ARROW dynamics inc.®

MFG: ARROW DYNAMICS, INC.
NAME: ~~COASTER INPECTION~~ LOOP, SUSPENDED AND CORK SCREW COASTER
Type: NON-KIDDIE

TECHNICAL BULLETIN 93-1 (F

DATE: June 3, 1993

TO: Operators of Loop, Suspended and Corkscrew Coasters

FROM: Ralph A. Gerhardt, Director of Engineering

RE: Over-The-Shoulder Restraint Bars

MANDATORY INSPECTION

RECOMMENDED REPLACEMENT

Recently, a body restraint in an older corkscrew coaster failed due to cracking through a weld which progressed over time. This was in a restraint that is two generations old and can be recognized by plug welds located in the top and bottom of the part that attaches to the pivot shaft. The next two generations of restraints have the plug welds on the side. Both of these versions are quite satisfactory.

Required Action

Arrow is asking for two actions on the older version of the body restraint:

1. Check the restraint by pulling up on each side of the bar during daily inspection and checkout. During loading, pull up on one side of the bar as a backup check during operation. This will also assure a locked condition.

2. Arrow strongly recommends that these older restraints be replaced with the new version. These may be obtained through parts. Please contact Carolyn Weaver.

Arrow will not assume any responsibility for injuries or any other liabilities which may result from negligence in complying with information contained in this bulletin.

Ralph A. Gerhardt
Ralph A. Gerhardt, Director
Engineering

Carolyn Weaver
Carolyn Weaver, Director
Material Procurement

RAG/CW/rlw

Arrow Dynamics, Inc. dba Arrow Inc.
Clearfield, Utah 84016, P. O. Box 1386, Freeport Center Building H-12
Tel: (801) 825-1611 TLX: 388411 Telecopier: (801) 776-2671

ARROW dynamics inc.®

June 3, 1993

Operators of Loop, Suspended and
Corkscrew Coasters

Dear Customer:

RE: Arrow Technical Bulletin 93-1 (Revised)

Recently we issued Arrow Technical Bulletin No. 93-1. The Bulletin lists two actions to be taken on the older version of the body restraint. Item 1 deals with inspection; item 2 recommends replacement.

We have been notified by one of our customers that the method described in item 1 for checking the condition of the restraints is not practical, since most ride operators cannot reach far enough to check BOTH sides of each restraint.

Therefore, we have revised Technical Bulletin 93-1 and included a copy herewith. Although you may have already returned the acknowledgement from the original bulletin, please acknowledge receipt of the revised bulletin by signing and returning the enclosed notification.

We are sorry for any inconvenience this may have caused.

Sincerely yours,

ARROW DYNAMICS, INC.

Carolyn Weaver

Carolyn Weaver, Director
Material Procurement

CW/rlw
Enclosure

Arrow Dynamics, Inc. dba Arrow Inc.
Clearfield, Utah 84016, P. O. Box 1386, Freeport Center Building H-12
Tel: (801) 825-1611 TLX: 388411 Telecopier: (801) 776-2671

ARROW

TECHNICAL BULLETIN NO.88-2

DATE: JANUARY 25, 1988

TO: OPERATOR'S OF CORKSCREW, LOOP, AND SUSPENDED COASTERS

SUBJECT: 1. NEW RATCHET MODULE THAT LOCKS RESTRAINT IN OPEN OR CLOSED POSITION.
2. RESTRAINT WITH CONTACT RELIEF.

TYPE OF CHANGE: AS MANUFACTURER, WE FEEL THAT THIS CHANGE IS NECESSARY TO PREVENT THE RESTRAINT BAR (WHEN IN THE UNLOCKED CONDITION) FROM FALLING OR BEING PUSHED DOWN ON TOP OF THE RIDERS. THE RELIEF IMPROVES RIDER COMFORT.

DISCUSSION: DESIGN AND PRODUCT TESTING HAS BEEN COMPLETED ON A NEW RATCHET MODULE THAT LOCKS THE RESTRAINT IN EITHER A LOCKED OPEN OR LOCKED CLOSED POSITION. THE NEW DESIGN WORKS AS FOLLOWS: TO UNLOAD, ACTIVATION OF EITHER THE FOOT PEDAL OR THE STATION AUTOMATIC RELEASE SETS THE RATCHET MODULE IN THE LOCKED OPEN CONDITION. THIS ALLOWS THE RESTRAINT TO BE PUSHED OPEN TO ANY POSITION, WHERE IT WILL REMAIN LOCKED, UNTIL RELEASED. ONCE THE COACH IS UNLOADED/LOADED, ACTIVATION OF THE FOOT PEDAL OR STATION AUTO RELEASE SETS THE RATCHET MODULE IN THE LOCKED CLOSED CONDITION. THIS ALLOWS THE RESTRAINT TO BE PULLED DOWN TO ANY DESIRED POSITION, INCLUDING ALL THE WAY CLOSED IF THE SEAT IS NOT OCCUPIED. THE RESTRAINT WILL STAY LOCKED IN THAT POSITION UNTIL THE RATCHET MODULE IS AGAIN PLACED INTO THE LOCKED OPEN CONDITION.

A NEW FLEXIBLE JOINT BETWEEN THE RATCHET BAR AND RESTRAINT SHAFT HAS BEEN DESIGNED AND SUCCESSFULLY TESTED. A SMALL AMOUNT OF MOVEMENT IN THIS JOINT ALLOWS THE RESTRAINT TO BE MOVED FROM ITS LOCKED POSITION ABOUT 1 TO 1-1/2 INCHES. THIS PROVIDES BODY CONTACT RELIEF IF THE RESTRAINT BECOMES TOO TIGHT DURING THE COURSE OF THE RIDE.

ACTION: CONTACT CAROLYN WEAVER (801)825-1618 FOR DETAILS.

ENCLOSURES: SAMPLE DETAILS ENCLOSED.

Arrow Dynamics, Inc. dba Arrow Inc.
Clearfield, Utah 84016 P.O. Box 1386, Freeport Center Building G-11
Telecopier (801) 776-2671

ARROW

LOCK OPEN/LOCK CLOSE

RATCHET RESTRAINT ASSEMBLY

(January 2, 1989)

I. Introduction

Step by step assembly instructions are provided by this document. These instructions will help you install the Lock Open/Lock Close Restraint System. Once installation is complete, minor adjustments may be required to tune each ratchet assembly. This will be simple if you follow the assembly instructions.

II. Drawings Required

Ratchet Restraint Assembly - D66093 (Sheet 1 of 2)
Ratchet Restraint Assembly - D66093 (Sheet 2 of 2)
Ratchet Module Assembly - D64890 (Sheet 1 of 2)
Ratchet Module Assembly - D64890 (Sheet 2 of 2)

III. Assembly Instructions

1. Check each "Ratchet Module Assembly" (D64890) to see that pre-assembly is correct. Check 5 inch and 1 3/16 inch dimensions. Adjust if required.

2. Install "Lap Bar Shaft" (D63892), Item 3 - D66093 into headrest using "Bearing" (S04657), Item 24 - D66093. Tighten "Bearings" to headrest, but leave collar set screws loose.

3. Install "Ratchet Module Assembly" (D64890), Item 1 and 2 - D66093, to coach. Do not tighten mounting bolts.

4. Attach "Ratchet Shaft" (D62377), Item 1 - D64890 to "Lap Bar Shaft" (D63892), Item 3 - D66093. Follow Detail A - Drawing D66093.

5. Tighten mounting bolts on "Ratchet Module Assembly" (D64890), Item 1 and 2 - D66093.

III. Assembly Instructions (Continued)

6. Move "Lap Bar Shaft" (D63892), Item 3 - D66093, until the "Ratchet Shaft" (D62377), Item 1 - D64890 is centered in the hole in "Ratchet Module Assembly" (D64890), Item 1 and 2 - D66093. Tighten set screws in "Bearings" (S04657), Item 24 - D66093.

7. Bench set the center screw (S02125), Item 47 - D66093, so that "Pedal Lever" (D63984) Item 5 - D66093 is at 90 degrees relative to "Pedal Lever Bracket" (D63985), Item 4 - D66093. Bolt "Pedal Lever Bracket" to coach. Torque bolts as indicated.

8. Install "Rod End" (S08914), Item 29 - D66093 on "Cable" (S11426), Item 26 - D66093. Rotate "Rod End" seven turns onto "Cable". Set with lock nut.

9. Install "Cable" (S11426), Item 26 - D66093 into "Pedal Lever Bracket" (D63985), Item 4 - D66093. Center threaded section in "Pedal Lever Bracket".

10. Attach "Release Arm Weldment" (C64878), Item 7 - D66093 and (C64877), Item 8 - D66093 to "Ratchet Module" (D64890), Item 1 and 2 - D66093. Tighten into place.

11. Install "Cable" (S11426), Item 26 - D66093, into "Release Arm Weldment" (C64878), Item 7 - D66093. Center threaded section in "Release Arm Weldment".

12. Attach "Cable" (S11426), Item 26 - D66093 to "Release Arm Weldment" (C64877), Item 8 - D66093 using jam nuts. Leave 1/16 inch thread out off "Esna Nut" (S02335), Item 63 - D66093.

13. Depress "Pedal Lever" (D63984), Item 5 - D66093, to full down position. This should allow shoulder restraint to open to desired position. If the "Ratchet Module Assembly" (D64890), Item 1 or 2 - D66093 does not allow this action, adjust "Rod End" (S06201), Item 15 - D64890 to pull "Ratchet Block" (B47695), Item 6 - D64890 away from the "Ratchet Shaft" (D62377), Item 1 - D64890.

III. Assembly Instructions (Continued)

14. Adjust "Set Screw" (502125) Item 47 - D66093, at the bottom of "Pedal Lever Bracket" (D63985) Item - 4 D66093, so that the "Pedal Lever" (D63984), Item 5 - D66093 bottoms on the "Set Screw", rather than the "Cable" (511426), Item 26 - D66093 linkage.

15. Return the "Pedal Lever" (D63984), Item 5 - D66093 to its full up position. Push the shoulder restraint to any closed position. If the "Ratchet Module Assembly" (D64890), Item 1 or 2 - D66093 does not allow this to happen, readjust the jam nuts on the "Cable" (511426), Item 26 - D66093 and/or the "Rod Ends" (506201), Item 15 - D64890 to cause the "Ratchet Block" (B47695), Item 6 - D64890 to push away from the "Ratchet Shaft" (D62377), Item 1 - D64890.

IV. This should complete the adjustment. Do not Change the 5 inch dimension on the "Ratchet Module Assembly" (D64890).

6. Limit Switch Actuator

a. Limit switch actuators must be in place and show no signs of bending or looseness. These are to be found at the left front wheel of the first coach and the right rear wheel of the last coach in each train.

IV. PERIODIC INSPECTIONS - CORKSCREW AND LOOP

track gauge no more than 3/8 movement

Items to be checked at other than daily intervals:

A. Coach under-carriage to be checked weekly.

1. Carefully examine each coach under-carriage for any signs of bending or cracks adjacent to or in welds. Particular attention must be given to the axle housing and wheel carrier weldment. It is important to use a strong light when working on the chassis area, axle housings or wheel carrier.

2. All fasteners on the chassis, axle housing and wheel carrier assembly must be in place and secure.

3. Brake fin fasteners must be in place and secure.

B. The vertical center spindle on the front axle of each coach requires a weekly check for any sign of looseness. This can be done by rocking the body of the coach from side to side. A firm resistance to this action should be felt. The coach should not rock at all.

The cause of any looseness is either a loose bearing adjustment on top of the spindle or a broken spindle. Any motion must be investigated at once and corrected.

C. The Vlier rubber springs that cushion the wheel carrier must be replaced at the start of each operating season and every six months for those parks that are on a year-round schedule.

The rubber tends to get stiff with use and take on a permanent deformation. The stiffness results in a harder ride while the deformation allows the chassis to run lower and may cause some chassis to rub or scrape on top of the brake assemblies.

ARROW

TECHNICAL BULLETIN - NO. 88-1

DATE: JANUARY 4, 1988

TO: OPERATORS OF CORKSCREW, LOOP, AND SUSPENDED COASTERS

SUBJECT: CHASSIS SPINDLE INSPECTION AND INSTALLATION PROCEDURE

TYPE OF ACTION: RECOMMENDED AS PART OF NEXT ANNUAL N.D.T. INSPECTION AND THEREAFTER.

DISCUSSION: THE CHASSIS SPINDLE IS TO BE INSPECTED FOR CORROSION AT THE SEAT FILLETS. SPINDLES WITH PITTING CORROSION ARE TO BE REPLACED. THE SPINDLE AND CHASSIS HOUSING ARE TO BE COATED WITH A CORROSION INHIBITOR FOR INSTALLATION.

ACTION REQUIRED:

1. REMOVE THE CHASSIS-AXLE SPINDLE
   SUSPENDED COASTER - PART NO. C54849
   CORKSCREW COASTER - PART NO. C33639

2. CLEAN SPINDLE AND BORE OF CHASSIS HOUSING WITH SOLVENT (METHYL ETHYL KETONE, NAPHTHA, 1, 1, 1 - TRICHLOROETHANE).

3. DRY SPINDLE AND BORE OF CHASSIS HOUSING.

4. INSPECT SPINDLE FOR PITTING CORROSION, AT FILLET RADIUS, ON BOTH SIDES OF THE SHAFT "SEAT" (SEAT IS LARGEST SHAFT DIAMETER).

5. IF SURFACE PITTING IS OBSERVED, REPLACE WITH NEW SPINDLE.

6. INSTALL SPINDLE USING ONE OF THE FOLLOWING SEALANTS: RHONE - POULENC RHODORSIL CAF 440F OR GENERAL ELECTRIC N-SIL RTV 128.

7. APPLY TWO (2) 1/4 INCH BEADS OF SEALANT TO TOP INSIDE OF BORE IN CHASSIS HOUSING AROUND ENTIRE CIRCUMFERENCE. APPLY SMALL BEAD ON TOP OF CHASSIS HOUSING.

8. APPLY 3/16 INCH BEAD OF SEALANT TO THE SPINDLE, 1/2 INCH BELOW THE BOTTOM OF THE SEAT.

9. SLIDE SPINDLE INTO CHASSIS HOUSING. EXCESS SEALANT SHOULD BE VISIBLE AT THE TOP AND BOTTOM OF THE CHASSIS HOUSING. IF NOT, REMOVE SPINDLE AND REPEAT STEPS 7 AND 8.

10. REMOVE EXCESS SEALANT. ALLOW TO CURE FOR 12 HOURS BEFORE USE.

11. THE REMOVAL OF SEALANTS DURING FUTURE N.D.T. INSPECTIONS CAN BE ACCOMPLISHED USING TOLUENE OR XYLENE. THEN FOLLOW PROCEDURES 1 THROUGH 10 FOR INSTALLATION.

ARROW CONTACT: ENGINEERING DEPARTMENT

ENCLOSURES: DRAWING C54849 - CHASSIS SPINDLE, DRAWING C33639-SPINDLE, CENTER AXLE.

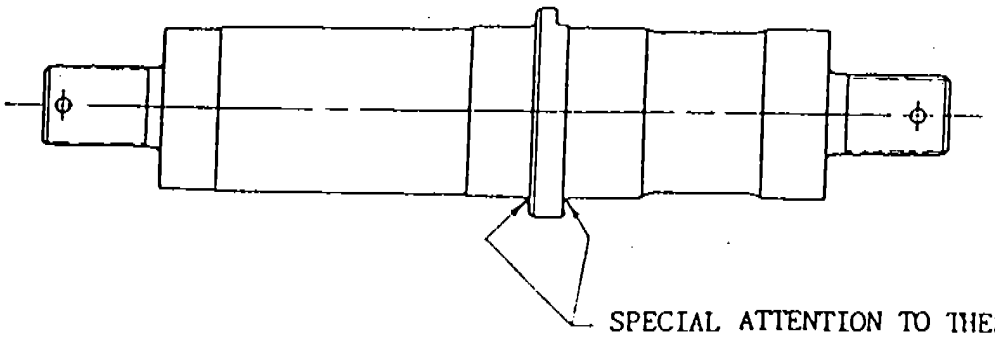
Arrow Dynamics, Inc. dba Arrow Inc.
Clearfield, Utah 84016 P.O. Box 1386, Freeport Center Building G-11
Tel (801) 825-1611 TLX 388411 Telecopier (801) 776-2671

DATE: JANUARY 4, 1988

TO: OPERATORS OF CORKSCREW, LOOP AND SUSPENDED COASTERS

SUBJECT: CHASSIS SPINDLE INSPECTION AND INSTALLATION PROCEDURE

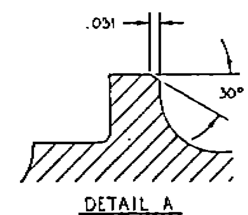
NOTE: SEE ARROW TECHNICAL BULLETIN NO. 88-1

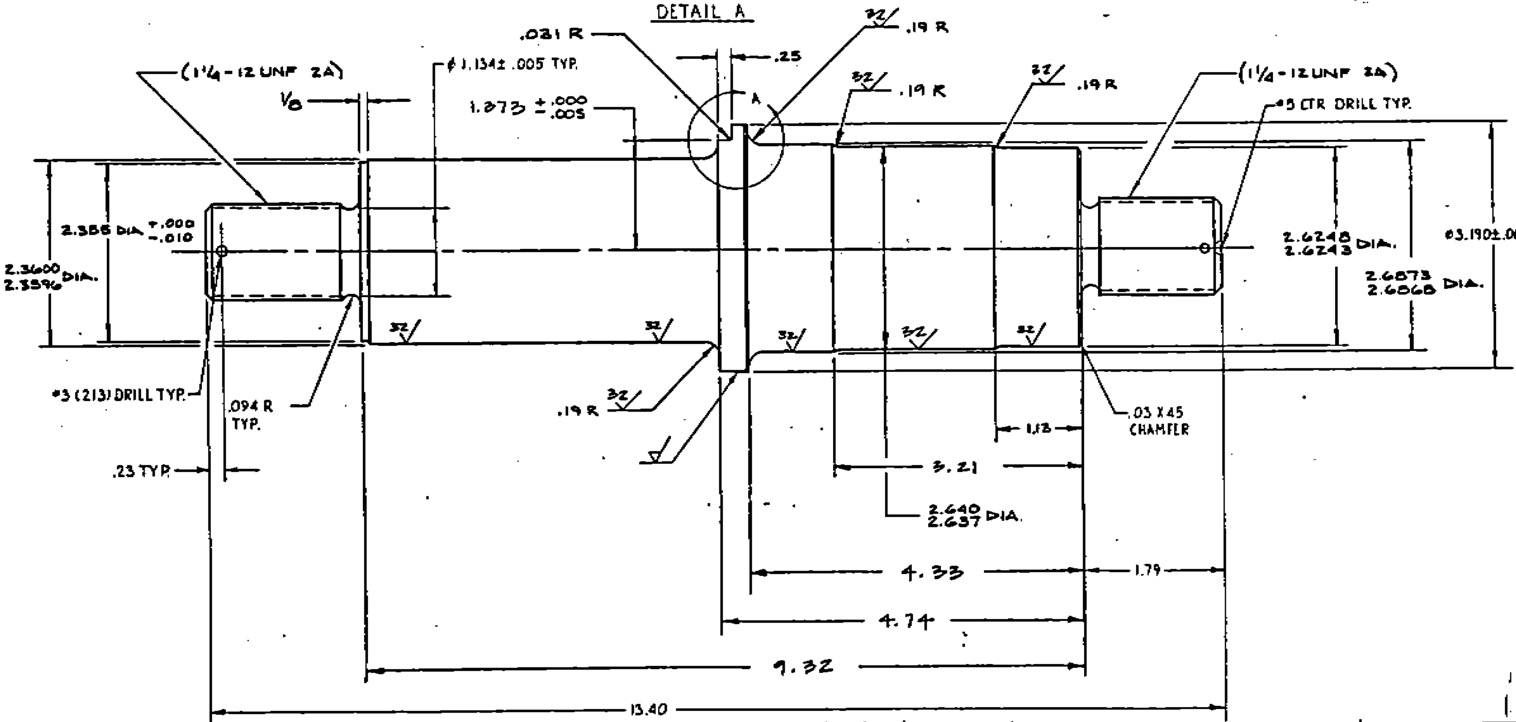


NOTES:

1. BEFORE STORAGE APPLY LIGHT COAT OF RUST PREVENTING OIL.
2. C33639 IS A PART OF CRITICAL NATURE & MUST CONFORM TO S.P. #8-1-1.
3. ALL INSIDE RADII TO BE GROUND. NO UNDERCUTS OR TOOL MARKS.
4. HEAT TREAT TO Rc 38-42 IN CONTROLLED ATMOSPHERE PRIOR TO FINAL MACHINE.
5. MAGNETIC PARTICLE INSPECT AFTER HEAT TREAT AND BEFORE FINAL MACHINE. INSPECTION RESULTS REQUIRED.
6. CERTIFIED MILL TEST REPORTS REQUIRED.

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG
L	B-2	ADDED 2.640/2.637 DIA	[illegible]	RT	RT
—	—	REDRAWN FOR CLARITY	[illegible]	[illegible]	
M	C-3	1.375 DIM WAS: ±.001	MG 3-8-[illegible]	[illegible]	
N	B,2-3	ADDED 4.58, .41 & 4.33	[illegible]	RFB 5-3-[illegible]	RFB
P	C/3	REVISED PICTURE TO SHOW THREAD RELIEF	[illegible]	[illegible]	[illegible]
Q	C-3	ADDED .195 DIM. DELETED 1.375	[illegible]	[illegible]	
R	C3	CORRECTED PICTURE (THREADS)	[illegible]	[illegible]	
S	D3,4	ADDED NOTE 4.	[illegible]	[illegible]	
T		ADDED RELIEF & MACH. FINISHES	[illegible]	[illegible]	
U	C-3	ADDED .094 R & ϕ1.134±.005. DELETE C33638	RDH 1-5-90		





ITEM	QTY	PART IDENT	DESCRIPTION	MAT'L SPEC
1	1	509684	BAR 3½ DIA. X 13.40"	4340 H.R. ANN.

NEXT ASSEMBLIES: C33665

UNLESS OTHERWISE SPECIFIED

SCALE: FULL
DRAWN: [illegible] 12-8-76
CHECK: EB
PROJECT: EB
APPROVAL: RT

DO NOT SCALE

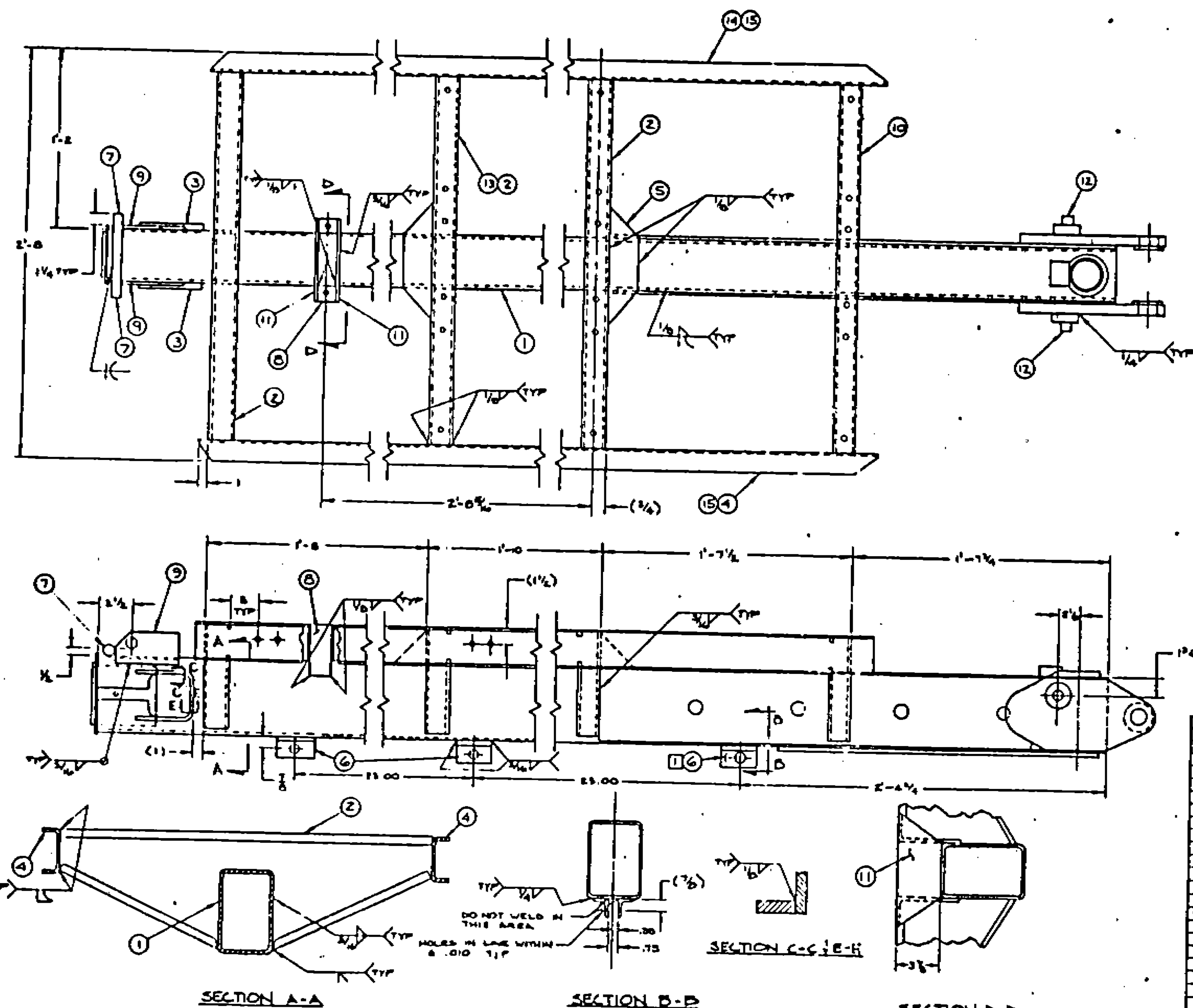
ARROWEK
PO Box 1355 · Freeport Center, Clearfield, Utah 84016

TITLE: SPINDLE, CENTER AXLE CORKSCREW

DRAWING NUMBER: C33639 U

MICROFILMED JUL 20 19[illegible]

C	—	ITEM (8) WAS A18708	
—	—	REMAIN WITHOUT CHANGE	



NOTES:

1. USE DRILL JIG B5916B FOR WELDING ITEM 6.
2. MASK FRONT & REAR HOUSING BORES AND YOKE PIN HOLES.
3. PRIME WITH GLEAM SEALER AND PAINT WITH BLACK POLANE.
4. WELD SPEC 001.
5. 801 ASSY FOR CORK TRAIN ONLY. 802 ASSY FOR LOOP TRAIN AND CORK TRAIN WITHOUT AUTOMATIC RELEASE.

