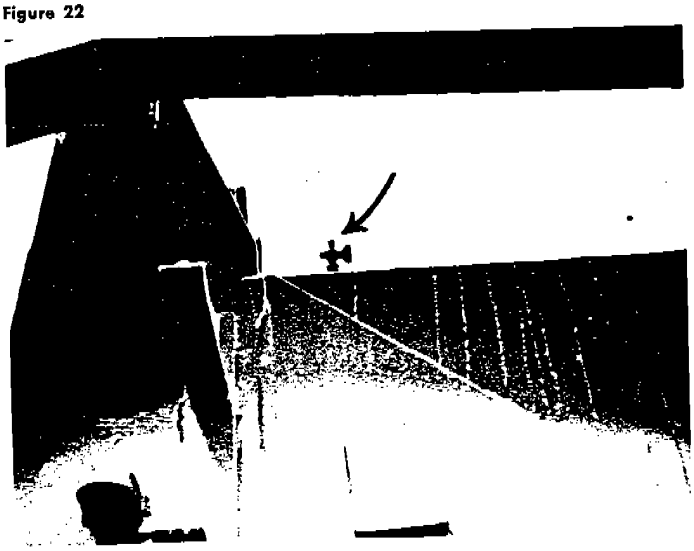


Figure 24

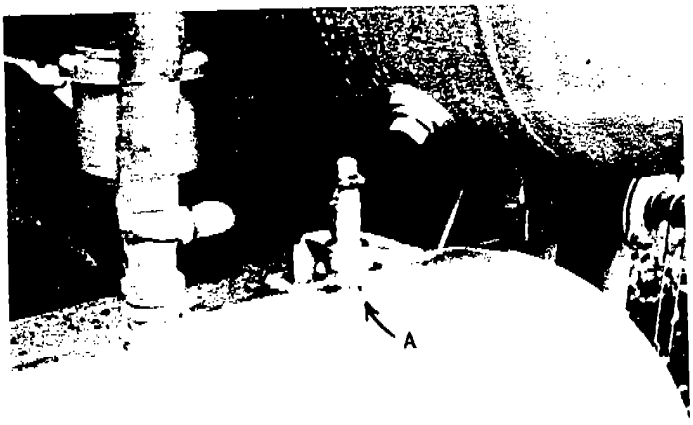


Figure 25

K. NORGREN REGULATORS KEEP BLEEDING AIR OFF

1. *Contamination*—clean regulator.
2. *Damaged diaphram, spring, etc.* Install kit.

L. ARMS WON'T FOLD INTO SADDLES WHEN LOADING

1. Check bleed off valve on tower base. (Figure 24)

THE BASIC DYNAPOWER TRANSMISSION SYSTEM

A. DESCRIPTION

The Hurricane hydrostatic transmission uses a closed circuit hydraulic system capable of "over center" operation. The inlet and discharge ports of a variable-displacement axial-piston pump are connected to the discharge and inlet ports of a motor by hose or tubing. The main hoses must be of high pressure type, capable of withstanding working pressures up to 2500 PSI; all other hoses can be of low pressure type. The pump is driven by an electric motor.

Other components of the system are: a filter and reservoir system, the fluid itself, a cooler, the connection from the hydraulic pump to the power source, the connection from the hydraulic motor to the output and the linkage to the pump control.

Plumbing and associated hardware have been minimized by building the charge pump and the check valves into the pump cover.

B. OPERATION

The pump operating control changes the amount and direction of flow. When the pump's variable cam is moved from neutral, oil flows from the pump to the motor through the main system lines. This causes the motor to rotate. The oil discharged from the motor is returned directly to the inlet of the pump. *The Hurricane pump is limited to one direction of flow only.*

Moving the pump control through neutral (over center) to the reverse position causes the motor to reverse direction by changing the side of the system developing high presssure fluid. Either side of the system can be the high pressure side. System valving provides proper operation and protection automatically when the system reverses.

Oil is supplied directly from the reservoir, through the filter, to the charge pump. It is discharged through one of the two check valves to charge the low pressure side of the system. This same oil also supplies pressure for the control, makeup and cooling oil to the closed system and inlet pressurization. Pressurization is maintained by the low pressure relief valve which relieves excess oil to the reservoir.

C. BASIC CARE OF THE SYSTEM

FLUID

The Hurricane is designed to use SAE 10W-30 or SAE 10W-40 oil. All other fluids should be submitted to the factory for possible approval on specific applications.

Check Reservoir: Fluid supply should always be at specified level. If necessary to add, use correct type of filtered or strained oil. Reservoir should be checked every 4-5 hours on the first day of use, twice a day for the first week and every day thereafter.

Check for External Leaks: Hoses and fittings should be checked regularly for leaks. Watch for cracks or wear—replace when indicated.

Change: Oil should be changed if color of hydraulic fluid changes, and once a year in any case. Use filtered or strained oil of correct type.

Caution

Running the system with an inadequate oil supply can cause damage to the parts. Reservoir should be checked daily for presence of water or emulsification of oil. If presence is noted, completely drain and flush system. Refill with NEW oil. (Filter or strain as directed above.)