ITEM	802 QTY	801 QTY	PART NUMBER	DESCRIPTION
15	2	—	B20691	CHANNEL
14	—	1	C44079-2	CHANNEL, FRAME SIDE MEMBER
13	—	1	C44080	CROSS MEMBER
12	2	2	B32718	SAFETY CABLE MTG. WELDMENT
11	2	2	A34005	GUSSET
10	1	1	C34248	CROSS MEMBER (FRONT)
9	2	2	A7811	ANCHOR
8	2	2	A31608	BRACKET-FLOOR TO SEAT
7	1	1	A23710	STOP
6	6	6	A30006	MOUNT, FRAME PIN
5	2	2	D40866	GUSSET
4	—	1	C44079-1	CHANNEL, FRAME SIDE MEMBER
3	2	2	A31002	COLLAR PLATE
2	3	2	C20695	CROSS MEMBER
1	1	1	D31891	MAIN BEAM WELDMENT

SCALE: NONE

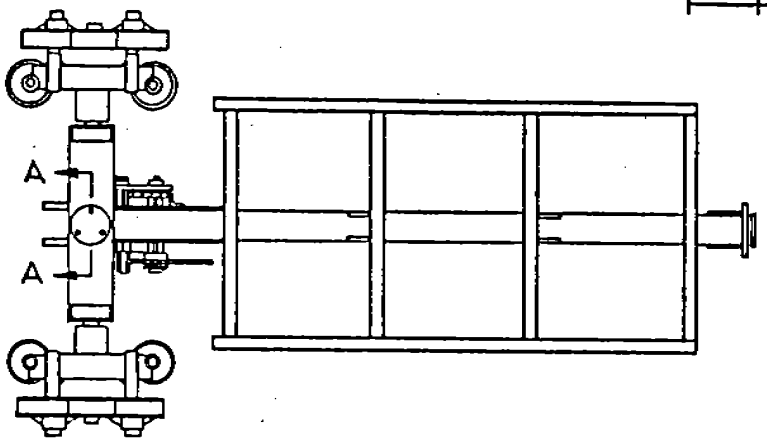
ARROW

INTERMEDIATE - CHASSIS WELDMENT - CORKSCREW

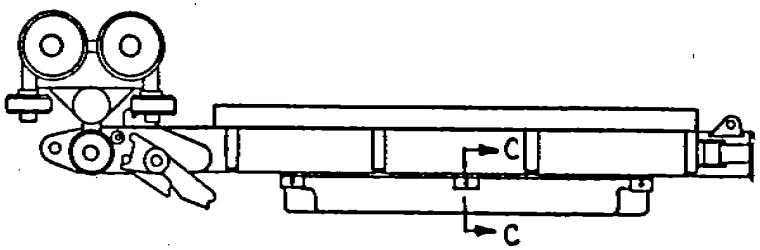
D43645 C

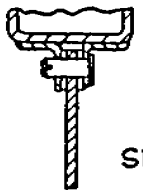
LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG. APP.

NOTES:



SECTION A-A





SECTION C-C

ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC

NEXT ASSEMBLIES

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS: ± 1/16
DECIMALS:
X ± .060
.XX ± .030
.XXX ± .010
ANGLES: ± ½°
MACHINE FINISH

DO NOT SCALE

SCALE
DRAWN DATE
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW

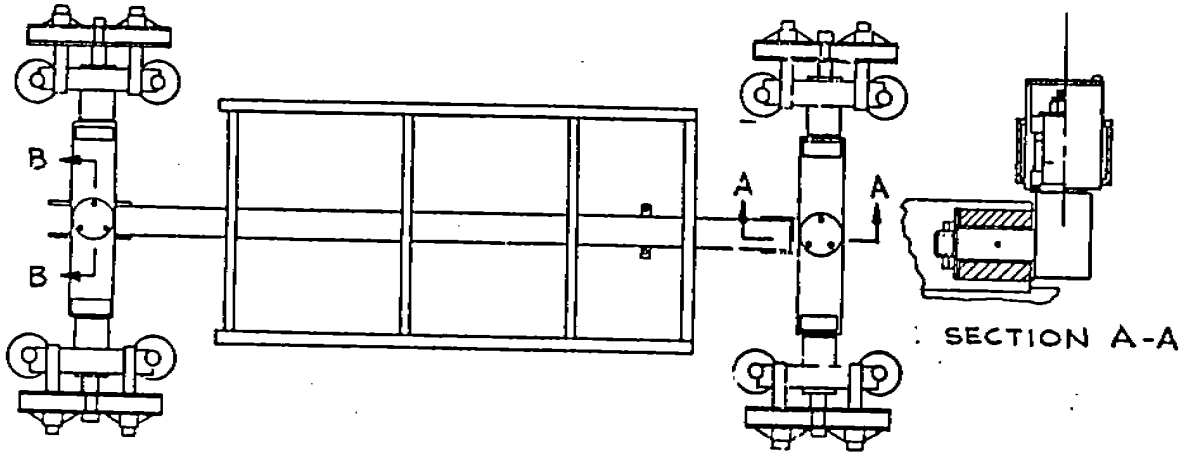
Arrow Development Co., Inc.
1835 Plymouth Street
Mountain View, CA 94042
(415) 968 8342

TITLE:

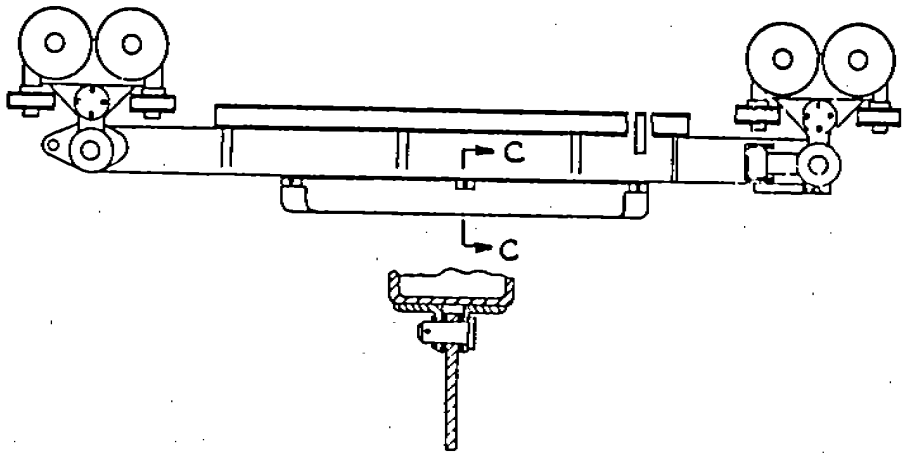
PICK-UP CHASSIS ASSY
CORKSCREW

B

DRAWING NUMBER | REV



SECTION A-A



SECTION C-C

SECTION B-B

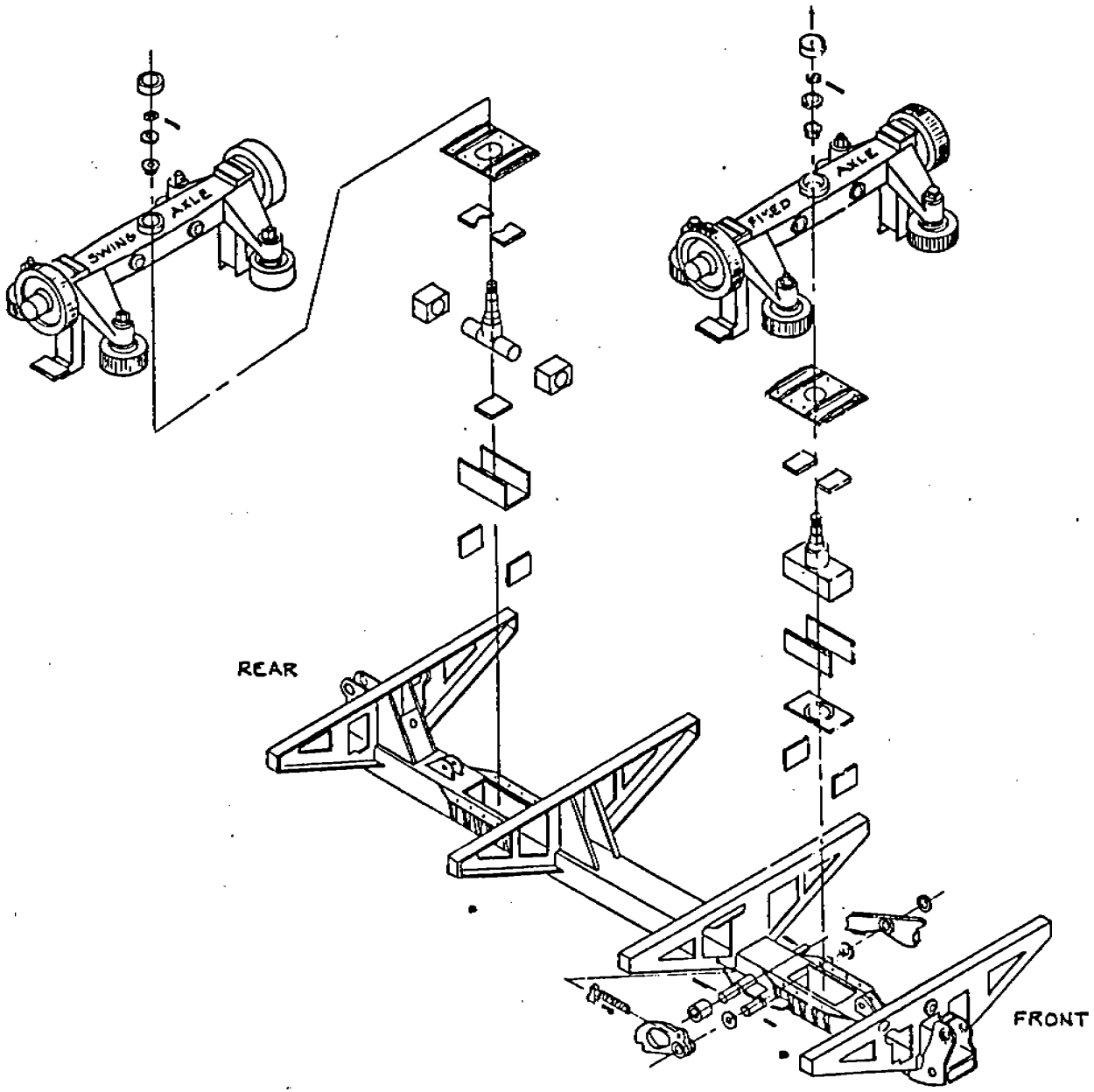
ARROW

Arrow Development Co., Inc.
1555 Plymouth Street
Mountain View, CA 94043
(415) 968-8342

TITLE:

TRAILING CHASSIS ASSEMBLY
CORKSCREW

DRAWING NUMBER



ARROW

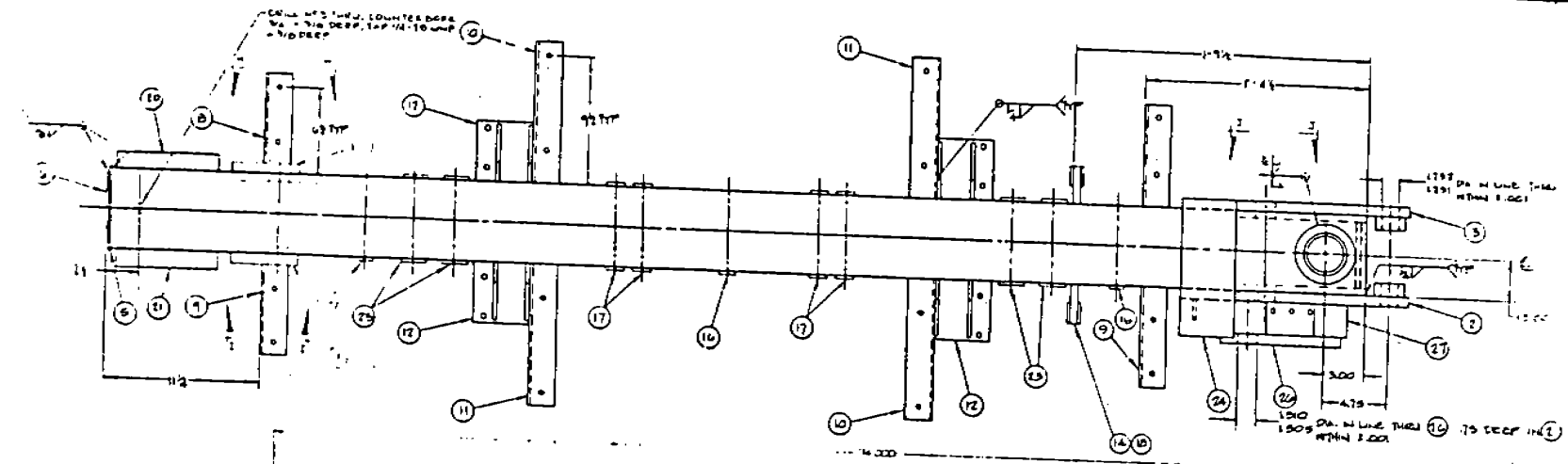
Arrow Development Co., Inc.
1558 Plymouth Street
Mountain View, CA 94043
(415) 968-8342

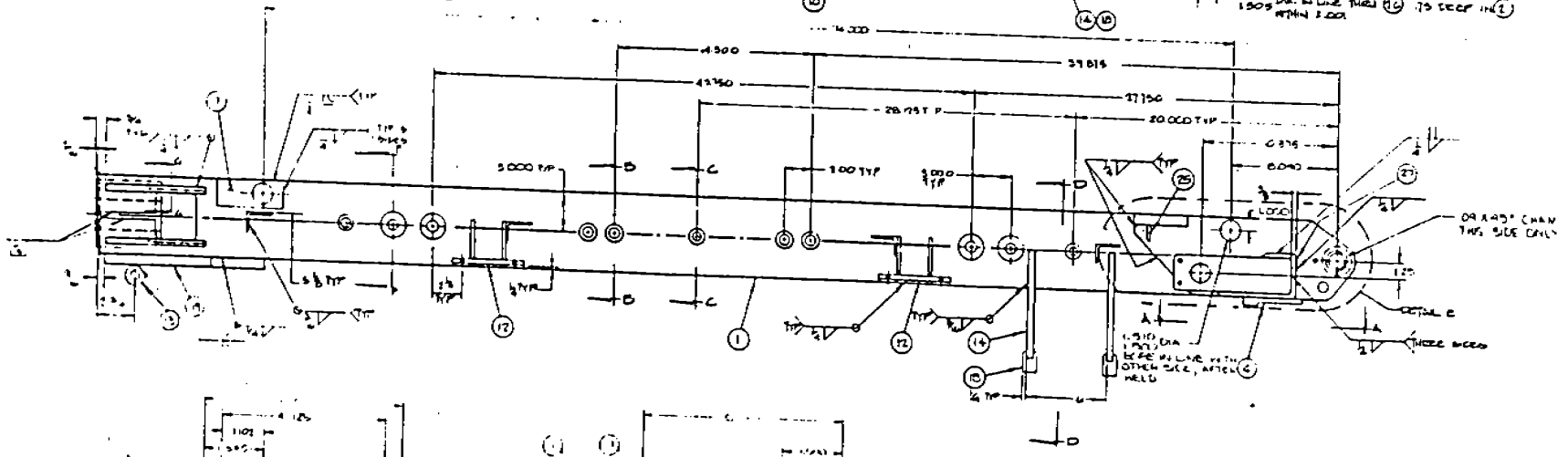
TITLE:

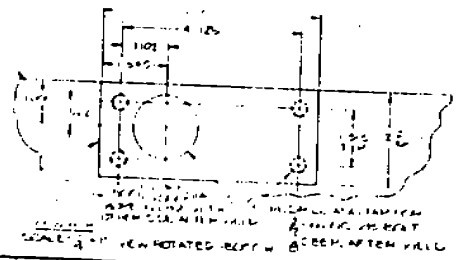
CHASSIS SUB-ASSY 2ND & 4TH COACH RUN-AWAY TRAIN

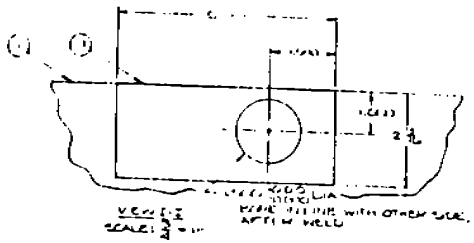
DRAWING NUMBER

NOTES









ARROW

CHASSIS MIDMOUNT PICK-UP

SUSPENDED COMPLETE

V. YEARLY INSPECTION - CORKSCREW AND LOOP

Once each year, normally during the winter shutdown, the following inspection is required.

A. Track And Lifts

1. Welded areas on the track including joints in the rails, tie to rail joints, tie to 12" beam and welding around the column saddle are to be inspected by magnetic particle or dye penetrant methods. Special attention should be given to high speed curves and pullout areas where the loads are the highest. If no signs of cracks are found in these areas, the slow speed spots require no more than a visual check.

   Track splice joints should be checked all around the pipe for small cracks starting in or adjacent to the weld. These joints should be checked over the entire course.

2. The lifts should be inspected in the same areas described for the track in general. In addition, the welding on the anti-rollback units and the chain guide should be subjected to magnetic particle or dye penetrant inspection.

B. Trains

Two coaches, including the number two coach from one train, that have been used the most must be completely disassembled and subjected to a thorough inspection as follows:

1. Check all wheel spindles for cracks using magnetic particle or dye penetrant.

2. Check all wheel spindles for wear caused by rotation of bearings on shaft. If this is a problem, use the inside bearing to the shaft.

3. The entire axle housing and wheel carrier weldments are to be subjected to a thorough magnetic particle inspection to detect any cracks that may be present.

4. Subject the wheel carrier spindle to a complete magnetic particle inspection.

5. Chassis Weldment

a. Remove the main vertical spindle from the chassis member, (this should slip out easily. There is a Technical Bulletin that called for modification of this spindle so that it does not press into the chassis.) and subject it to a complete magnetic particle or dye penetrant inspection to detect any cracks.

b. Check all welds around hubs that hold dog shafts and all welds between the body support frames and the main chassis member using magnetic particle or dye penetrant.

c. Remove the hitch yoke from the chassis and subject it to a complete magnetic particle or dye penetrant inspection.

Check the bushings in the hitch yoke and in the chassis for wear, looseness or scoring. Replace bushings as required.

d. Check welding of anchors for safety cable attachment.

6. A close visual inspection of all remaining chassis parts should be made.

7. If the above procedure uncovers any problems, then all remaining coaches must be examined in those areas that show trouble.

   If no problems are found, then the remaining coaches must be disassembled so that all of the following items can be inspected using magnetic particle or dye penetrant methods.

   a. All wheel spindles

   b. All main vertical spindles

   c. All hitch yokes

   d. All wheel carrier spindles

   e. All axle housings at welds around central hub, top and bottom.

   In addition all spindles are to be examined carefully for wear caused by rotating bearing races.

8. Inspect the cushion block bearing for wear. If the bronze backing is visible, replace the bushing.

9. All reassembly of coaches must be in accordance to the pertinent Arrow Dynamics, Inc. assembly drawings. Careful attention must be paid to all torque values for fasteners.

ARROW

ARROW COASTER INSPECTION

BY

ARROW DYNAMICS, INC.
(JANUARY 1991)

Arrow Dynamics, Inc. d/b/a Arrow I
[illegible] Utah 84016 P.O. Box [illegible] Freeport Center Building G-11
Te[illegible] 825-1611 TLX [illegible] [illegible] 776-2571

THE ARROW DYNAMICS' WORKBOOK IS TO BE USED IN THE A.R.E.A. SEMINAR ONLY AS A GENERAL GUIDE IN DISCUSSING ARROW PRODUCTS AND MAINTENANCE ISSUES.

IT IS NOT TO BE USED TO ORDER PARTS OR MAINTAIN ANY EQUIPMENT SHOWN OR DESCRIBED IN THE ILLUSTRATIONS.

SERVICE, MAINTENANCE, AND OPERATING PERSONNEL ARE TO REFER TO THE ARROW OPERATOR'S MANUAL FOR INSTRUCTIONS PERTAINING TO THE OPERATING AND MAINTENANCE OF THEIR SPECIFIC RIDE.

ARROW DYNAMICS IS NOT LIABLE FOR ANY ACTIVITY RELATING TO THE OPERATION OR MAINTENANCE OF ANY RIDE USING INFORMATION FROM THIS WORKBOOK, IN LIEU OF THE RIDE OPERATOR'S MANUAL FURNISHED FOR EACH RIDE.

ARROW COASTER INSPECTION

I. INTRODUCTION

It is difficult to over emphasize the importance of a comprehensive program of inspection and maintenance that is performed faithfully and conscientiously by knowledgeable people.

Each Arrow Dynamics coaster has an Owner's Manual that describes such a program on a daily, weekly and monthly basis with a more complete inspection to be performed annually.

Each inspection must be performed by someone who understands what he is looking for and how to recognize a problem. A complete understanding of the mechanics of the system is essential to a good maintenance program.

A log book should be maintained to verify that each required inspection or maintenance procedure has been completed. The log book should be signed by the person performing a task and by a responsible supervisor who can verify that the task was performed. The log book should list any discrepancies observed and what was done to resolve them. Any discrepancy must be corrected before running the ride.

II. IMPORTANCE OF INSPECTION

The theme in all ride inspection and maintenance must be faithful adherence to each scheduled item, attention to detail and common sense. It is extremely dangerous to decide that is not worth checking because nothing has been found for the past three months.

It is important that any repairs are made properly. It is dangerous to permit emergency repairs, temporary fixes or any alteration of any part of a system without consulting the manufacturer of the ride.

We have seen many repairs that have been made or even new parts made for rides, using the wrong procedures or improper materials, that have failed after a short period of operation.

Considering the liability problem we face in today's society, it is very foolish to pretend to save money by improper repairs or replacement of parts.

III. DAILY INSPECTIONS - CORKSCREWS AND LOOPS

We will consider the train-track system used on corkscrews, loops and other Arrow coasters as they are the same units in each case.

The following are to be checked every day the ride will operate, before opening the ride.

A. Track And Supporting Structure

1. Walk around the ride under the track and check for:

   a. Cracks (area close to ground) in ties, track, etc.

   b. All cross braces and other structural members in place.

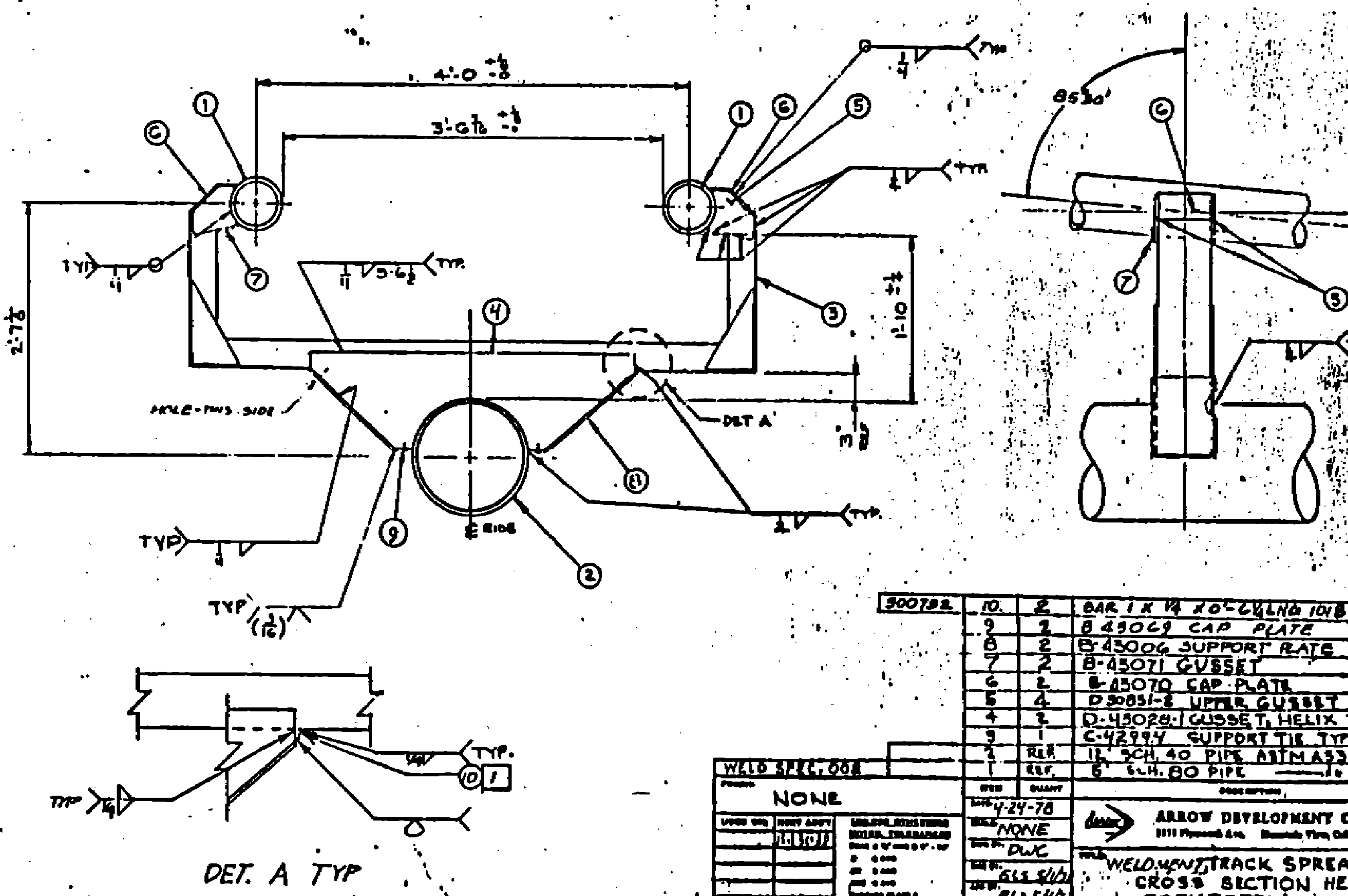
   c. Any nuts, bolts or other parts on the ground.

   d. Loose or broken anchor bolts at the base of supports.

   e. Grout solidly in place below column base plates.

NOTE:
1 ADD ITEM 10 IF NECESSARY

SYM	ZONE	REVISIONS	DATE	BY	APP
A		ITEMS 6,7, WERE 42490, 45817 ADD ITEM 9 ... DIMENSIONS	5/1/78	[illegible]	[illegible]
B		ADDED ITEM 10 ADDED DETAIL A	6/12/78	BB	[illegible]
C	C-3	[illegible] TYP WAS [illegible] TYP; ADDED WELD TO INSIDE OF (1)	7-19-78	DWC	[illegible]
D		QTY. (5) WAS (3)	7/19/78	[illegible]	
E	4-B	TYP. [illegible] WAS TYP.	11-27-78	DWC	[illegible]
F	C-3	REMOVE WELD BEHIND BAR	[illegible]	[illegible]	[illegible]



	ITEM	QUANT	DESCRIPTION
300792	10.	2	BAR 1 X 1/4 X 0'-6 LNG 1018 HRS
	9	2	B 45069 CAP PLATE
	8	2	B-45006 SUPPORT PLATE
	7	2	B-45071 GUSSET
	6	2	B-45070 CAP PLATE
	5	4	D 50851-2 UPPER GUSSET
	4	2	D-45028-1 GUSSET, HELIX TIE
	3	1	C-42994 SUPPORT TIE TYPE 2
	2	REF.	12" SCH. 40 PIPE ASTM A53 GRADE A
	1	REF.	5" SCH. 80 PIPE

WELD SPEC. 008
FINISH: NONE

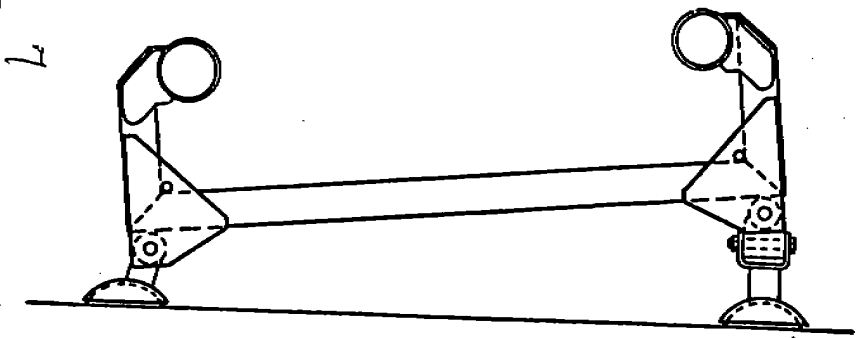
DATE 4-24-78
SCALE NONE
DWN. BY DWC

ARROW DEVELOPMENT COMPANY

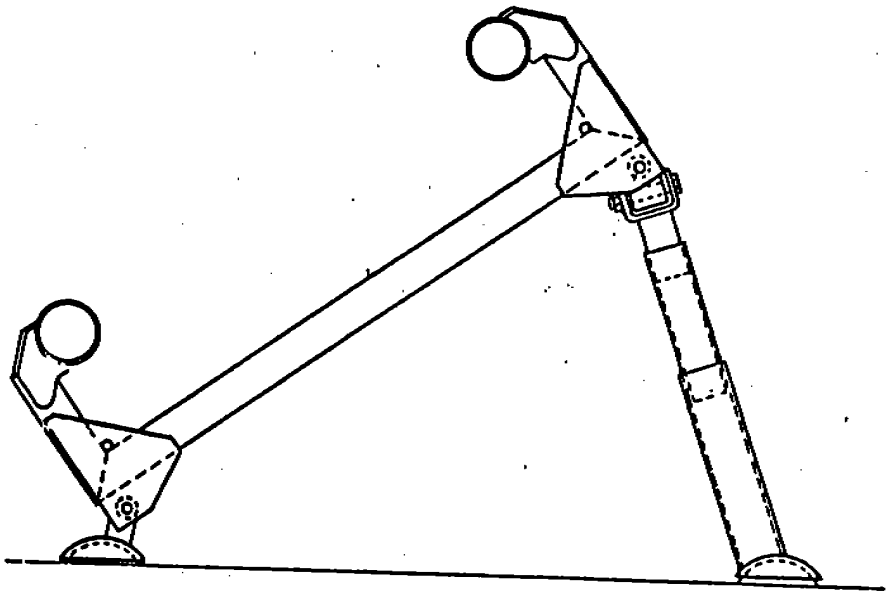
TITLE WELDMENT, TRACK SPREADER CROSS SECTION HELIX CORKSCREW

NOTES:

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP



CROSS SECTION TRACK @ 1° THRU 7° BANK



CROSS SECTION TRACK @ 8° THRU 55° BANK

ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC

NEXT ASSEMBLY

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS ± 1/16
DECIMALS:
.X ± .090
.XX ± .000
.XXX ± .010
ANGLES: ± ½°
MACHINE FINISH 125
DO NOT SCALE

SCALE
DRAWN DATE
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW

Arrow Development Co., Inc.
1555 Plymouth Street
Mountain View, CA 94043
(415) 968 0342

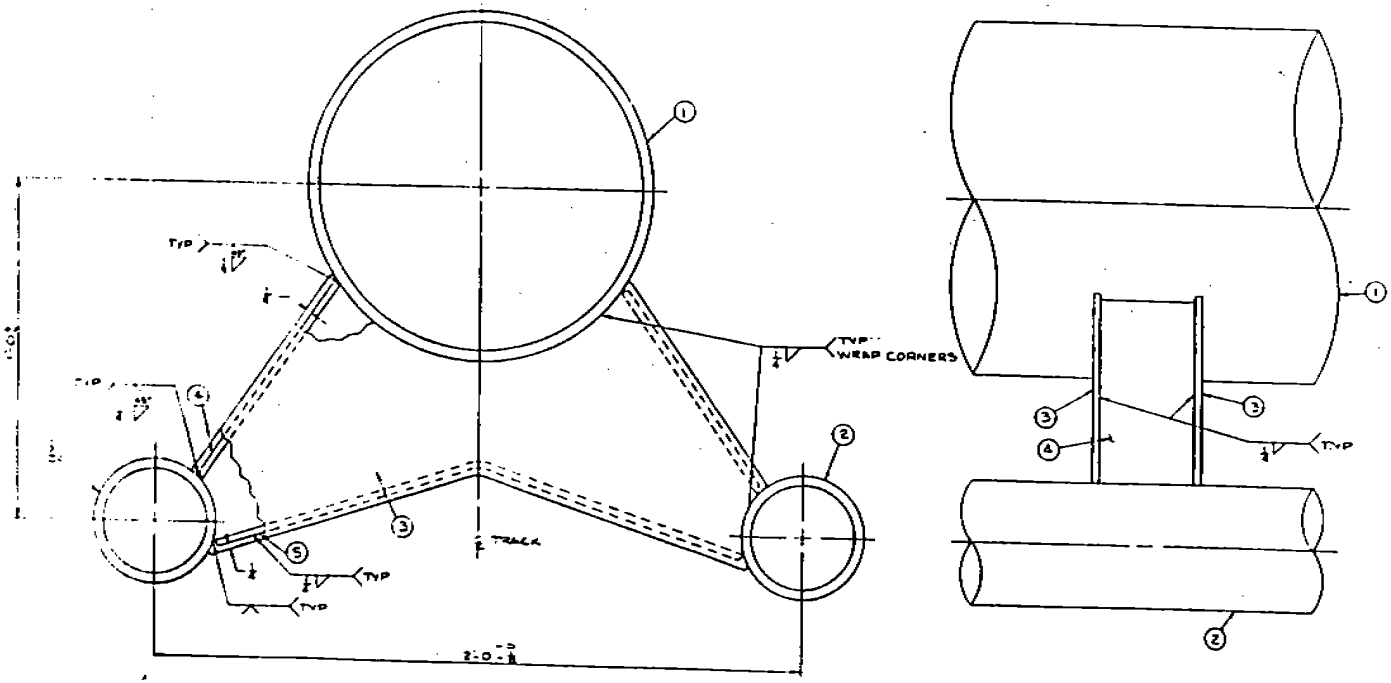
TITLE:
CROSS SECTION THRU TRACK - RUN-AWAY TRAIN

B

DRAWING NUMBER

REV

NOTES
1. WELD SPEC 001
2. FINISH PAINT



5	1	C60969-2	TIE PLATE GUSSET	
4	2	C60968-1	TIE PLATE GUSSET	
3	2	053208	TIE PLATE	
2	REF	501015	PIPE 4" SCH 40	A53 GR B
1	REF	506030	PIPE 12" STD (.375 WALL)	A53 GR B

ARROW

WELDMENT - TRACK TIE ASSY
SUSPENDED CARTER

D 60968

MATERIAL

2. Walk up lift stairway and check:

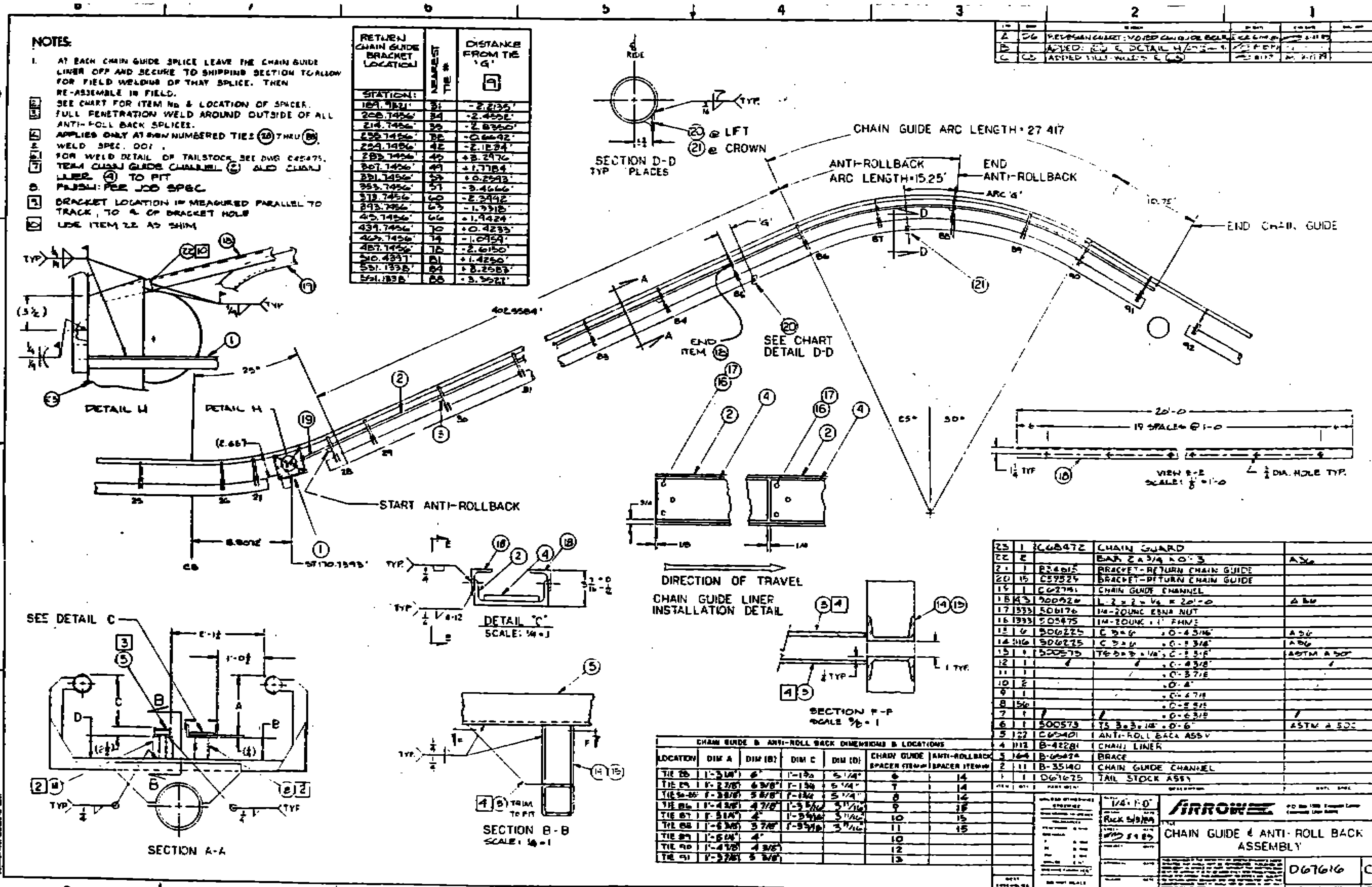
   a. Lift chain for any sign of excess wear on side bars, pins or barrels.

   b. Chain guide for cracks or bending of channel and attachment gussets. Sand or other abrasive material. Polyethylene liner in place.

   c. Track, ties and other welded areas.

   d. Examine head shaft at top of lift for loose fasteners, alignment of shaft and sprocket. Wear pattern on sprocket.

   e. Checker drive for adjustments.



NOTES:

1. AT EACH CHAIN GUIDE SPLICE LEAVE THE CHAIN GUIDE LINER OFF AND SECURE TO SHIPPING SECTION TO ALLOW FOR FIELD WELDING OF THAT SPLICE. THEN RE-ASSEMBLE IN FIELD.
2. SEE CHART FOR ITEM No & LOCATION OF SPACER.
3. FULL PENETRATION WELD AROUND OUTSIDE OF ALL ANTI-ROLL BACK SPLICES.
4. APPLIES ONLY AT EVEN NUMBERED TIES (28) THRU (88)
5. WELD SPEC. 001.
6. FOR WELD DETAIL OF TAILSTOCK SEE DWG C45475.
7. TRIM CHAIN GUIDE CHANNEL (2) AND CHAIN LINER (4) TO FIT
8. FINISH: PER JOB SPEC.
9. BRACKET LOCATION IS MEASURED PARALLEL TO TRACK, TO ℄ OF BRACKET HOLE
10. USE ITEM 22 AS SHIM

RETURN CHAIN GUIDE BRACKET LOCATION STATION:	NEAREST TIE #	DISTANCE FROM TIE 'G' [9]
184.9821'	31	-2.2135'
208.7456'	34	-2.4552'
214.7456'	35	-2.8350'
238.7456'	38	-0.6642'
259.7456'	42	-2.1234'
283.7456'	45	+3.2976'
307.7456'	49	+1.7784'
331.7456'	53	+0.2593'
353.7456'	57	-3.4666'
373.7456'	60	-2.3442'
393.7456'	63	-1.7318'
415.7456'	66	+1.9424'
439.7456'	70	+0.4233'
463.7456'	74	-1.0959'
487.7456'	78	-2.6150'
510.4397'	81	+1.4250'
531.1338'	84	+3.2583'
551.1838'	88	-3.3527'

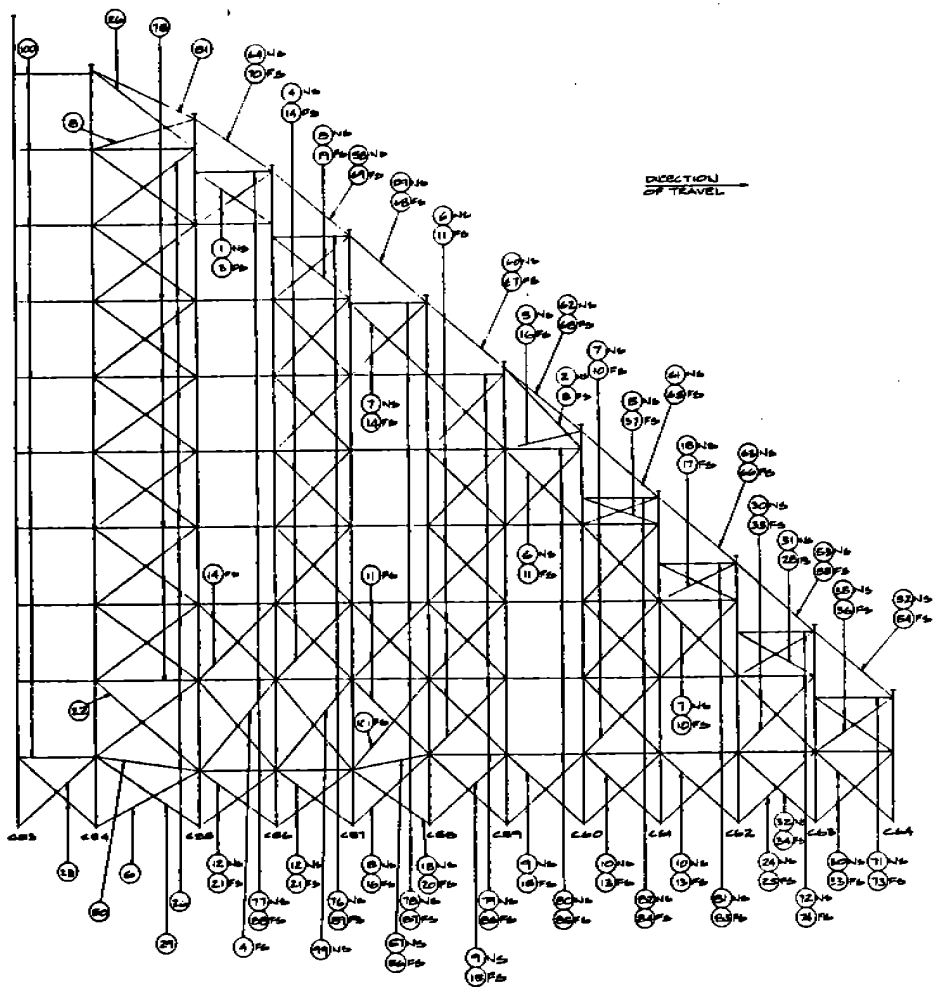
CHAIN GUIDE & ANTI-ROLL BACK DIMENSIONS & LOCATIONS

LOCATION	DIM A	DIM (B)	DIM C	DIM (D)	CHAIN GUIDE SPACER ITEM#	ANTI-ROLLBACK SPACER ITEM#
TIE 28	1'-3 1/8"	6"	1'-1 7/8	5 1/4"	6	14
TIE 29	1'-2 7/8"	6 3/8"	1'-1 3/4	5 1/4"	7	14
TIE 30-85	1'-3 1/8"	5 5/8"	1'-1 3/4	5 1/4"	8	14
TIE 86	1'-4 3/8"	4 7/8"	1'-3 5/16	3 11/16	9	15
TIE 87	1'-5 1/4"	4"	1'-3 9/16	3 11/16"	10	15
TIE 88	1'-6 3/8"	3 7/8"	1'-3 9/16	3 11/16"	11	15
TIE 89	1'-6 1/4"	4"			10	
TIE 90	1'-4 7/8"	4 3/8"			12	
TIE 91	1'-5 7/8"	5 3/8"			13	

ITEM	QTY	PART NO.	DESCRIPTION	MATL SPEC
23	1	C68472	CHAIN GUARD	
22	2		BAR 2 x 3/4 x 0'-3	A36
21	1	B24615	BRACKET-RETURN CHAIN GUIDE	
20	15	C59529	BRACKET-RETURN CHAIN GUIDE	
19	1	C62781	CHAIN GUIDE CHANNEL	
18	63	500920	L-2 x 2 x 1/4 x 20'-0	A36
17	1333	506176	1/4-20UNC ESNA NUT	
16	1333	503475	1/4-20UNC x 1" FHMS	
15	6	506225	C 5 x 6.7 x 0-4 3/16"	A36
14	116	506225	C 5 x 6.7 x 0-5 3/4"	A36
13	1	500575	TS 5 x 3 x 1/4" x 0-5 5/8"	ASTM A 500
12	1	✓	✓ x 0-4 3/8"	✓
11	1		x 0-3 7/8	
10	2		x 0-4"	
9	1		x 0-4 7/8	
8	56		x 0-5 5/8	
7	1	✓	✓ x 0-6 3/8	✓
6	1	500573	TS 3 x 3 x 1/4" x 0-6"	ASTM A 500
5	127	C65401	ANTI-ROLL BACK ASSY	
4	112	B-42281	CHAIN LINER	
3	164	B-65474	BRACE	
2	11	B-35140	CHAIN GUIDE CHANNEL	
1	1	D67625	TAIL STOCK ASSY	

ARROW
SCALE: 1/4 = 1'-0"
Rick 5/9/84
CHAIN GUIDE & ANTI-ROLL BACK ASSEMBLY
D67616 C

NOTES:



ARROW

SUPPORT INSTALLATION
TOWER C63-C64

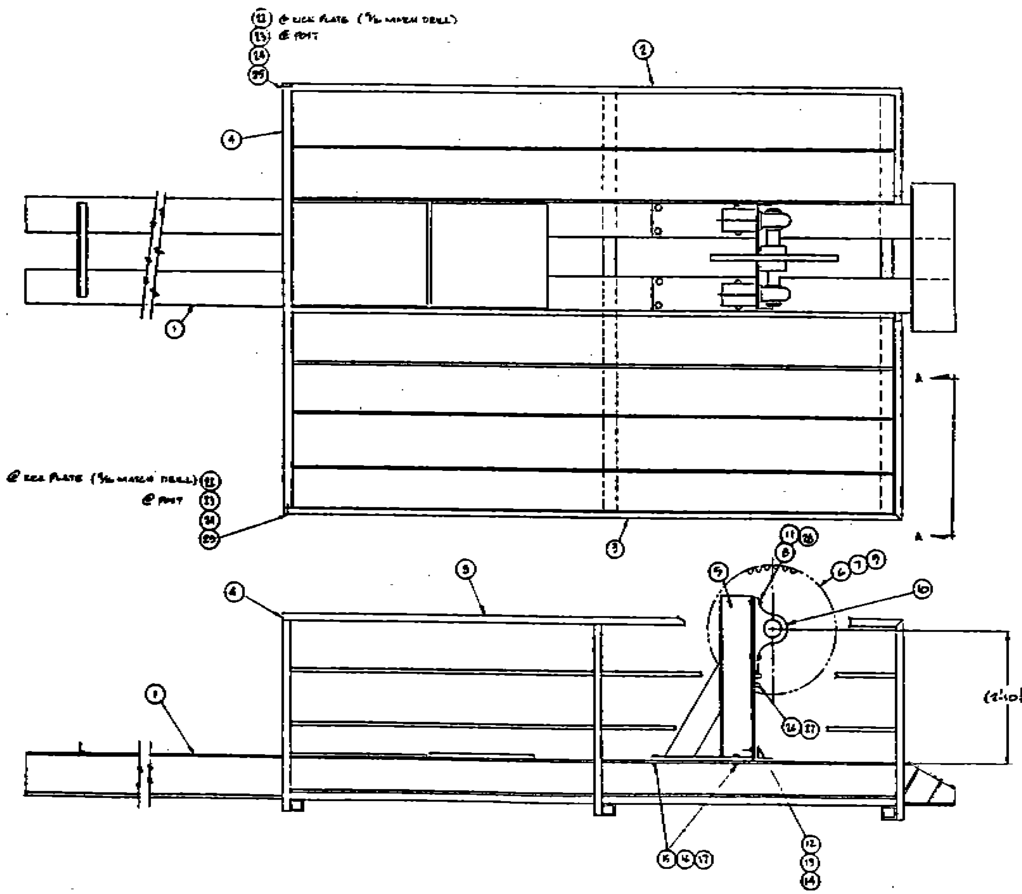
DG2610 A

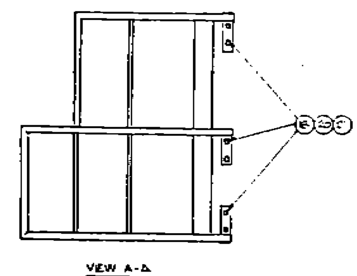
SHT 2 OF 2

MICROFILMED

NOTES
1. FINISH: PER JOB SPEC.
2. FOR FASTENER TORQUE REQUIREMENTS, SEE STANDARD TORQUE SPECIFICATIONS, DRAWING D66195.
3. 501 AS SHOWN, 502 OPPOSITE

LTR		DESCRIPTION		
A		ADDED NOTE 3, ITEMS 29-32		
B		ITEMS 18-27 WERE ...		