COOLER

Maximum charge pump inlet temperature must not exceed 108° F. Cooler exterior should be kept clean at all times. Core or radiator should be blown clear for efficient cooling.

FILTER

Under no circumstances should the suction filter on the Dynapower charge pump be allowed to by-pass, thus permitting contaminants to enter the closed loop.

Those filter units which have a by-pass feature should have a spring or block installed to prevent any by-passing.

Prior approval of the filter element manufacturer should be obtained for this type of installation in the remote possibility that the element might collapse under vacuum.

If it is determined by the filter element manufacturer that the by-pass feature must be incorporated, the unit should have an 8 to 10 PSI minimum by-pass.

Note

CHANGE: Change filter after first 25 hours, then after each 600 hours, or more frequently if dirt conditions of the particular installation make it desirable. If indicator-type filter is used, change when indicator shows need. Change filter after any pump or motor replacement.

ALSO: If a magnetic filter or screen is installed in the reservoir outlet, check and clean when changing filter element.

Caution

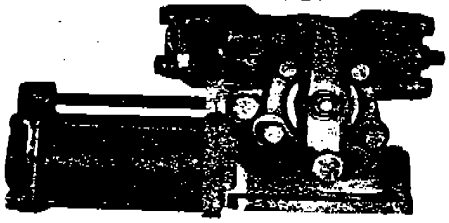
Before re-starting system check oil supply level in the reservoir. Damage can occur if system is run with an inadequate oil supply.

OPERATION INSPECTION

Make a daily inspection of the entire installation.

CHANGING LONG DIFFERENTIAL PRESSURE COMPENSATED OVERRIDE CONTROL

(Servo-Valve)



The following procedure details the removal and replacement of the standard horsepower and control with adjustable neutral detent.

All part numbers in parenthesis following the part names refer to the individual parts as identified in figure 88.

1. Remove two tube assemblies (8) (or one if motor control). Remove six bolts (4 short, 2 long) items (28) and (38), and six lock washers (63).

2. Lift control assembly from pump housing, breaking the seal with gasket (65). Care should be taken to avoid bending the feedback lever (22) by swinging it to one side, as illustrated in Fig. 1, before proceeding to step 3. Remove o-ring (70).

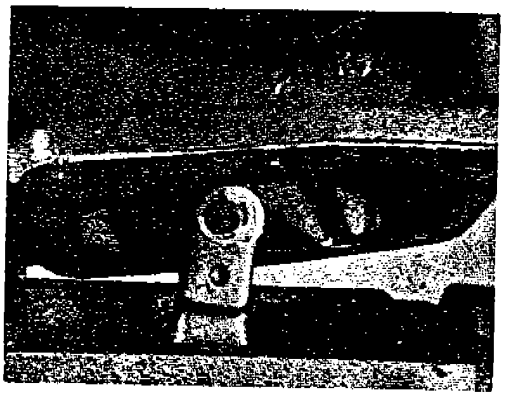


Figure 1 Cam actuator arm and valve sleeve

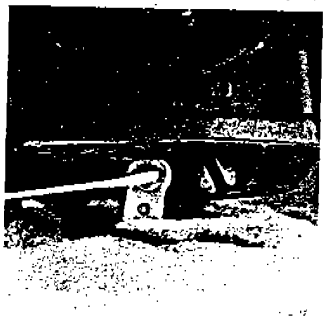


Figure 2 Removing E-ring

3. With a small screwdriver, remove E-ring (71) from the side of the cam arm opposite the counterbore. A clean shop rag should be positioned around the cam arms to prevent the loss of the E-ring into the pump housing. See Fig. 2.

4. Remove clevis pin (73) with 2nd E-ring and slip the control link (72) from the cam lever. Remove gasket (65) from control housing.

5. When reinstalling servo, place gasket (65) on pump housing using a thin coat of clean oil to hold it in place.

6. Position control housing (57) so that rod link (72) slips into slot in pump cam arm. Place a clean shop rag around the cam arm and insert clevis pin (73) with one new E-ring (71) attached in counterboared side of cam arm and through rod link (72). Install the 2nd new E-ring on clevis pin (73). See fig. 3.

7. Install new O-ring (70) in seat on pump housing using a thin coat of grease to hold it in place.

8. Install control assembly to pump using four short and two long hex bolts (items 28 & 38) and six lock washers, *making sure the slot in the valve sleeve assembly (22) is positioned over the pin on the cam lever assembly* and that the O-ring (70) is properly seated. Torque 6 hex bolts to 132 lbs.

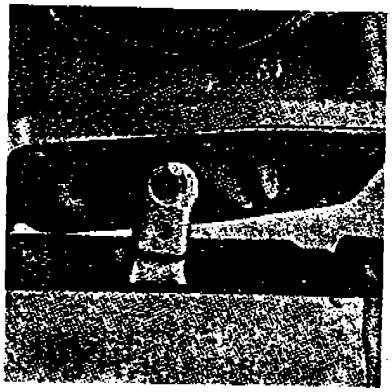


Figure 3 Cam actuator arm and cam follower