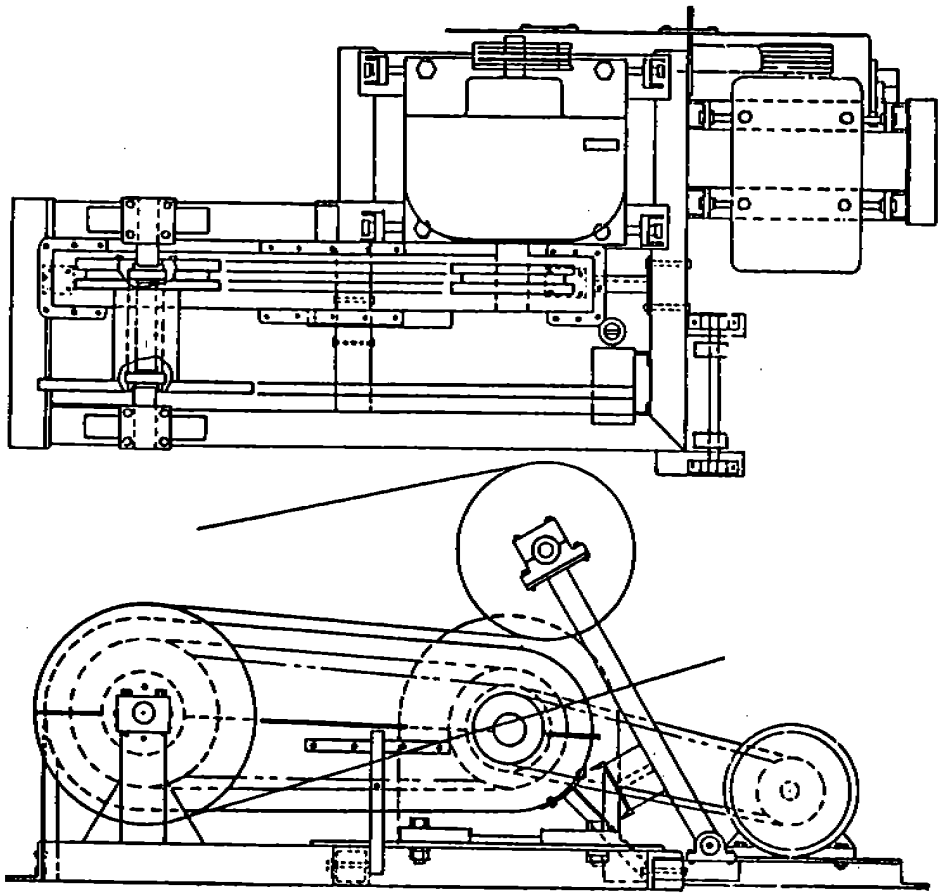

VIEW A-A

ITEM	QTY 502	QTY 501	PART NUMBER	DESCRIPTION	MATL SPEC
32	1	-	C64234-502	WELDMENT - SAFETY RAIL - G	
31	1	-	D64236-502	WELDMENT - SAFETY RAIL - F	
30	1	-	C64235-502	WELDMENT - SAFETY RAIL - E	
29	1	-	D64393-502	HEADSTOCK PLATFORM WELDMENT	
28	16	16	511906	3/8 FLAT WASHER	L32F
27	1	1	315627	[illegible]	
26	1	1	502350	3/4-10UNC JAM NUT	
25	12	12	506221	1/4 FLATWASHER	
24	6	6	502267	1/2-20UNC HEX NUT	GE ZN
23	4	4	501544	1/2-20UNC x 2 1/2 HHCS	GE 5
22	2	2	501490	1/2-20UNC x 1 HHCS	GE 5
21	44	44	506163	1/2 FLATWASHER	
20	22	22	502271	1/2-13UNC HEX NUT	GE ZN
19					
18	22	22	501456	1/2-13UNC x 4 HHCS	GE 5
17	16	16	506175	1" FLATWASHER	
16	8	8	505083	1-8UNC HEX NUT	GE ZN
15	8	8	501686	1-8UNC x 5 HHCS	GE 5
14	8	8	506125	1 1/4 FLATWASHER	
13	4	4	502275	3/4-10UNC HEX NUT	GE ZN
12	4	4	501605	3/4-10UNC x 2 HHCS	GE 5
11	8	8	502270	5/8-11UNC HEX NUT	GE ZN
10	2	2	[illegible]	DODGE PILLOW BLOCK - 5" BORE - TYPE E	
9	2	2	512579	RINGFEEDER LOCKING ASS'Y 5" BORE	SEE P.P SPEC
8	8	8	501596	5/8-11UNC x 5 HHCS	GE 5
7	1	1	C66342	SPROCKET	
6	1	1	C66341	SHAFT	
5	2	2	C90446	WELDMENT - BEARING SUPPORT	
4	-	1	C64234-501	WELDMENT - SAFETY RAIL - G	
3	-	1	D64236-501	WELDMENT - SAFETY RAIL - F	
2	-	1	C64235-501	WELDMENT - SAFETY RAIL - E	
1	-	1	D64393-501	HEADSTOCK PLATFORM WELDMENT	

ARROWHEAD

HEADSTOCK PLATFORM ASSEMBLY

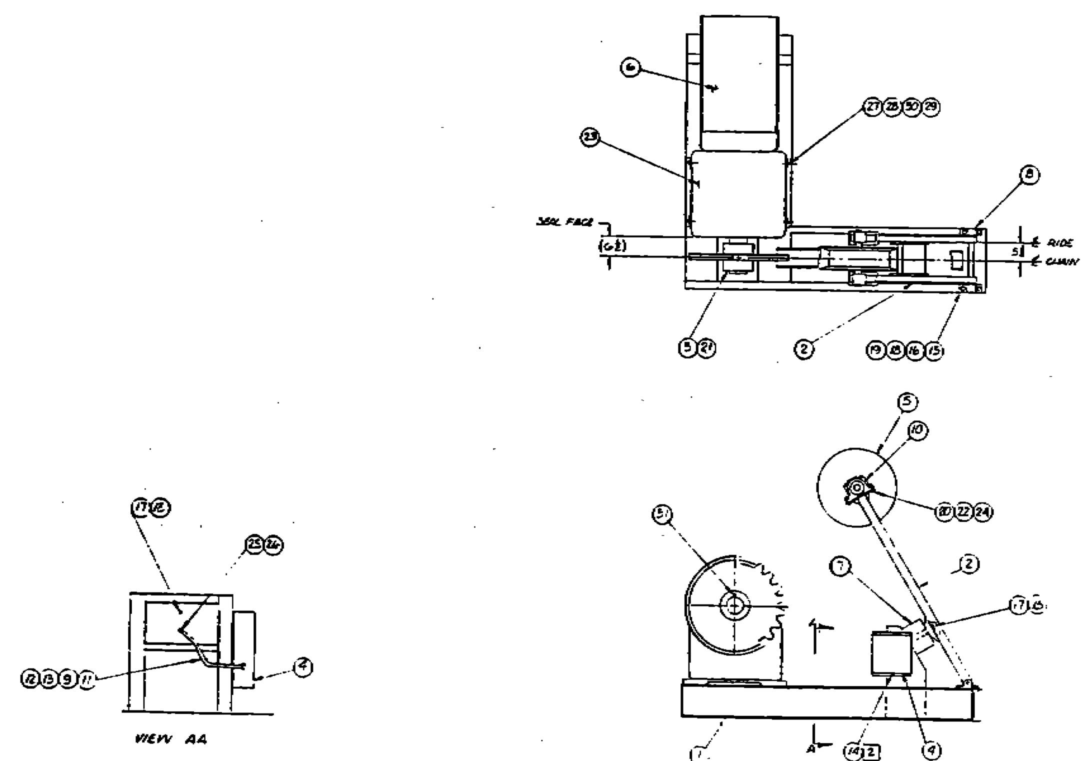
D67626 B



ARROW	Arrow Development Co., Inc. 1858 Plymouth Street Mountain View, CA 94043 (415) 968 8242
TITLE: ASSEMBLY, LIFT DRIVE CORKSCREW	
THIS DRAWING IS THE PROPERTY OF ARROW DEVELOPMENT COMPANY AND SHALL NOT BE REPRODUCED, PUBLISHED OR DISCLOSED, IN WHOLE OR PART, WITHOUT THE WRITTEN CONSENT OF ARROW. IT IS TO BE USED ONLY FOR FURNISHING OF ITEMS FOR ARROW. THIS DOCUMENT OR COPIES ARE SUBJECT TO RETURN UPON DEMAND AND ARE DISTRIBUTED WITH THE UNDERSTANDING THAT IT SHALL NOT BE USED IN ANY WAY DETRIMENTAL TO ARROW.	DRAWING NUMBER

NOTES

1. FOR FASTENER TORQUE REQUIREMENTS, SEE STANDARD TORQUE SPECIFICATION - DRAWING D66195
2. MATCH DRILL (8) 9/16 DIA & MOUNT ITEM (4) WHERE CONVENIENT. ITEM (4) MUST BE MOUNTED VERTICALLY.



ITEM	QTY	PART NUMBER	DESCRIPTION	MATL SPEC
33	6	506081	1/4 FLATWASHER	
32	3	502267	1/4-20 UNC HEX NUT	GR 2H
31	1	500663	BAR 1/4 x 1/4 x 0.516	C1018
30	4	511453	1 1/4 HARDENED WASHER	
29	8	510188	1 1/4 FLATWASHER	
28	4	510925	1 1/4-5 UNC HEX NUT	GR 2H
27	4	511749	1 1/4-5 UNC x 5 1/2 HHCS	GR 5
26	1	506125	3/4 FLATWASHER	
25	1	502290	3/4-16 UNF HEX NUT	GR 2H
24	12	506109	5/8 STD FLATWASHER	
23	1	513363	GEAR REDUCER, DODGE QUILMAC - 2 - 17.69	SEE PP SPEC
22	4	502272	5/8-11 UNC HEX NUT	GR 2H
21	4	506839	5/8-11 UNC x 2 SHSS	
20	4	506112	5/8-11 UNC x 5 1/4 HHCS	GR 5
19	4	502396	1/2 BEVEL WASHER	
18	10	506168	1/2 FLATWASHER	
17	1	502287	1/2-20 UNF HEX NUT	GR 2H
16	4	502271	1/2-13 UNC HEX NUT	GR 2H
15	4	501442	1/2-13 UNC x 2 1/2 HHCS	GR 5
14	3	501336	1/4-20 UNC x 1 HHCS	GR 5
13	1	506171	FITTING WEATHERHEAD 100066-106	
12	1	504197	FITTING WEATHERHEAD 100066-106	
11	1	504228	AIR HOSE 3/8 x 1'-4	
10	2	503478	PILLOW BLOCK DODGE TYPE K 1 1/16 BORE	
9	2	503626	HOSE CLAMP - AERO SEAL M6	
8	2	506110	PILLOW BLOCK DODGE SC 1 7/16 BORE	
7	1	506249	AIR SPRING, GOODYEAR # 1B5-005	
6	1	513364	MOTOR, 250 HP RELIANCE LC 5612ATE	SEE PP SPEC
5	1	B34957	IDLER WHEEL & SHAFT ASSY	
4	1	D64044	FILTER REGULATOR ASSY	
3	1	566692	LIFT DRIVE SPROCKET	
2	1	C34958	PIVOT ARM WELDMENT	
1	1	D63576	LIFT DRIVE FRAME WELDMENT	

ARROW — LIFT DRIVE ASSEMBLY

DRAWN: RICK SIEMERS — DATE: 3-1-90

D67524

14

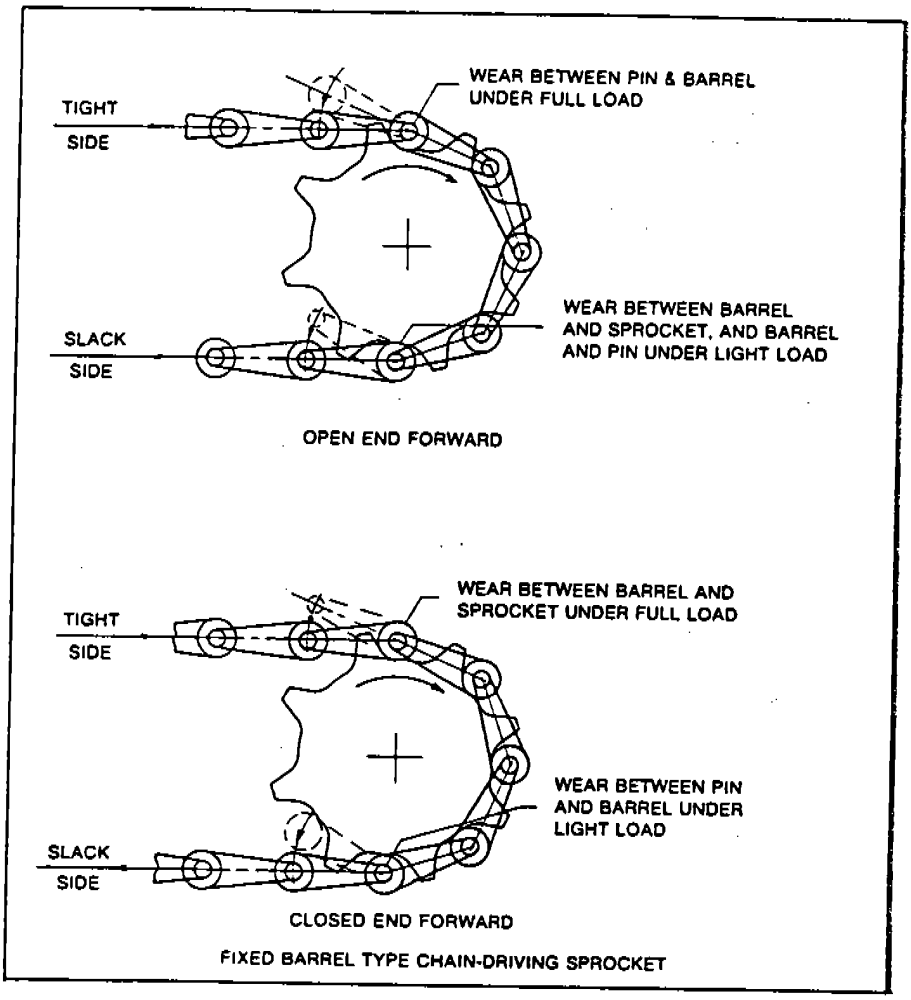
RECOMMENDED DIRECTION OF TRAVEL FOR OFFSET CHAINS

Fixed Barrel Chains

By fixed barrel we are referring to chains such as welded steel, knuckle, or cast chains. Although the proper direction of travel for these types of chains has always been of interest, the development of welded steel chains with offset construction demanded a clarification of the subject. Customers wanted to know what the advantage would be in replacing combination chains with welded steel chain. Although there are certainly other advantages, the one that will be discussed here will be that of less sprocket and barrel wear when operated in the proper direction.

The recommended direction of travel for offset type chains with fixed barrels is open end forward or open end pointing in direction of travel (see figure 1). This is true for conveyor chains, elevator chains or drive chains where the driving sprocket is less in diameter than the driven sprocket. To fully understand why this is true, we must look at the action of the chain on the sprocket. We will look at two adjacent links about to contact the sprocket and identify them as the leading link and trailing link. As soon as the leading link has seated on the sprocket tooth, the trailing link must also start to do the same. This action of the trailing link preparing to seat on the next tooth causes nearly all the sprocket wear. As the leading link is carried around the sprocket, the trailing link will articulate downward through an angle determined by the number of teeth on the sprocket. As the trailing link does this, it must pivot about its connection with the leading link. Since the chain is operating open end forward, it will be connected through the chain pin. The pin will rotate inside the barrel and no movement of the barrel will be required. Since the barrel does not move, once seated on the sprocket tooth, no wear will take place on either the tooth or barrel O.D.

From the discussion above we can also understand why wear would occur if the chain was run incorrectly, or closed end forward. It was explained that movement occurs through which ever part of the trailing link is connected to the leading link. That is, with the chain running closed end forward, the trailing link would be connected to the leading link by the barrel and the barrel must rotate to permit the trailing link to seat on the next tooth. This will result in wear between the barrel and tooth.



FIXED BARREL TYPE CHAIN-DRIVING SPROCKET

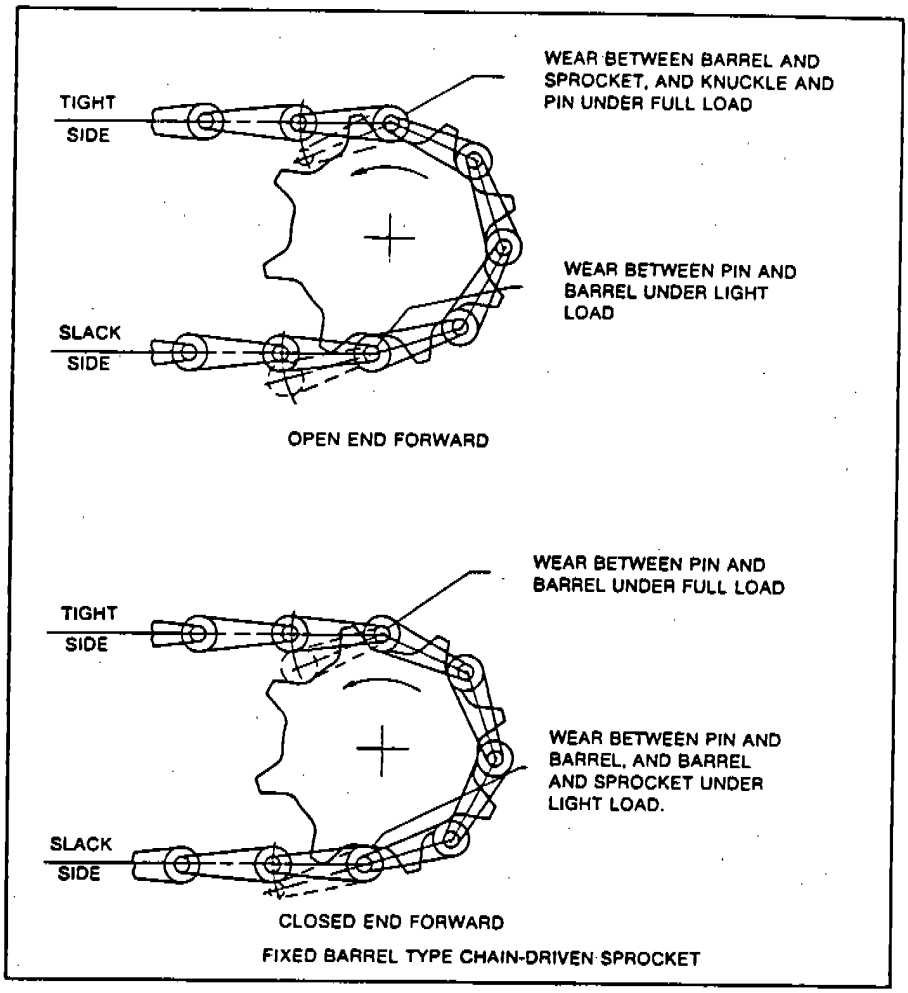
All of the above was concerned with the chain entering the sprocket, but what happens when it leaves the sprocket? Actually the exact opposite happens. That is, the leading link is now the one that must articulate downward to release from the sprocket and follow the return path. As this happens you can see its barrel must rotate on the tooth. However, there is little wear caused by this action since the chain load decreases as it goes around the sprocket and is at its least load when it leaves the tooth. With the chain operated open end forward, this is the only action that will cause any wear on the sprocket teeth. It is estimated that operating the chain in the recommended direction can decrease sprocket wear as much as 90% as compared to one operated improperly or a chain with straight side bar fixed barrel construction.

To be complete and correct in our discussion of this subject we must take a look at drive chains separately. A drive chain is different than a conveyor chain in that the load is the same on both driving and driven sprocket. The maximum load coming at the entry of the driving sprocket and at the exit of the driven

sprocket. At these two points the loads are the same. When the sprockets are of a different size (as they usually are), we must also take into account the amount of articulation of the links along with the chain loading. The greater the articulation or movement, the greater the amount of wear. The articulation would, of course, be greater on the smaller sprocket. Let's look at the recommended travel for the three possible drive arrangements.

1. *Driving sprocket smaller than driven sprocket. The recommended travel for this arrangement is open end forward (See figure 1).* The reason being, as the chain enters the drive sprocket it will undergo its maximum articulation and load in the system. As explained before, with the chain operating open end forward all movement will occur on the pin and not on the barrel. It is true the same load will be experienced as the chain comes off the driven sprocket and the link will pivot on the barrel, but because the articulation is less the wear would be less than would be at the drive sprocket if the travel were reversed.
2. *Driving and driven sprocket the same diameter chain may be run in either direction* since the loading and articulation is the same on both sprockets.
3. *Driving sprocket larger than driven sprocket. Recommended travel for this arrangement is closed end forward (See figure 2).* Because the maximum articulation and load occurs as the chain leaves the driven sprocket, the travel must be such that the link pivots on the pin at this point. To do this the chain must come onto the sprocket closed end forward.

A good rule to remember is the direction of travel should be such that the link pivots (whether leaving or entering) on the pin where both the articulation and the loading are a maximum.



FIXED BARREL TYPE CHAIN-DRIVEN SPROCKET

3. Check all brakes for:

   a. Loose fasteners.

   b. Condition of brake friction material.

   c. Air hoses for wear, cuts, etc.

   d. Any signs that chassis has been rubbing on top of brakes.

   e. Proper air pressure setting.

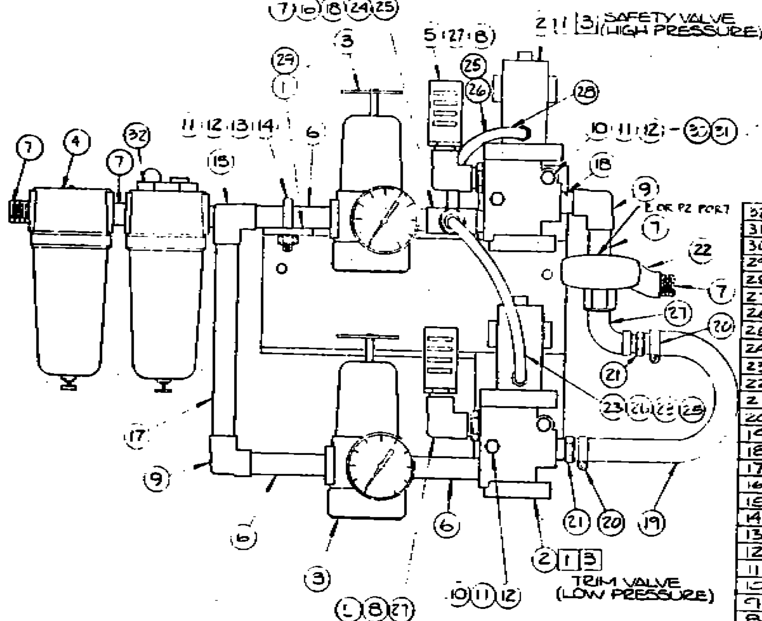
   f. Water in filters.

   g. Leaks in any piping or air line equipment.

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG
A		(1) WAS E1024H-00-P1 ADD LINE BETWEEN (6) & (2) (HIGH PRESSURE)	[illegible] 10-6-81	11/6/81	
B		QTY (7) WAS (5) [illegible] ITEM [illegible] (8) WAS [illegible]	[illegible]	[illegible]	
C		ADDED ITEM (32), ITEM (23) WAS 510049 ITEM (26) WAS 503625	[illegible]		
D		ADD NOTE 4 & ITEMS (29) (30) (31)	[illegible]		
E		ITEM 10 502 QTY W/ 2, ITEM 30, 31 QTY W/ 2	[illegible]	[illegible]	
F	C-3	ADD ITEM (23) QTY 1, (29) WAS D50624-2	[illegible]	[illegible]	
G		(1) WAS D50624-1, (29) WAS D61831	[illegible] 9-87		
H		ITEM 1 W/ D61831-1, 29 W/ D61831-2	[illegible]		
J		ADD ITEM (32), ITEM (7) [illegible]	[illegible]	[illegible]	
K	C-2	CHANGED ITEM (28) W/ 505624	[illegible]	[illegible]	

NOTES:

1. THE VALVE IS A SOLENOID PILOT 3 WAY 2 POSITION NORMALLY OPEN 110V/50HZ-120V/60HZ
2. APPLY SEALANT TO THREADS TO PREVENT LEAKAGE
3. DO NOT PLUG PILOT EXHAUST OR LINE EXHAUST
4. 501 AS SHOWN, 502 OPPOSITE HAND



ITEM	QTY 502	QTY 501	PART IDENT	DESCRIPTION	MATL SPEC
32	1	1	508488	LUBRICATOR - PARKER HANNIFIN 07L[illegible]	
31	4	—	501349	1/4-20UNC x 4 HHCS	
30	4	—	B61558	VALVE SPACER	
29	1	—	D506242	MOUNTING BRACKET	
28	4	4	511512	HOSE CLAMP STN STL [illegible]	
27	3	3	504132	STREET EL WTHHD. 3400x8	
26	2	2	504227	1/4 AIR HOSE x0'-9	
25	4	4	511185	HOSE FITTING WTHRHD 10004B-102	
24	2	2	510047	BUSHING 1/2-1/8 NPT	
23	1	—	511184	STREET ELBOW-WEATHERHEAD [illegible]	
22	1	1	509732	VALVE 1/2 PARKER HANNIFIN OR-50	
21	2	2	506287	HOSE FITTING KA08-08 MB	
20	2	2	505617	HOSE CLAMP M-10	
19	1	1	504224	AIR HOSE H-101 1/2 x 1'-5	
18	2	2	510046	PIPE NIPPLE 1/2 NPT x 1 1/2	
17	1	1	508613	PIPE NIPPLE 1/2 NPT x 8	
16	1	1	502950	PIPE CROSS 1/2 NPT	
15	1	1	504162	STREET TEE 1/2 NPT WEATHERHEAD 3750-8	
14	1	1	505687	1/2 PIPE U-BOLT 1/4-20UNC THD	
13	2	2	506021	1/4 FLATWASHER	
12	6	6	502192	1/4 LOCKWASHER	
11	6	6	502267	1/4-20UNC HEX NUT	
10	—	4	501346	1/4-20UNC x 3 HHCS	
9	2	2	502913	ELBOW 90° 1/2 NPT	
8	2	2	502962	BUSHING 3/4-1/2 NPT	
7	5	5	502899	CLOSE NIPPLE 1/2 NPT	
6	3	3	502888	PIPE NIPPLE 1/2 NPT x 4	
5	2	2	504849	MUFFLER SCHRADER 4808-1000	
4	1	1	504845	FILTER - PARKER HANNIFIN 7F32A	
3	2	2	504844	REGULATOR - PARKER HANNIFIN 7R318A	
2	2	2	510045	VALVE - NORGREN E1024H-00-P1	
1	—	1	D50624-1	MOUNTING BRACKET	

OPERATING LOGIC TABLE

OPERATING MODE	HIGH PRESSURE VALVE	LOW PRESSURE VALVE
BRAKE OPEN (PRESSURE RELEASED)	X	X
TRIM (LOW PRESSURE APPLIED)	X	O
SAFETY (HIGH PRESSURE APPLIED)	O	O OR X

X = ENERGIZED
O = DE-ENERGIZED

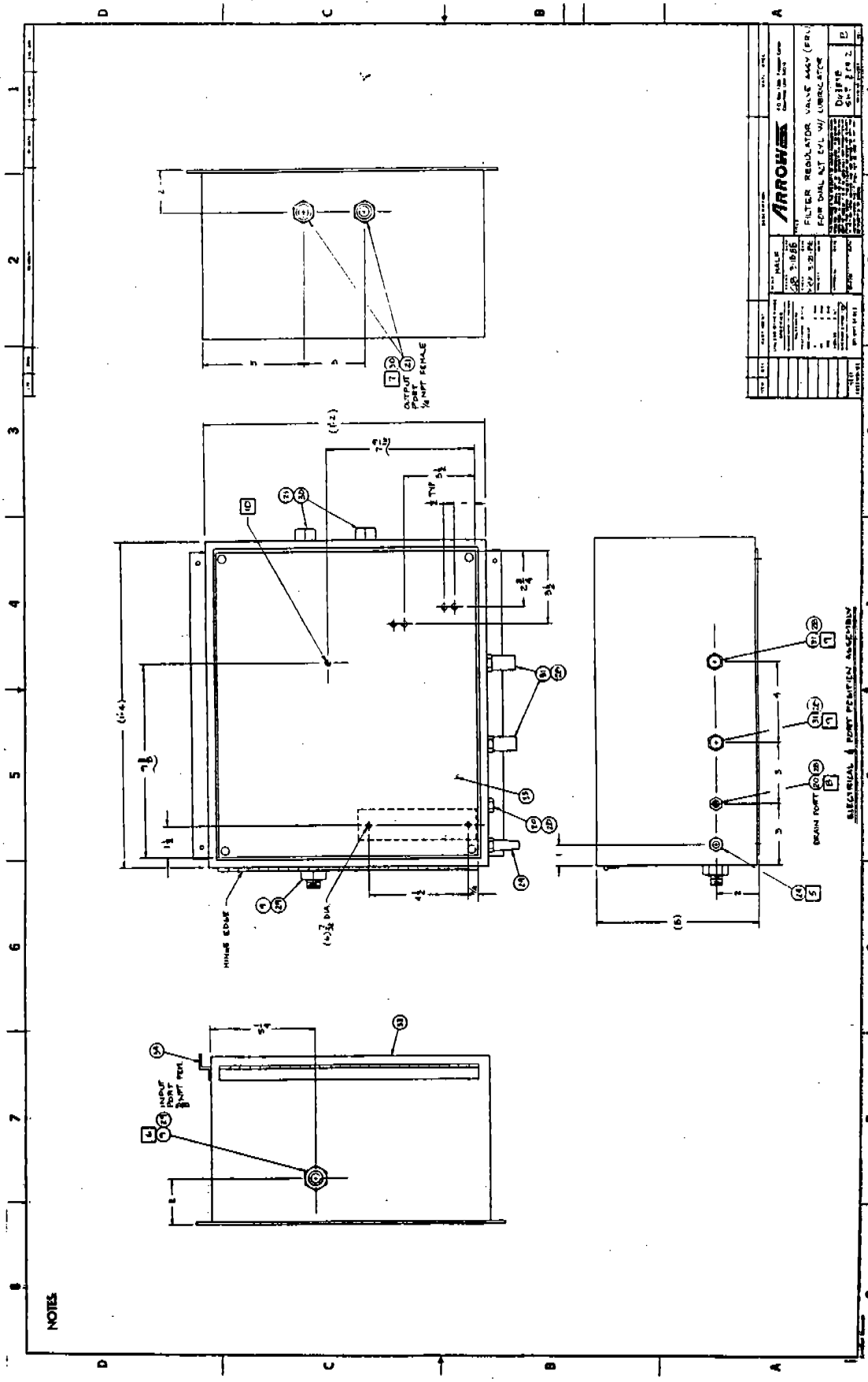
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES
SCALE 3/8 = 1
DO NOT SCALE

ARROW P.O. Box 1186, Freeport Center, Clearfield, Utah 84016

TITLE: ASSEMBLY: FILTER, LUBRICATOR VALVE REGULATOR

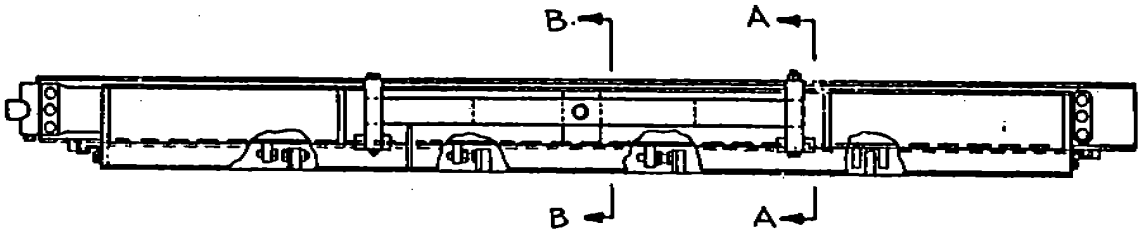
C50640 K

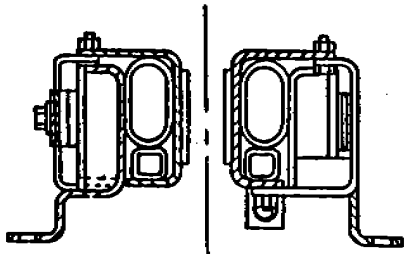
18


ARROW
FILTER REGULATOR VALVE ASSY (FR)
FOR DIAL SET CYL W/ LUBRICATOR
OUTPUT PORT ¼ NPT FEMALE
INPUT PORT ¼ NPT FEM
HINGE EDGE
BRASS PORT
ELECTRICAL & PORT POSITION ASSEMBLY
NOTES

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP

NOTES:





SECTION B-B SECTION A-A

ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC

NEXT ASSEMBLIES

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS: ± 1/16
DECIMALS:
.X ± .060
.XX ± .030
.XXX ± .010
ANGLES: ± ½°
MACHINE FINISH 125

DO NOT SCALE

SCALE
DRAWN DATE
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW

Arrow Development Co., Inc.
1555 Plymouth Street
Mountain View, CA 94043
(415) 968-8342

TITLE:
BRAKE ASSEMBLY
CORKSCREW

B

DRAWING NUMBER

REV

B. Trains

1. Check hitch yokes:

a. Look for any signs of looseness or wear around the entire hitch area.

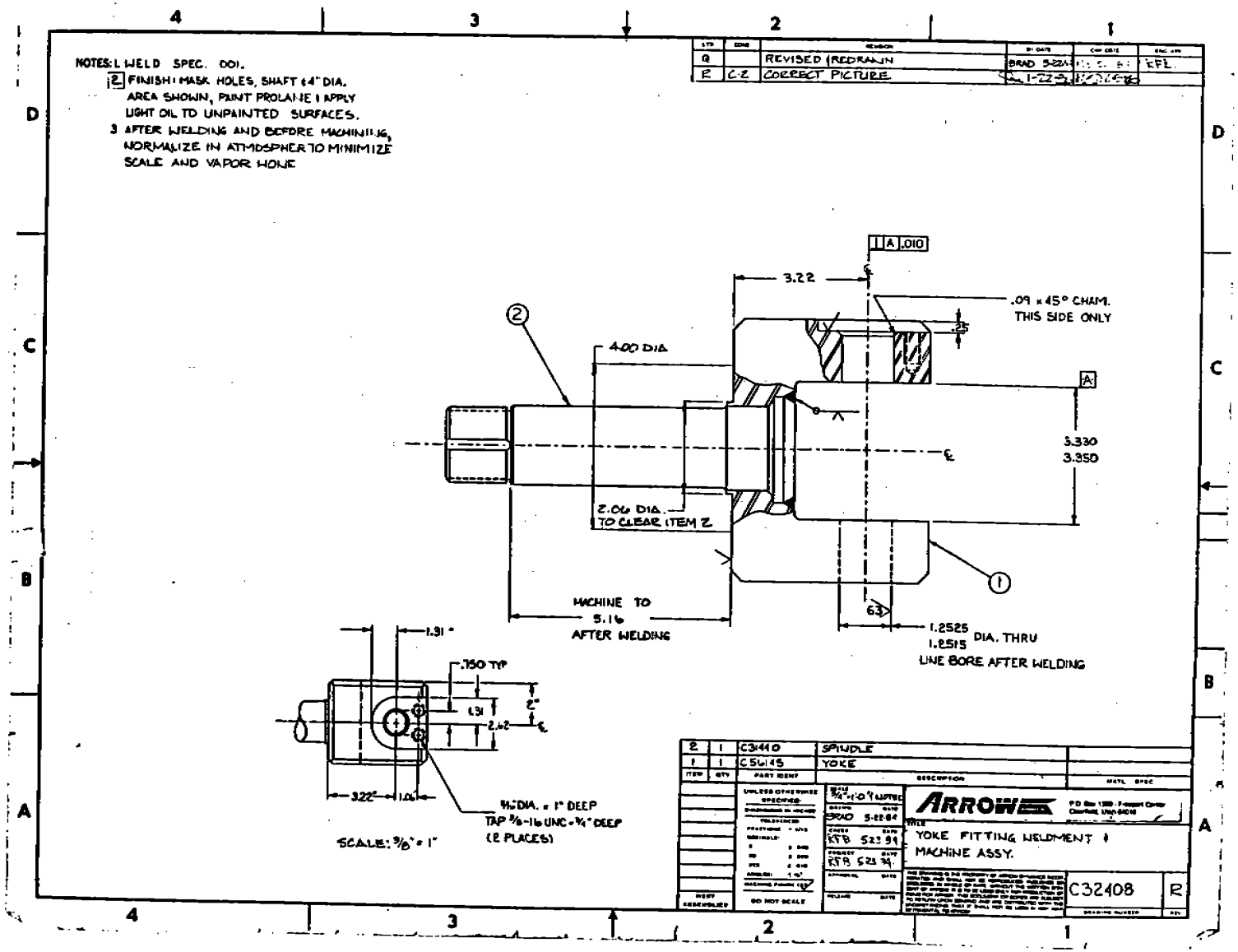
b. Thrust washers inside yokes on both pins must be in place.

c. There should be no fore and aft movement between coaches. No space between the hitch yoke and the rear of the chassis member.

d. All fasteners on hitch pins, including safety wire must be in place and secured.

e. Two safety cables must be in place and secure at both ends.

f. Safety arms over axles must be in place and secure at both ends.


NOTES: 1 WELD SPEC. 001.
2 FINISH: MASK HOLES, SHAFT ±4" DIA. AREA SHOWN, PAINT PROLANE 1 APPLY LIGHT OIL TO UNPAINTED SURFACES.
3 AFTER WELDING AND BEFORE MACHINING, NORMALIZE IN ATMOSPHERE TO MINIMIZE SCALE AND VAPOR HOLE
REVISED (REDRAWN
CORRECT PICTURE
1 A .010
3.22
.09 x 45° CHAM. THIS SIDE ONLY
4.00 DIA
3.330
3.350
2.06 DIA. TO CLEAR ITEM 2
MACHINE TO 5.16 AFTER WELDING
63
1.2525 DIA. THRU
1.2515
LINE BORE AFTER WELDING
1.31
.750 TYP
2.42
3.22
1.06
⅝ DIA. x 1" DEEP
TAP ⅝-16 UNC - ¾" DEEP
(2 PLACES)
SCALE: ⅜" = 1"
2 1 C3440 SPINDLE
1 1 C5615 YOKE
ITEM QTY PART IDENT DESCRIPTION MATL SPEC
ARROW
YOKE FITTING WELDMENT & MACHINE ASSY.
C32408
R

ARROW
(801) 825-1611
P O Box 1386 - Freeport Center
Clearfield, Utah 84016

DATE: NOVEMBER 17, 1981

TO: ALL CORKSCREW AND LOOP OPERATORS

SUBJECT: NON-DESTRUCTIVE TESTING

GENTLEMEN:

During the past season, we were notified of one failure of a hitch yoke (C-32408) and one failure of an axle housing (D-31458). Although we do not think that there is a general problem, we do feel that a complete inspection of these two items is necessary before the next operating season.

A review of the Corkscrew owner's manual will show that an annual inspection of ALL hitch yokes is recommended. The hitch yokes must be removed from the coaches in order to inspect them properly. The entire yoke assembly must be subjected to a magnetic particle or dye penetrant inspection with particular attention given to the weld area shown in Fig. 1.

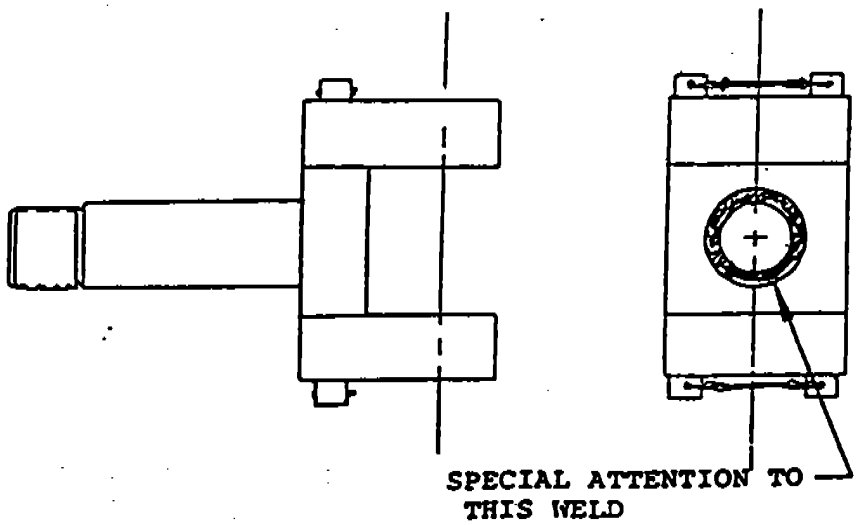


FIG. 1

ARROW Hydraulics Inc.
(801) 825-1611
P.O. Box 1386 - Freeport Center
Clearfield, Utah 84016

If any cracks are found, the yoke assembly should be replaced. The axle housing must be removed from the chassis in order to make a proper examination.

The axle housing must be subjected to a magnetic particle or dye penetrant inspection over the area shown in Fig. 2, with special attention given to the weld around the top and bottom of the central hub area.

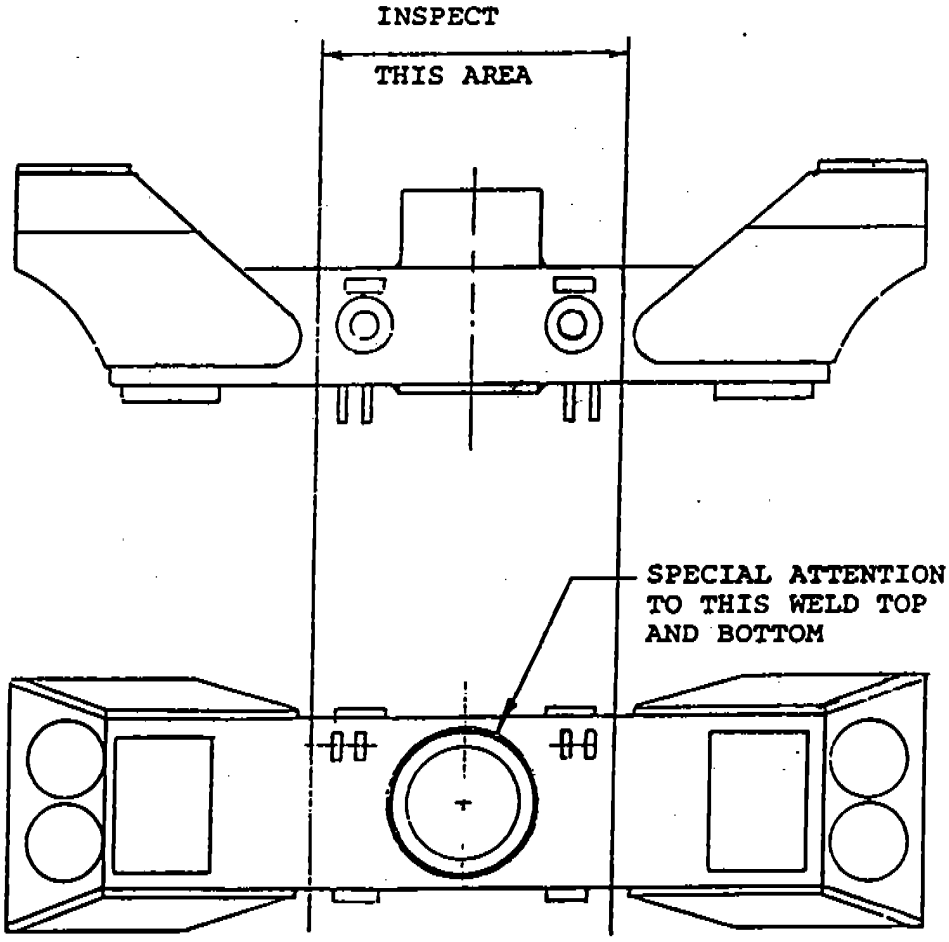


FIG. 2

ARROW
(801) 825-1611
P O Box 1386 - Freeport Center
Clearfield, Utah 84016

If any cracks are found, please contact the Engineering Department at Arrow-Huss for repair or replacement information.

It is very important to perform daily visual inspection of all chassis assemblies as called out in the owner's manual. Many problems including cracks can be located long before they cause trouble if someone with proper light only looks each day at the various parts on each chassis such as hitch yokes, axle housing, wheel carriers, chain and anti roll back dogs and chassis frames.

If there are any questions, regarding these recommendations, please contact Arrow Huss, (408) 438-4100.

Very truly yours,

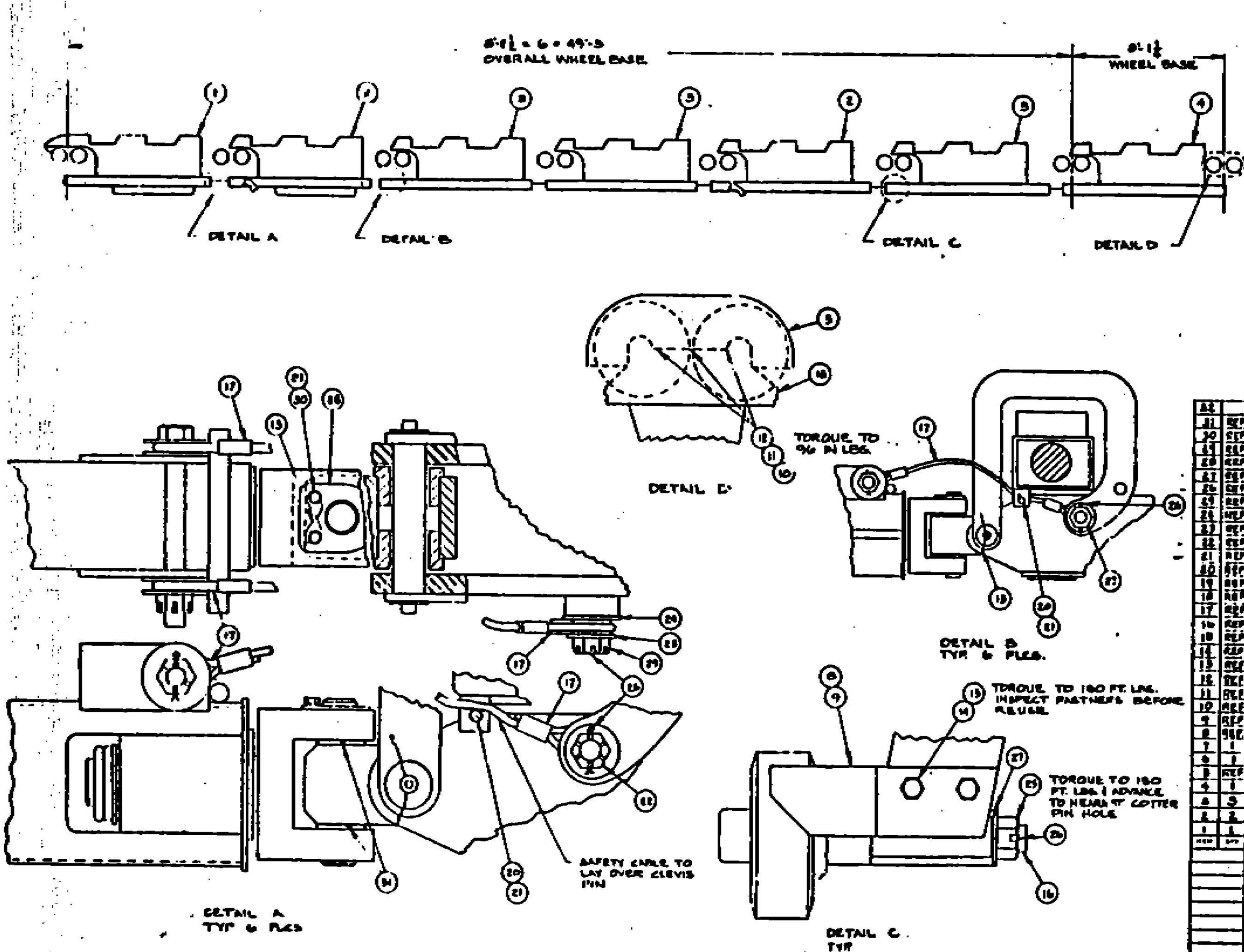
R V Toomer

Ronald V. Toomer
Director of Engineering

RVT:wc

NOTES

1. ALL PARTS NEEDED TO JOIN COACHES TOGETHER ARE SHIPPED ON COACH ASSYS.
2. REMOVE UP WHEEL TO INSTALL COACHES TO TRACK AND RE-INSTALL PER DETAIL C
3. FINISH TOUCH UP WITH POLANE L PAINT PER [illegible] SPECS



ITEM	QTY	PART NUMBER	DESCRIPTION
32			
31	REF	A 44331	THRUSTWASHER
30	REF	302194	5/8 LOCKWASHER
29	REF	307901	5/8-11UNC x 1 BHCS
28	REF	B 41911	COUPLING PIN & AXIS
27	REF		7/8 DIA. FLATWASHER
26	REF		1/8 DIA x 1 1/2 COTTER PIN
25	REF		ROMOCO NUT # 45204-8B
24	REF	A 33776	WASHER
23	REF		5/8 DIA. FLATWASHER
22	REF		5/8-18UNF SLOTTED NUT
21	REF		1/8 DIA x 1 COTTER PIN
20	REF		1/2 DIA x 1 1/4 STD CLEVIS PIN
19	REF	301815	3/4-10UNC x 5 HHCS
18	REF	D41500	WHEEL CARRIER ASSY
17	REF	B-31574	SAFETY CABLE
16	REF	C-31017	UP WHEEL SPINDLE
15	REF	302807	3/4-10UNC ESNA NUT
14	REF	301860	3/4-10UNC x 4 1/2 HHCS
13	REF	303606	STAINLESS STEEL WIRE DOWELS
12	REF	304021	1/4 STD FLATWASHER
11	REF	304116	1/4-20UNC ESNA NUT
10	REF	301838	1/4-20UNC x 1 HHCS
9	REF	C-39049-2	UP-STOP BRACKET
8	REF	C-39049-1	UP-STOP BRACKET
7	1	B-33370	SOCKET
6	1	B-33371	TOOL
5	REF	C-31350	WHEEL CARRIAGE FENDER
4	1	D-43879	TRAILING COACH
3	3	D-43878	INTERMEDIATE COACH ASSY.
2	2	D-43877	PICK UP COACH ASSY.
1	1	D-43876	LEAD COACH ASSY.

ARROW

7 COACH TRAIN ASSEMBLY-LEFT HAND RELEASE

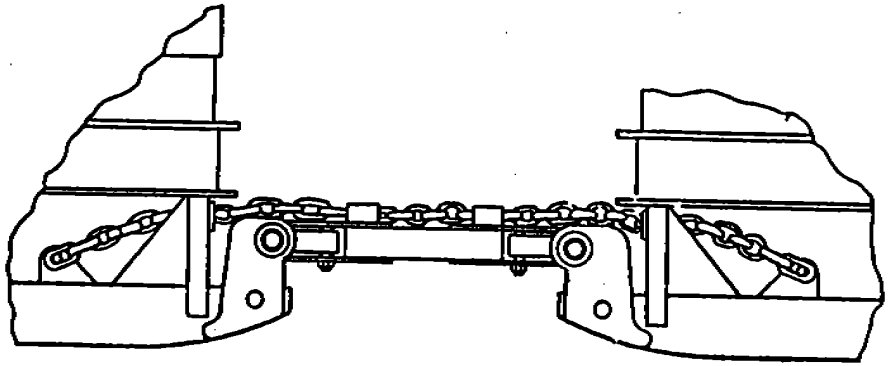
D 48900

DATE 7-17-80

26

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP.

NOTES:



ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC

NEXT ASSEMBLIES

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS ± 1/16
DECIMALS:
.X ± .000
.XX ± .000
.XXX ± .010
ANGLES: ± 1°
MACHINE FINISH 125

DO NOT SCALE

SCALE
DRAWN DATE
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW

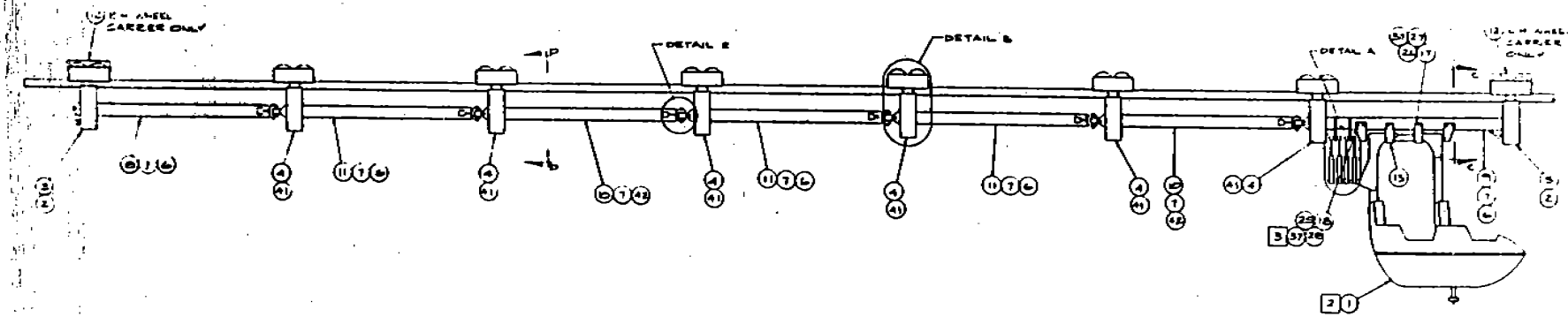
Arrow Development Co., Inc.
1958 Plymouth Street
Mountain View, CA 94043
(415) 968 8347

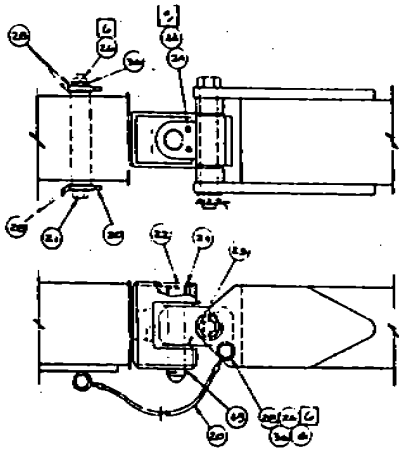
TITLE:
TYPICAL TOW BAR & SAFETY CHAIN CONNECTION BETWEEN COACHES

B

DRAWING NUMBER REV

NOTES





DETAIL E
ZONE D-8, ALT. 2
1/4 : 1

ARROW

SEVEN COACH TRAIN ASSEMBLY
SUSPENDED COASTER

K-1091 C

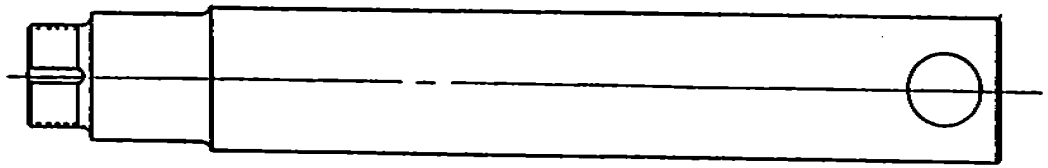
2. Wheel Carriers:

a. The two SKF spherical bearings in the wheel carrier are to be lubricated daily with a small quantity of grease as shown on the axle assembly print.

b. Visually check the wheel carrier weldment for any sign of bending or cracks.

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP.

NOTES:



ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC

NEXT ASSEMBLIES

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS: ± 1/16
DECIMALS:
.X ± .060
.XX ± .030
.XXX ± .010
ANGLES: ± ½°
MACHINE FINISH 125
DO NOT SCALE

SCALE
DRAWN DATE
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW

Arrow Development Co., Inc.
1535 Plymouth Street
Mountain View, CA 94043
(415) 968 8347

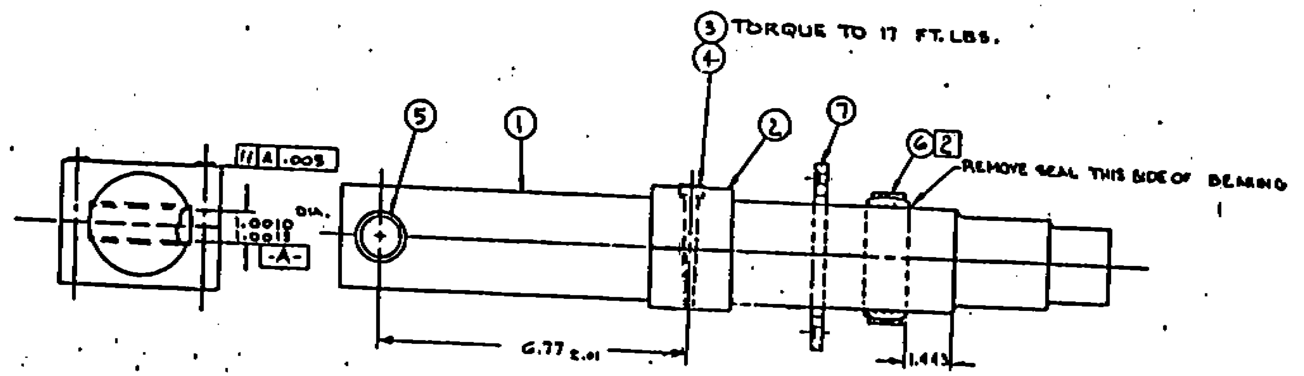
TITLE
SPINDLE
WHEEL CARRIER

B

DRAWING NUMBER | REV

4 3 2 1

NOTES:
1. COAT ALL NON PAINTED SURFACES WITH CORROSION PREVENTION MTL.
2. LUBRICATE ITEM (6) WITH A NGLI GRADE 2 OR 3 LITHIUM BASE GREASE WITH MOLYBDENUM DISULFIDE, DOW CORNING "MOLYKOTE" BR2-S OR SIMILAR.



QTY	PART NO.		DESCRIPTION	MATL SPEC	ITEM
1	C39840		CAP		
1	501923		SPHERICAL PLAIN BEARING SKF GE3200ES-2RS		7
1	B35243		WHEEL CARRIER SPINDLE BUSHING		6
2	502193		5/16 DIA, LOCKWASHER		5
2	501977		5/16-18UNC-2A x 2 S.H.C.S.		4
1	C38351		CLAMP BLOCK		3
1	D38350		SPINDLE		2
					1

ARROW

SCALE: NONE
DRAWN: [illegible] 1/19/77
7/25-7/29/77
D41691
D31462

TITLE: ASSEMBLY, SPINDLE

C 40150

DO NOT SCALE

LTR		REVISION			
A	—	ADD SEC. C-C & NOTE # 10	[illegible]	[illegible]	
B	—	ADDED ITEM 38 & DETAIL D	[illegible]	[illegible]	
C	—	ITEM 27 WAS ¼-28 × 1 HHCS	[illegible]	[illegible]	
D	—	REMOVED ITEM 21, ITEM 22 QUANT WAS 8	[illegible]	[illegible]	
E	—	[illegible]	[illegible]	[illegible]	

NOTES

[1] TIGHTEN INNER BEARING ADJUSTMENT NUT (ITEM 23) TO 70 FT LBS WHILE ROTATING ITEM 1 BACK & FORTH TO SEAT ITEM 30 THEN BACK OFF ITEM 23 AND RETIGHTEN TO 40 FT LBS. INSTALL ITEM 24 LOCKWASHER & THEN INSTALL OUTER NUT (ITEM 23) & TIGHTEN TO 55 FT-LBS.

[2] APPLY THIN COAT CHEVRON MULTI-MOTIVE GRS-1 OR EQUAL TO ITEM 11

[3] ITEM 19 TO BE PACKED WITH CHEVRON MULTI-PURPOSE GRS-1 OR EQUAL.

[4] ADD ITEM 9 AS REQ'D TO SHIM ITEM 13 TO GIVE OPTIMUM CLEARANCE TO ITEM 3

[5] TORQUE TO 56 IN LBS.

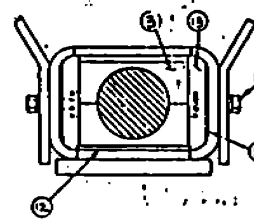
[6] TORQUE TO 77 IN LBS.

[7] TORQUE TO 49 IN LBS.

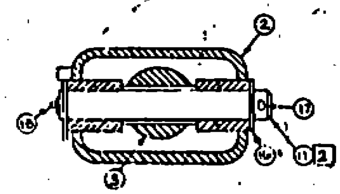
[8] TORQUE TO 72 FT LBS.

[9] LUBRICATE WITH A NGLI GRADE 2 OR 3 LITHIUM BASE GREASE WITH MOLYBDENUM DISULFIDE; DOW CORNING "MOLYKOTE" BR2-S OR SIMILAR.

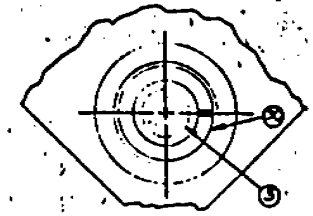
[10] INSTALL BOTH ITEMS 30 AND BEARING ON SPINDLE WITH SPLIT IN OUTER RING 90° FROM VERTICAL AS SHOWN IN DETAIL C



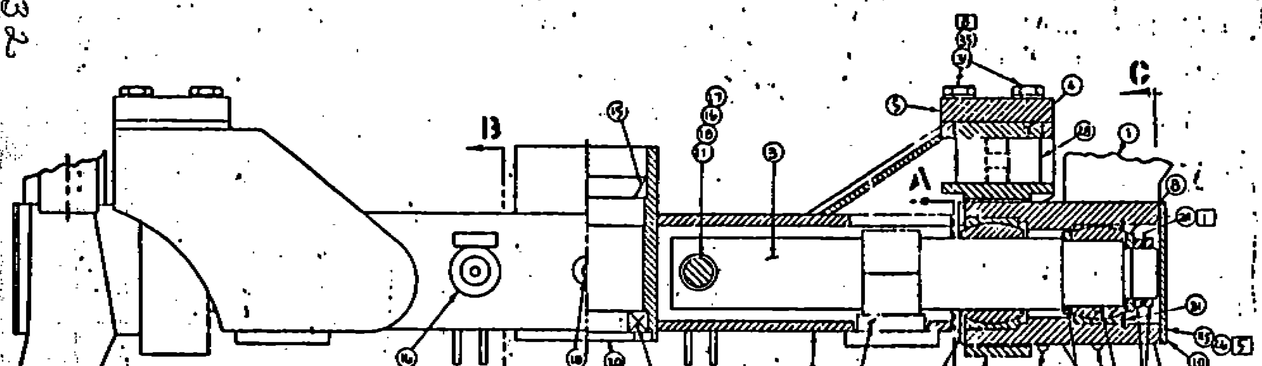
SECTION A-A
ZONE 5-B

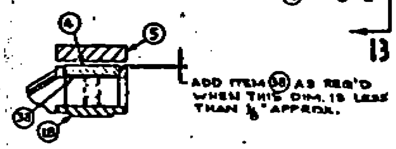


SECTION B-B
ZONE 5B



SECTION C [10]





DETAIL D
ZONE B4

FIND NO.	QTY	PART NUMBER	DESCRIPTION	
38	AR	A-44162	SPACER	
37	2	508468	WEATHERHEAD ADAPTER TEE 5750-2	
36	2	508470	⅛ PTF ALEMITE RELIEF FIT # 30510C (700-1000 PSI)	
35	12	502227	½ DIA EXT TOOTH LOCKWASHER	
34	12	501465	¼-20 UNF × 1½ HHCS	
33	4	503583	⅛ NPT GRS FITTING	
32	12	502057	¼-28 UNF × ⅝ ALLEN FHMS NYLOK	
31	2	507921	TRUARC RETAINING RING # N5000-334	
30	2	507924	SKF SPHERICAL PLAIN BRG # GE 1 204 ES	
29	4	508502	¼-28 UNF × ⅜ TEE NUT PRONG	
28	4	507922	VLIER E-LAST-O SPRING # ES-5371	
27	4	501556	¼-28 UNF × 1⅛ HHCS	
26	8	502122	⅜ DIA EXT TOOTH LOCKWASHER	
25	8	501551	⅜-24 UNF × ¾ HHCS	
24	2	506649	BRG LOCKWASHER, WH05	
23	4	506076	BRG ADJUSTMENT NUT FOMOCO # 61-4152	
22	4	502192	⅜ DIA LOCKWASHER	
20	1	504820	⅝ SEAL # 82910	
19	1	504982	TIMKEN CONE # 899 AS	
18	3	506005	LUBE FITTING ¼-28 UNF ALEMITE #[illegible]-B OR EQUAL	
17	2	506039	3/16 DIA × 1¼ COTTER PIN	
16	2	506175	1 DIA PLAIN WASHER	
15	1	501515	TIMKEN CUP # 29522	
14	1	504497	TIMKEN CUP # 394A	
13	4	B-32003	SIDE BUMPER	
12	2	B-33220	LOWER PAD	
11	2	B-38786	PIVOT PIN	
10	2	B-39839	CAP	
9	1	A-32366	SHIMS	
8	2	B-38884	WASHER	
7	2	B-38535	WASHER	
6	2	B-38592	CUSHION BLOCK	
5	2	C-38944	COVER	
4	1	B-38398	ROCKER ASSY	
3	1	C-40150	SPINDLE ASS'Y	
2	1	D-31459	AXLE HOUSING	
1	1	D-41500	WHEEL CARRIER ASSY	

SCALE ½ = 1

D4164A
D41524
D41526

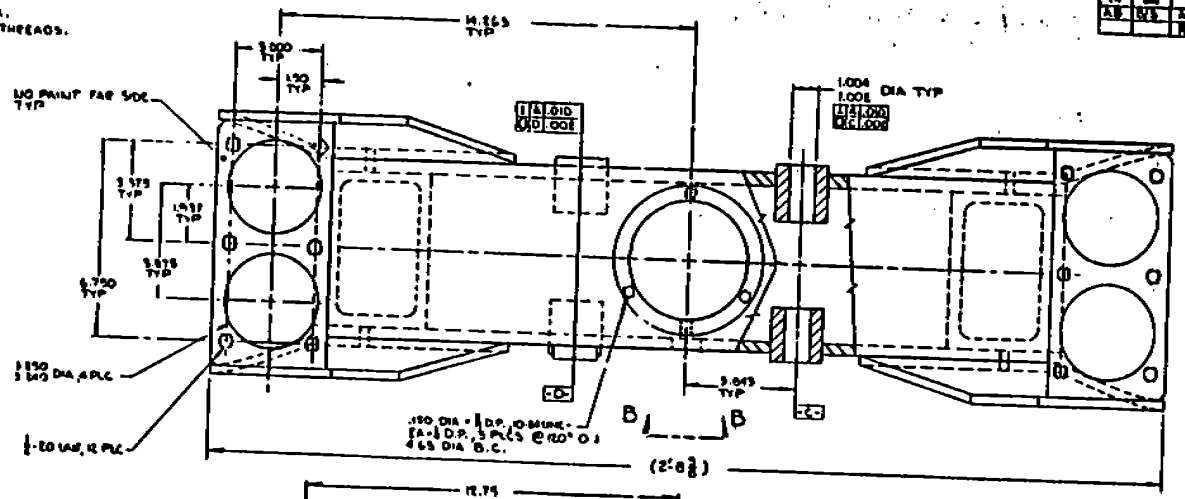
ARROW

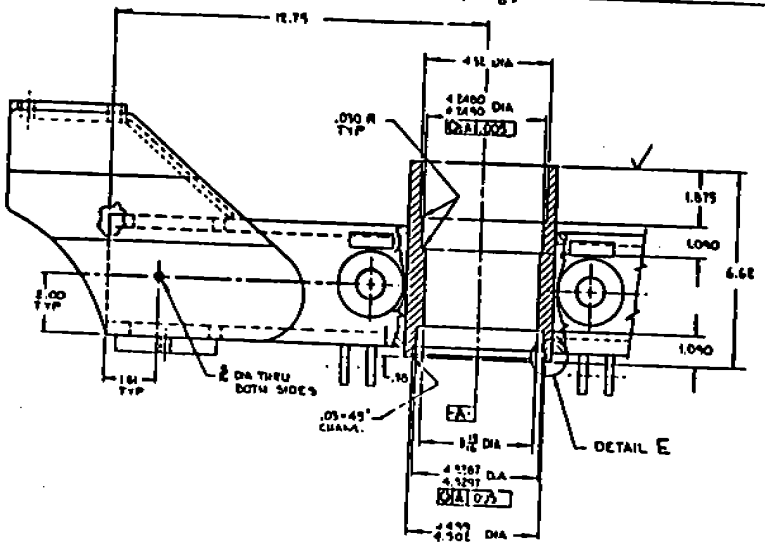
AXLE ASSEMBLY

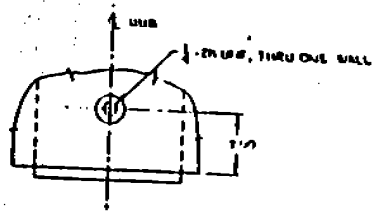
D 41681 | 6

32

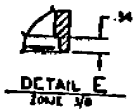
NOTES:
1. FINISH: PAINT GLOSS BLACK.
2. NO PAINT IN HOLES OR ON THREADS.







VIEW B-B
SCALE 4/0

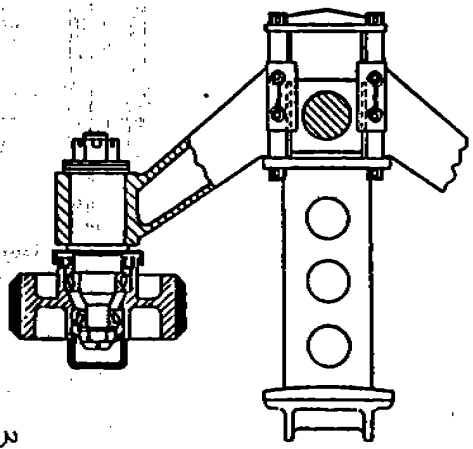


DETAIL E
SCALE 3/0

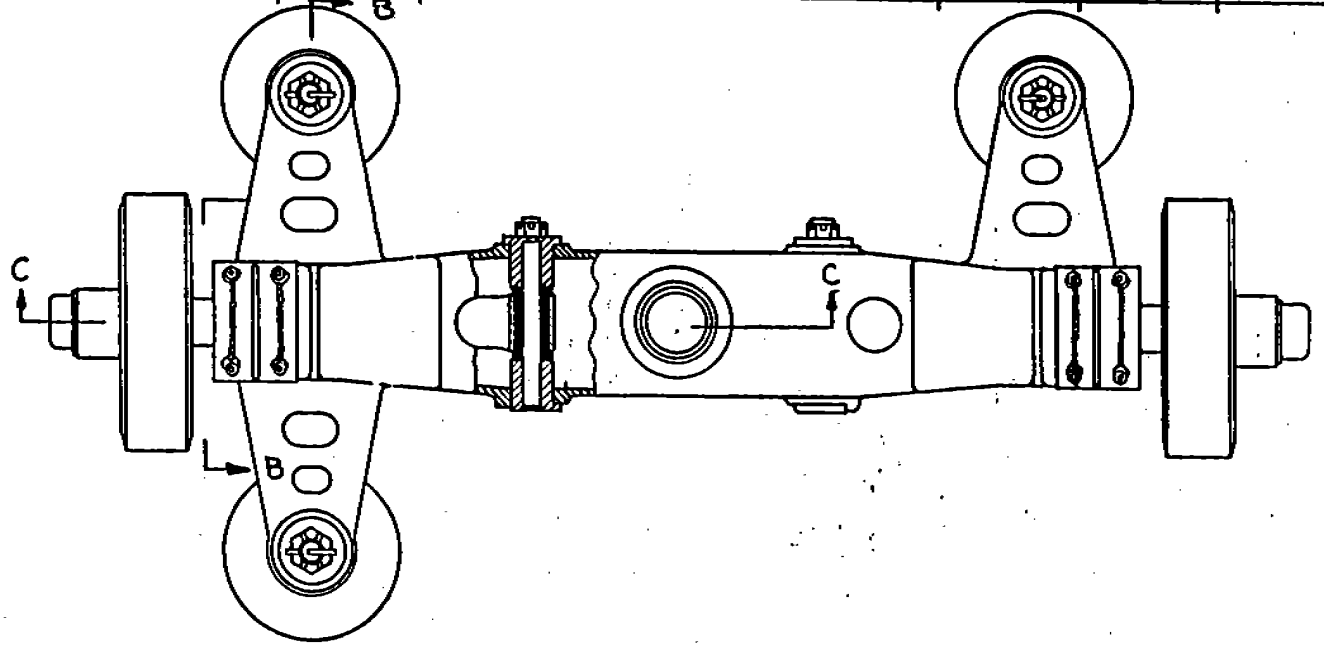
		D31458	AXLE HOUSING WELDMENT		
				ARROW	
				AXLE HOUSING MACHINE DETAIL	
D31459				D 31459	AB

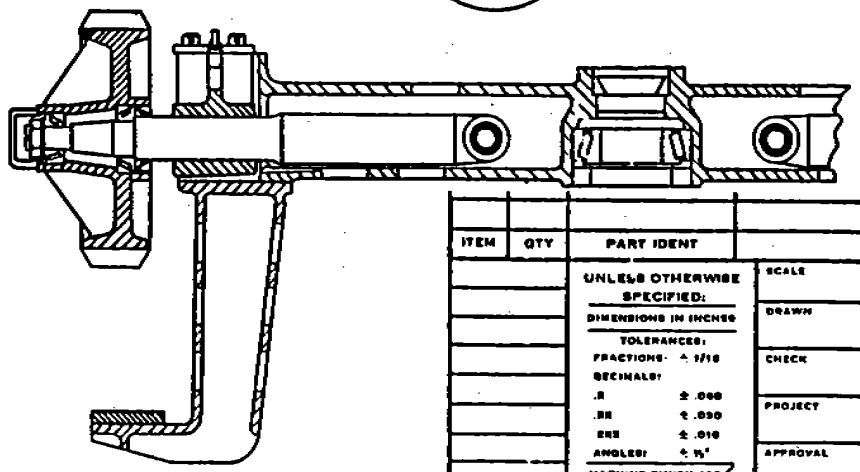
MICROFILM

NOTES:



SECTION B-B.





SECTION C-C

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG. APP.
	G				

ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC

NEXT ASSEMBLIES

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS ± 1/16
DECIMALS:
.X ± .060
.XX ± .030
.XXX ± .010
ANGLES: ± ½°
MACHINE FINISH 125
DO NOT SCALE

SCALE	
DRAWN	DATE
CHECK	DATE
PROJECT	DATE
APPROVAL	DATE
RELEASE	DATE

ARROW

Arrow Development Co., Inc.
1559 Plymouth Street
Mountain View, CA 94043
(415) 968 8342

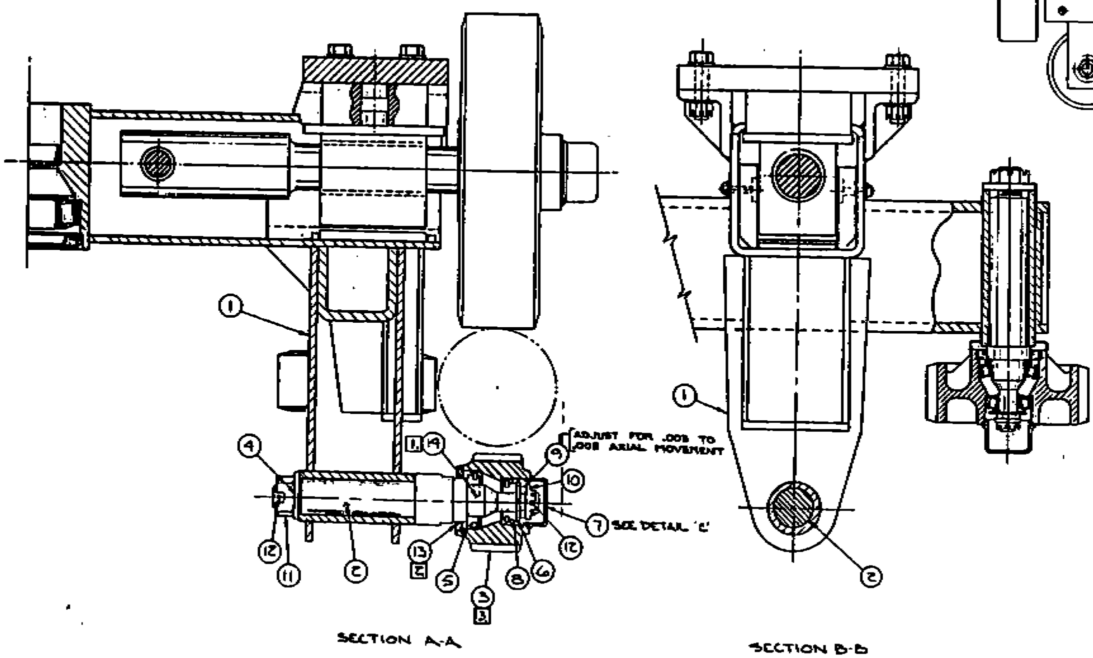
TITLE:
ROAD AXLE ASSEMBLY - FIXED
RUN-AWAY TRAIN COACH

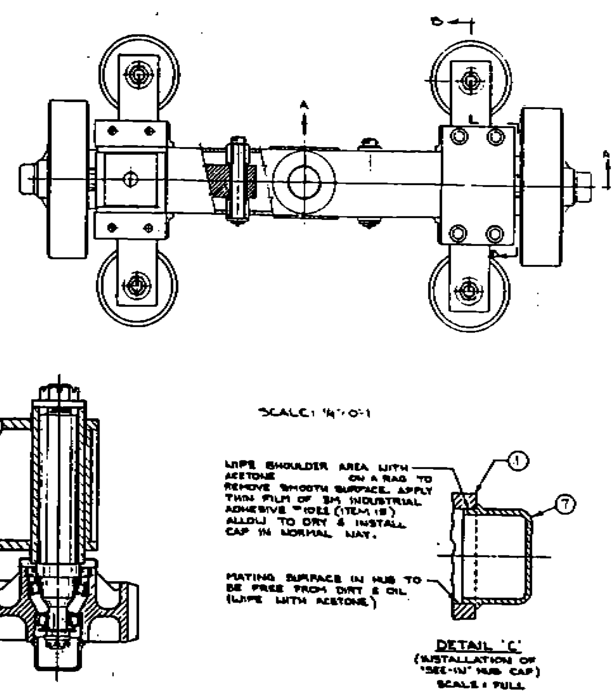
B — DRAWING NUMBER — REV

17

NOTES

1. WHERE INNER SURFACE OF CONE (ITEM 5) CONTACTS WITH SPINDLE (ITEM 2) APPLY LOCTITE #601 (ITEM 14). CAUTION: AVOID GETTING LOCTITE ON ROLLER SURFACES OF CONE (ITEM 5).
2. SEAL (ITEM 13) SHOULD BE INSTALLED FRONTWARDS AS SHOWN
3. LUBE BEARINGS WITH 1/4 FLUID OUNCE OF 10WT OIL.





ITEM	QTY	PART NO.	DESCRIPTION
15	N/A	606181	3M INDUSTIAL ADHESIVE #1022
14	A/R		LOCTITE #601
13	2	504902	CHICAGO RAWHIDE SEAL #17284
12	4	606124	COTTER PIN 1/8 DIA. x 1 1/2
11	2	506848	DORMAN SLOTTED NUT #615-071
10	2	606180	FO.MO.CO. LOCKWASHER #374536-S
9	2	505550	FO.MO.CO. NUT #374504-S
8	2	504463	TIMKEN CONE #LM11949
7	2	B31763	HUB CAP
6	2	A17452	SPINDLE WASHER
5	2	504491	TIMKEN CONE #LM67048
4	2	A33849	WASHER
3	2	C56954	UPSTOP WHEEL ASSEMBLY 5 3/4 OD
2	2	C56478	UPSTOP WHEEL SPINDLE
1	1	D68610	AXLE MODIFICATION

SCALE: HALF

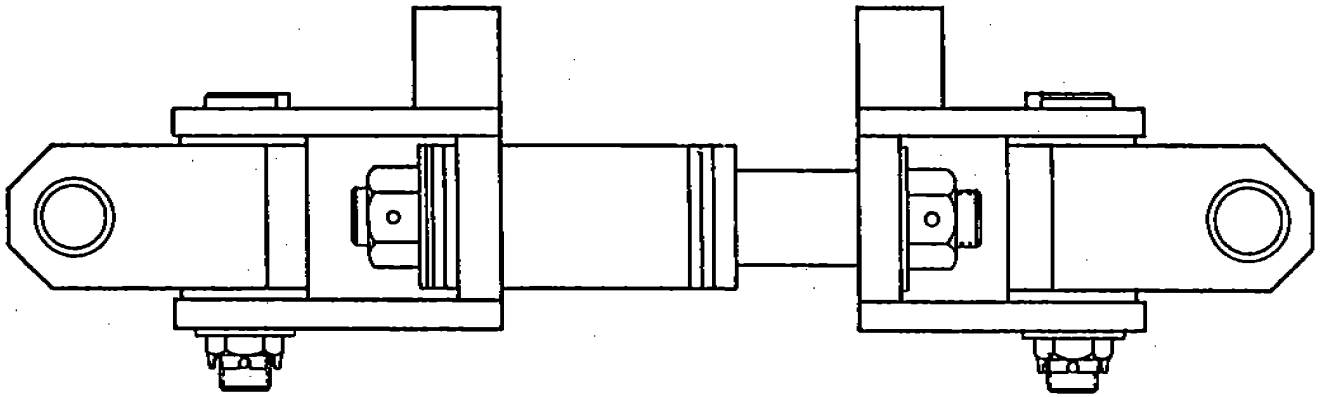
ARROW

AXLE MODIFICATION ASSEMBLY
RUNAWAY TRAIN

D68611

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP

NOTES:



36

ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC

NEXT ASSEMBLIES

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS ± 1/16
DECIMALS:
.X ± .040
.XX ± .020
.XXX ± .010
ANGLES: ± ½°
MACHINE FINISH 125

DO NOT SCALE

SCALE
DRAWN DATE
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW

Arrow Development Co., Inc.
1555 Plymouth Street
Mountain View, CA 94043
(415) 968-8341

TITLE:

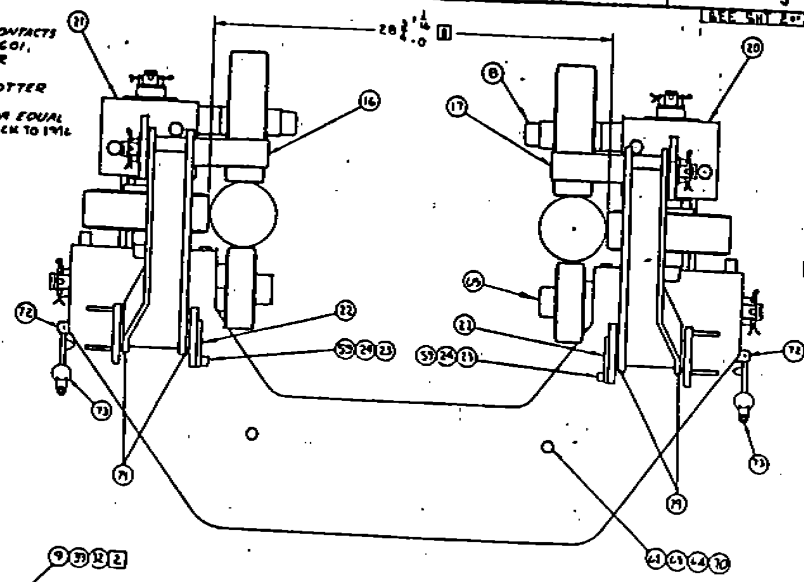
HITCH BAR ASSY.
RUN-AWAY TRAIN

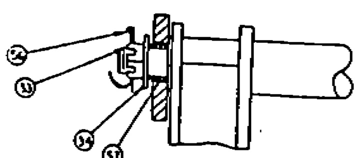
B

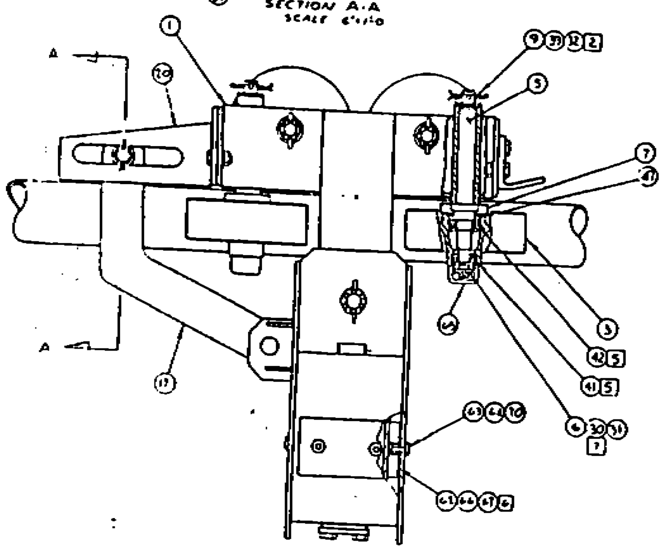
DRAWING NUMBER

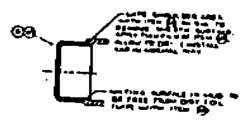
REV

NOTES
1. WHERE INNER SURFACE OF CONE (ITEM 42(41)) CONTACTS WITH SPINDLE (ITEM 4 OR 5) APPLY LOCTITE #601. CAUTION: AVOID GETTING LOCTITE ON ROLLER SURFACES OF CONE (ITEM 42(41))
2. TORQUE TO 300 FT-LBS/ ADVANCE TO NEXT COTTER PIN HOLE
3. PACK WITH CHEVRON MULTI-PURPOSE GRS-1 OR EQUAL
4. TIGHTEN BOLTS TO PRELOAD (11) & (17) FROM 1/16 THICK TO 1 9/16 THICK (61) FROM 1/4 THICK TO 1/16 THICK. (≈ 12%)
5. LUBRICATE WITH 10 WT OIL 1/2 OZ.
6. SHIM AS REQUIRED.
7. ADJUST FOR .003-.005 AXIAL MOVEMENT
8. USE ITEM (8) TO SHIM ITEM (1) (AS SHOWN IN DETAIL 'C' ON SHEET 2) TO OBTAIN 28 1/4 DIM; USE A MAXIMUM OF TWO SHIMS PER SIDE.




SECTION A-A
SCALE 6"=1'0


ITEM (13) & (12) NOT SHOWN FOR CLARITY


DETAIL B
INSTALLATION OF HUB CAP

71	10	504415	1/8 x 1 1/2 COTTER PIN	
70				
69		504181	3M INDUSTRIAL ADHESIVE # 847L	
68		500043	ACETONE	
67	8	B56011	BUMPER SHIM	
66	8	B56016	BUMPER SHIM	
65	6	D51165	HUB CAP	
64	4	502366	1/4-20 UNC TEE NUT PRONG x 3/8	
63	4	401336	1/4-20 UNC HHCS x 1	
62	4	B54111	SIDE BUMPER	STL
61	2	B54715	CUSHION	
60	1	B54575	SPACER	
59	AR	503008	.0032 DIA. SAFETY WIRE	
58	4	502303	1/2-13 UNC ESNA NUT	STL
57	2	B21565	BUSHING MOD.	
56	2	502462	1/8 x 2 1/2 COTTER PIN	
55	AR	510710	LOCKTITE # 601	
54	2	510709	SPHERICAL BEARING GE45ES	
53	2	510708	SPHERICAL BEARING GE35ES	
52	1	509556	TIMKEN CUP # 39422	
51	2	B54492	THRUST WASHER	
50	2	B54489	BEARING RETAINER	
49	2	B54488	BEARING RETAINER	
48	4	506005	1/4-28-UNF SHORT ZERK FITTING	
47	8	504865	NATIONAL SEAL #50065 - NO SUBSTITUTION	
46	2	510184	C/R OIL SEAL # 19210	
45	1	504920	C/R OIL SEAL # 32310	
44	1	504515	TIMKEN CUP # 25522	
43	1	504449	TIMKEN CONE # 25590	
42	10	504491	TIMKEN CONE # LM 67048	
41	10	504463	TIMKEN CONE # LM 11949	
40	2	509272	1/4 DIA x 2 1/2 COTTER PIN	
39	8	501454	3/16 DIA x 1 1/2 COTTER PIN	STL
38	12	510705	10-24 UNC FHMS P x 3/8	STL
37	12	510706	1/4-20 UNC FHMS P x 5/8	STL
36	2	509525	1 1/4 FLAT WASHER	STL
35	2	510165	1 1/4-12-UNF SLOTTED HEAVY HEX NUT	STL
34	2	502101	7/8 FLAT WASHER	
33	2	505838	7/8-14 UNF SLOTTED NUT	STL
32	8	506C64	1-14UNF SLOTTED HEX NUT	STL
31	10	506180	FOMO CO LOCKWASHER # 374536-5	STL
30	10	503330	FOMO CO NUT # 374504-5	
29	12	506125	3/4 FLAT WASHER	
28	12	502307	3/4-10 UNC HEX ESNA NUT	STL
27	12	501506	3/4-10 UNC x 2 1/4 HHCS	STL
26	4	501455	1/2-13 UNC HHCS-5	STL
25	4	501493	1/2-11 UNC HHCS-4 1/2	STL
24	2	502194	3/8 LOCKWASHER	STL
23	2	507501	3/8-16 UNC x 1 SHCS DRILLED HEAD	STL
22	2	C48872	SHAFT WELDMENT	
21	1	E37712-30	MOUNTING BRACKET	
20	1	E37712-30	MOUNTING BRACKET	
19	1	C540841	SAFETY PLATE	
18	1	C540842	SAFETY PLATE	
17	1	E37715-300	SECONDARY SUPPORT	
16	1	E37715-301	SECONDARY SUPPORT	
15	2	B54493	CUSHION PLATE	
14	2	B54492	CUSHION PLATE	
13	2	B54458	CUSHION	
12	2	B54457	CUSHION	
11	1	D54312	OUTER AXLE	
10	1	D54278	INNER AXLE	
9	8	B54774	WASHER - ROAD WHEEL	
8	4	B54592	HUB CAP - SHORT	
7	4	B54480	DUST SHIELD	
6	10	A17452	SPINDLE WASHER	
5	8	C54479	ROAD WHEEL SPINDLE	
4	2	D54478	UP WHEEL SPINDLE	
3	8	C42533	ROAD WHEEL	
2	2	C28475	UP & GUIDE WHEEL	
1	2	D54053	WHEEL CARRIER	

ITEM	QTY	PART IDENT	DESCRIPTION	MAT'L SPEC
83	5/8	511873	1 1/4 THIN FLAT WASHER (.0478 THK.)	
82	4	502304	5/8-11 UNC ESNA NUT	
81	4	D63136	CUSHION WASHER	
80	4	502190	5/8 FLATWASHER	
79	4	511668	NYLON THRUST BEARING 1 1/8 OD x 1 1/4 ID x 1/8	BOSTON UT 2034
78	2	506034	5/16 SAE FLATWASHER	
77	2	502322	5/16-18 UNC ESNA NUT	
76	2	501365	5/16-18 UNC x 1 1/2 HHCS	
75	2	506174	1/4-20 UNC ESNA NUT	
74	2	501341	1/4-20 UNC x 1 1/4 HHCS	
73	2	511520	RUBBER HOOD LATCH	
72	2	511136	ANCHOR BRACKET	

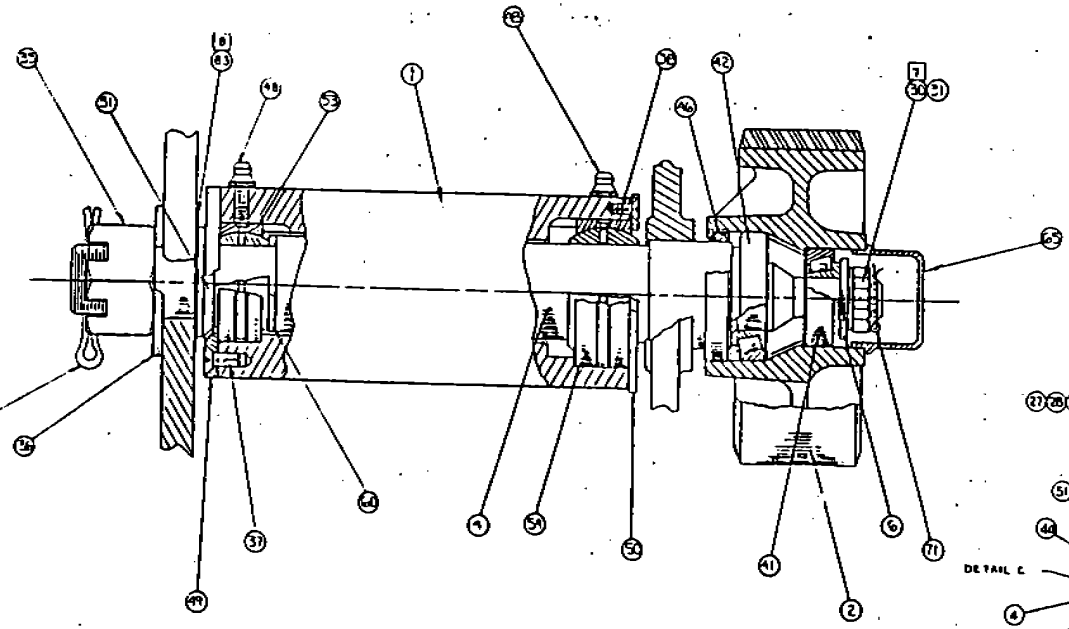
SCALE 1"=1'-0
DN 10-17-81
FED 21-81

ARROW
AXLE ASSEMBLY
SUSPENDED COASTER
D54487 H

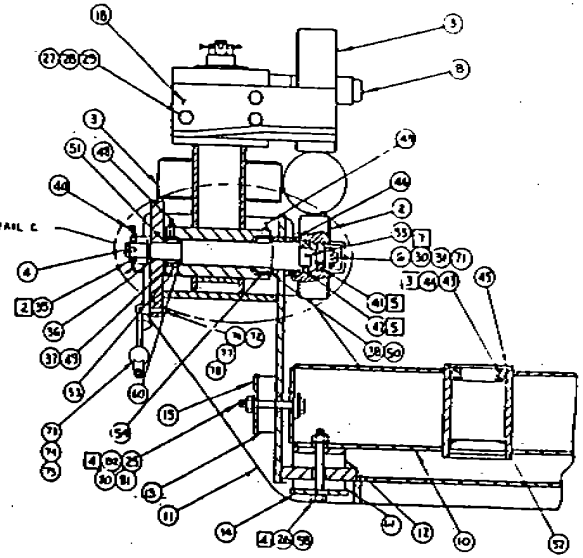
MICROFILMED 1

NOTES
SEE SHT 1 OF 2

A	C-3	CHANGE NUT 1-14UNF WAS 1/2			
B		ADD ITEM 10, 11, SHT 2 OF 2 DET. C			
C					
D		ADD ITEMS 08 - 09 & NOTE 7			
F					
G	B-3				
H		ITEM 83 + NOTE 6 & 28 DIA DIM ADDED			



DETAIL C



DETAIL C

SEE SHT 1 OF 2

ARROW

AXLE ASSY.
SUSP. COASTER

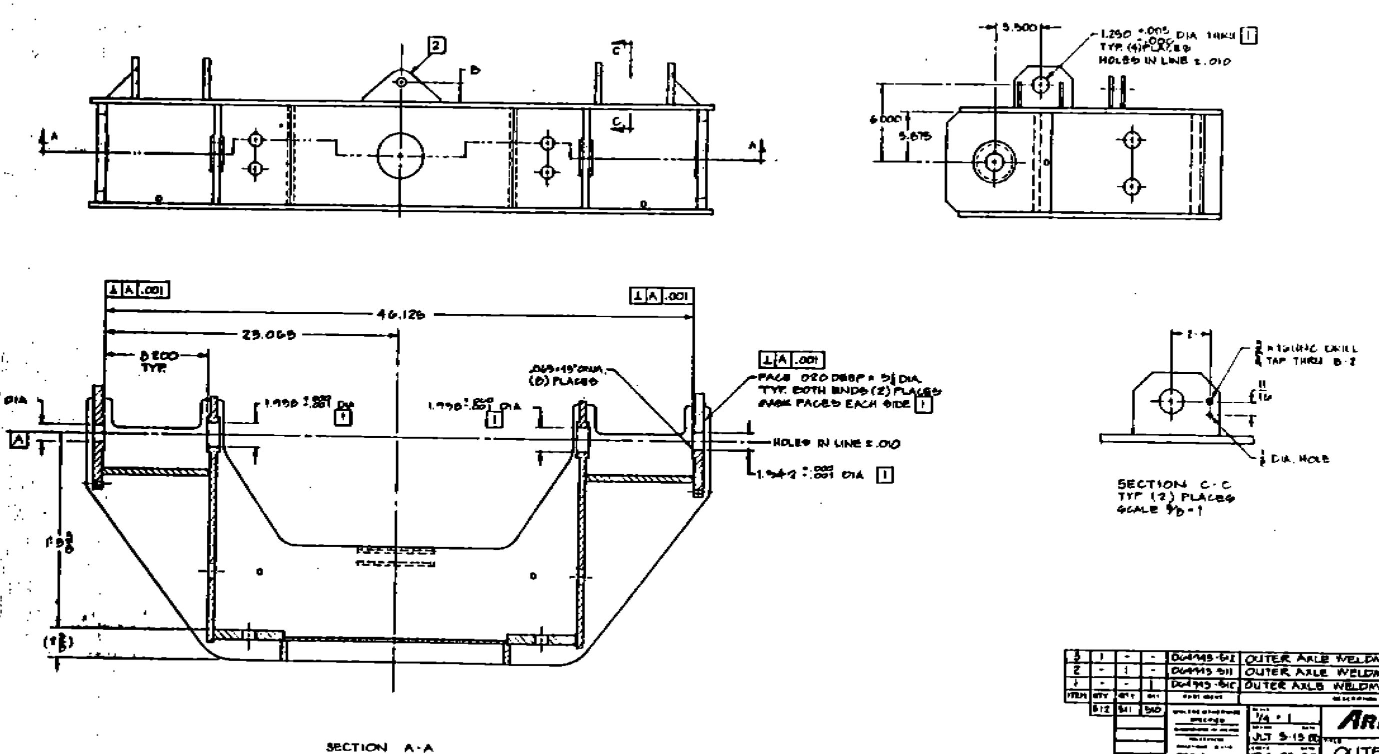
054487
SHT 2 OF 2
H

MICROFILMED

NOTES

1. FINISH: PER JOB SPEC. MASK IN LINE BORES & FACES
2. 510 - INTERMEDIATE AXLE
   511 - LEAD AXLE
   512 - TRAILING AXLE

2	-B- REF.
510	NONE
511	1½ - 1 HOLE
512	3½ - 2 HOLES

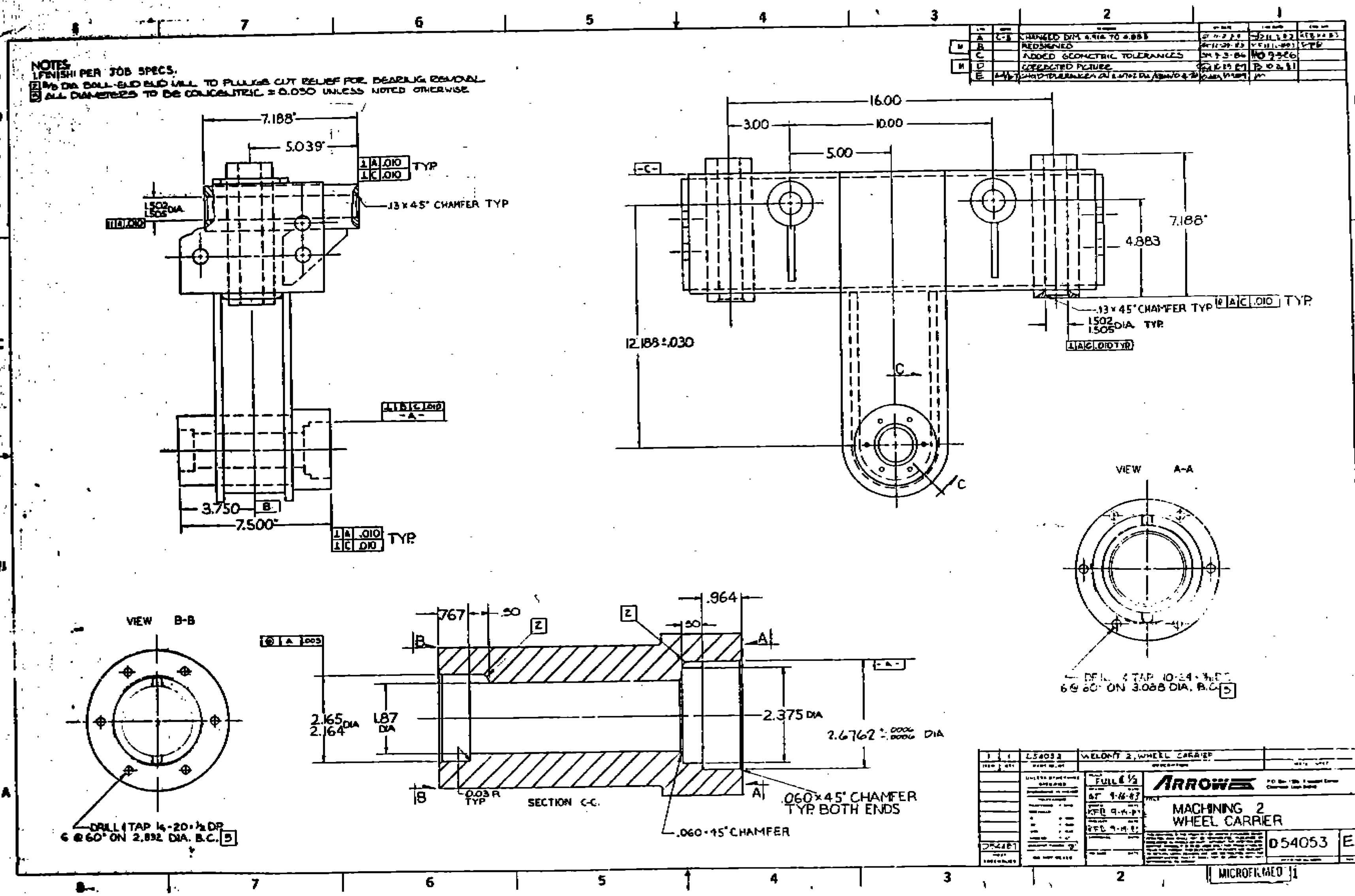


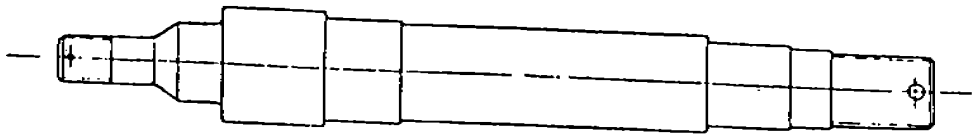
ITEM	QTY 512	QTY 511	QTY 510	PART NUMBER	DESCRIPTION
3	1	-	-	D64943-512	OUTER AXLE WELDMENT
2	-	1	-	D64943-511	OUTER AXLE WELDMENT
1	-	-	1	D64943-510	OUTER AXLE WELDMENT

ARROW

OUTER AXLE MACHINING
SUSPENDED COASTER

D64944


NOTES
1. FINISH PER JOB SPECS.
4 ⅝ DIA BALL-END END MILL TO PLUNGE CUT RELIEF FOR BEARING REMOVAL
5 ALL DIAMETERS TO BE CONCENTRIC ±0.030 UNLESS NOTED OTHERWISE
A CHANGED DIM 4.916 TO 4.883
B REDESIGNED
C ADDED GEOMETRIC TOLERANCES
D CORRECTED PICTURE
7.188"
5.039"
.13 x 45° CHAMFER TYP
1.502 1.505 DIA
3.750
7.500"
TYP
16.00
3.00
10.00
5.00
-C-
7.188"
4.883
.13 x 45° CHAMFER TYP
1.502 1.505 DIA TYP
12.188±.030
-A-
VIEW A-A
DRILL & TAP 10-24 x ½ DP 6 @ 60° ON 3.088 DIA. B.C. 5
VIEW B-B
DRILL & TAP ¼-20 x ½ DP 6 @ 60° ON 2.832 DIA. B.C. 5
.767
.50
.964
2.165 2.164 DIA
1.87 DIA
2.375 DIA
2.6762 DIA
.060 x 45° CHAMFER TYP BOTH ENDS
.060 x 45° CHAMFER
.03 R TYP
SECTION C-C
D54053
WELDMT 2, WHEEL CARRIER
FULL & ½
ARROW
MACHINING 2 WHEEL CARRIER
D54053 E
MICROFILMED



ITEM	QTY	PART IDENT	DESCRIPTION	MATL

UNLESS OTHERWISE SPECIFIED:

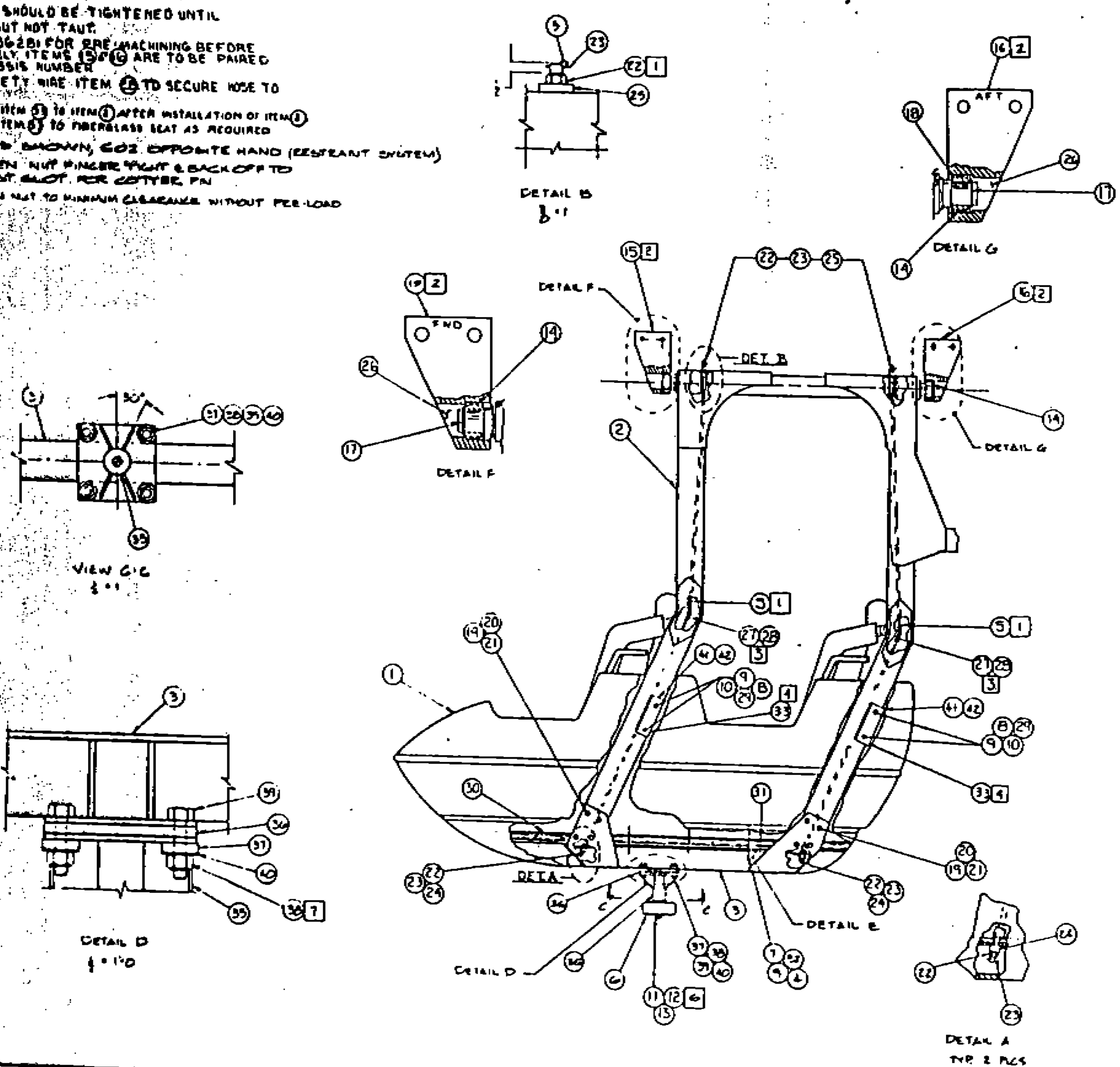
DO NOT SCALE

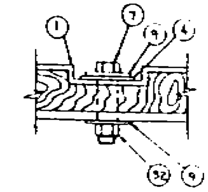
ARROW

SPINDLE
UPSTOP · SUSPENDED COASTER

B

NOTES:
1. CABLE SHOULD BE TIGHTENED UNTIL SNUG BUT NOT TAUT.
2. SEE 656281 FOR PRE-MACHINING BEFORE ASSEMBLY. ITEMS 15 & 16 ARE TO BE PAIRED BY CHASSIS NUMBER
3. USE SAFETY WIRE ITEM 28 TO SECURE HOSE TO CABLE.
4. FASTEN ITEM 33 TO ITEM 1 AFTER INSTALLATION OF ITEM 8. POT IN ITEM 33 TO FIBERGLASS SEAT AS REQUIRED
5. ... AS SHOWN, -002 OPPOSITE HAND (RESTRAINT SYSTEM)
6. TIGHTEN NUT FINGER TIGHT & BACK OFF TO NEAREST SLOT FOR COTTER PIN
7. TIGHTEN NUT TO MINIMUM CLEARANCE WITHOUT PRE-LOAD





42	6	6	661644	SHIM
41	6	6	661645	DOUBLER PLATE
40	4	4	[illegible]	1/2 FLATWASHER
39	4	4	506328	1/2-13 UNC x 2 1/4 HHCS
38	4	4	502303	1/2-13 UNC ELA NUT
37	4	4	[illegible]	SHOCK MOUNT [illegible]
36	1	1	C66492	GUIDE WHEEL SHOCK PAD
35	1	1	C66490	GUIDE WHEEL MOUNT [illegible]
34	1	—	26090-502	COACH BODY
33	4	4	C60133	POT IN BRACKET
32	6	6	506046	ESNA NUT 3/8-16 UNC
31	1	1	C60272	FLOOR MAT REAR
30	1	1	C60225	FLOOR MAT FRONT
29	4	4	501398	HHCS 3/8-16UNC x [illegible]
28	A/R	A/R	503808	SAFETY WIRE
27	2	2	504228	HOSE WEATHERHEAD [illegible]
26	REF	REF	C56281	BEARING HOUSING PAID
25	2	2	E51455	WASHER
24	2	2	[illegible]	BEVEL WASHER
23	4	4	506127	COTTER PIN 1/8 x [illegible]
22	4	4	502379	ESNA NUT 5/8-18UNF
21	8	8	502196	LOCKWASHER 1/2
20	8	8	502271	HEX NUT 1/2-13 UNC
19	8	8	[illegible]	HHCS 1/2-13 UNC x 4 1/2
18	1	1	504514	RETAINING RING
17	2	2	[illegible]	RETAINING RING
16	1	1	C54066	AFT BEARING HOUSING
15	1	1	C54067	FWD BEARING HOUSING
14	2	2	504574	SPHER BEARING 1.75 BORE
13	1	1	506124	COTTER PIN 1/8 DIA x 1 1/2
12	1	1	506183	SLOTTED HEX NUT 3/4-[illegible]
11	1	1	[illegible]	[illegible]
10	4	4	502269	HEX NUT 3/8-16UNC
9	16	16	502176	FLATWASHER 3/8
8	4	2	502194	LOCKWASHER 3/8
7	6	6	501392	HHCS 3/8-16UNC x 2 1/2
6	1	1	[illegible]	[illegible]
5	2	2	A56286	SAFETY CABLE
4	6	6	502171	7/16 FLATWASHER
3	1	1	D56165	LOWER HANGER
2	1	1	D56163	COACH HANGER
1	—	1	26090-001	COACH BODY

SCALE 1/4 : 1

ARROW

COACH ASSY
BUSP COASTER

3. Check all wheels as follows:

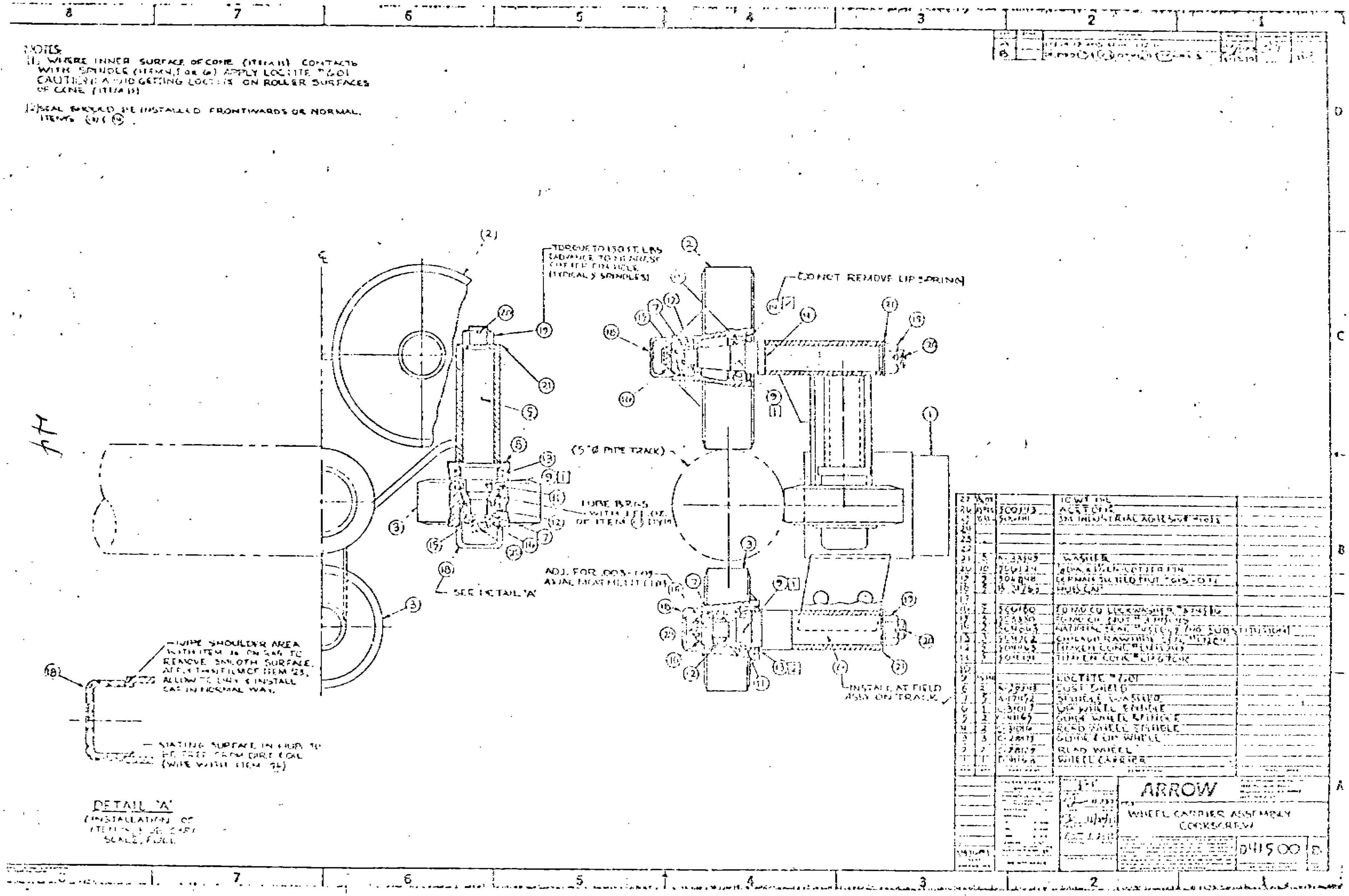
a. Wheels with excessive tread wear must be replaced. Any wear of 1/4 inch or more is considered to be excessive.

b. Cuts and cracks or checking of the polyurethane are not cause for replacement as long as the tread is not coming off of the hub.

c. Loose tread or missing chunks of tread is reason for replacement of the wheels if the chunks are large enough to extend into the normal running path of the wheel.

d. All wheels should have 1/4" to 1/2" of oil showing in the hub caps.

e. Wheel bearings should be adjusted so that a barely perceptible end play exists for the most free running condition.


NOTES:
WHERE INNER SURFACE OF CONE CONTACTS WITH SPINDLE APPLY LOCTITE #601. CAUTION: AVOID GETTING LOCTITE ON ROLLER SURFACES OF CONE
SEAL SHOULD BE INSTALLED FRONTWARDS OR NORMAL.
TORQUE TO 150 FT. LBS ADVANCE TO NEAREST COTTER PIN HOLE (TYPICAL 3 SPINDLES)
DO NOT REMOVE LIP SPRING
(5" Ø PIPE TRACK)
LUBE BRGS
ADJ. FOR .003-.005 AXIAL MOVEMENT
SEE DETAIL 'A'
INSTALL AT FIELD ASSY ON TRACK
WIPE SHOULDER AREA TO REMOVE SMOOTH SURFACE. ALLOW TO DRY & INSTALL SEAL IN NORMAL WAY.
SEATING SURFACE IN HUB TO BE FREE FROM DIRT & OIL
DETAIL 'A'
SCALE: FULL
WASHER
COTTER PIN
HUB CAP
LOCKWASHER
LOCTITE #601
DUST SHIELD
SPINDLE WASHER
ROAD WHEEL
WHEEL CARRIER
ARROW
WHEEL CARRIER ASSEMBLY
CORKSCREW
041500

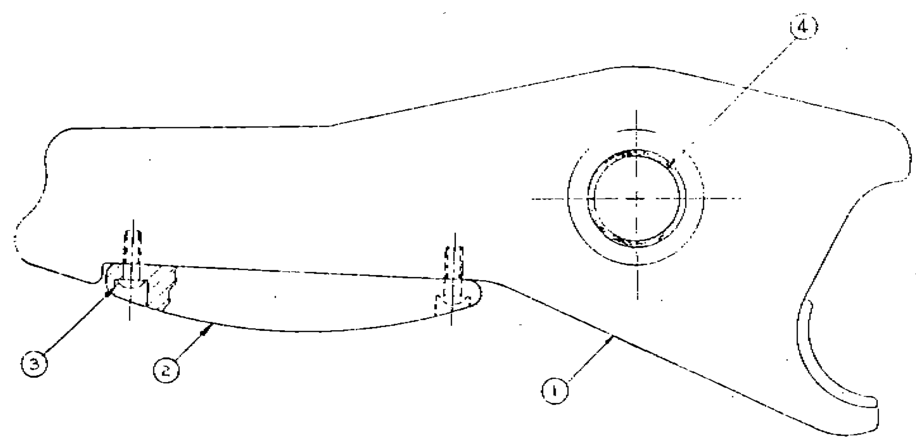
4. Chain dogs and anti-rollback dogs:

   a. Dogs should show no sign of bending and should move freely on their shafts.

   b. Return springs must be in place on the chain dogs.

   c. Dog shafts are replaceable and if not properly secured they may move outward. This will cause the dogs to be out of position so that they may not engage properly. Check to dimension given on drawings.

NOTES:
1. FINISH NONE
2. USE LOCKTITE 242 ON BOLTS.



ITEM	QTY	PART IDENT	DESCRIPTION	MATL
4	1	B42701	BUSHING	
3	2	512292	1/4-28 UNF x 3/4 RHMS P	SS
2	1	D65560	LINER	
1	1	D65558	ANTI ROLLBACK DOG	

SCALE: FULL

ARROW

ANTI ROLL BACK DOG ASSY.

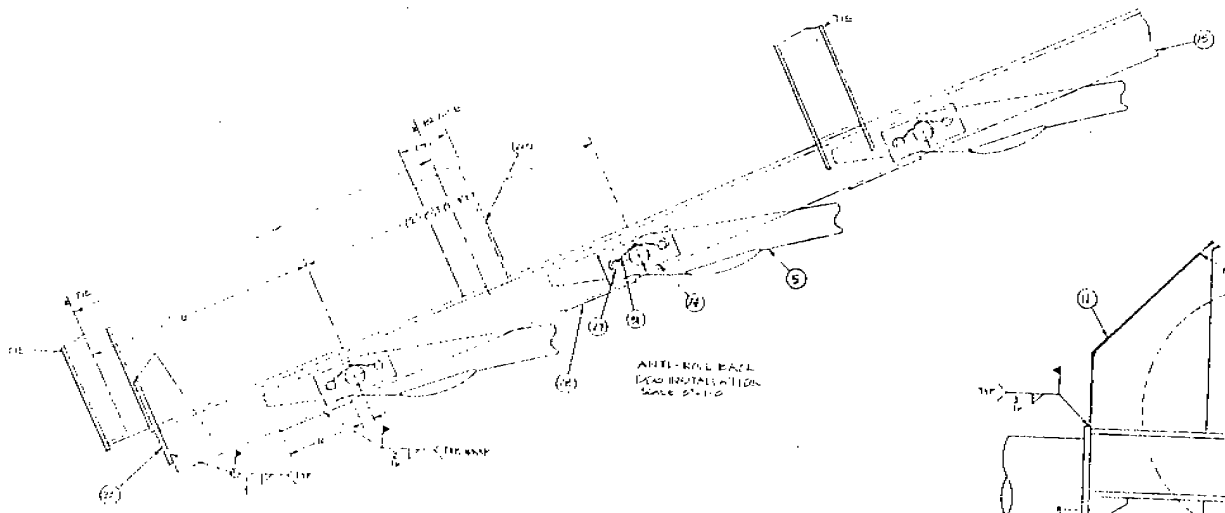
C65557 A

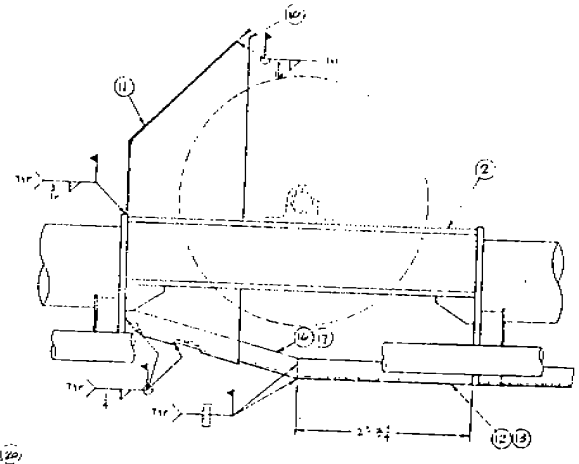
DO NOT SCALE

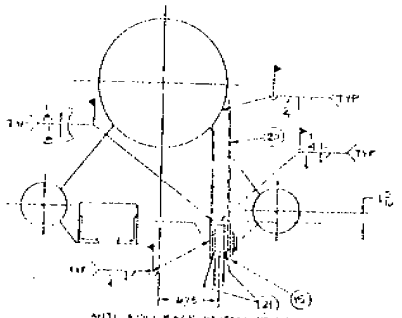
MICROFILMED

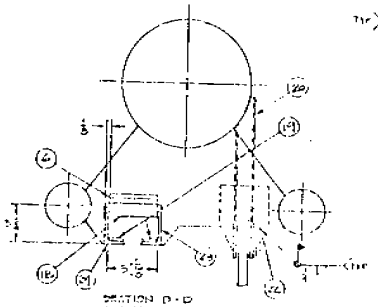
45

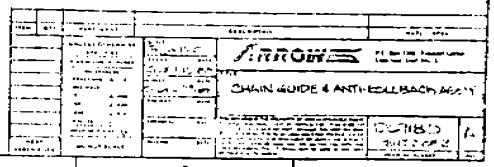
NOTES



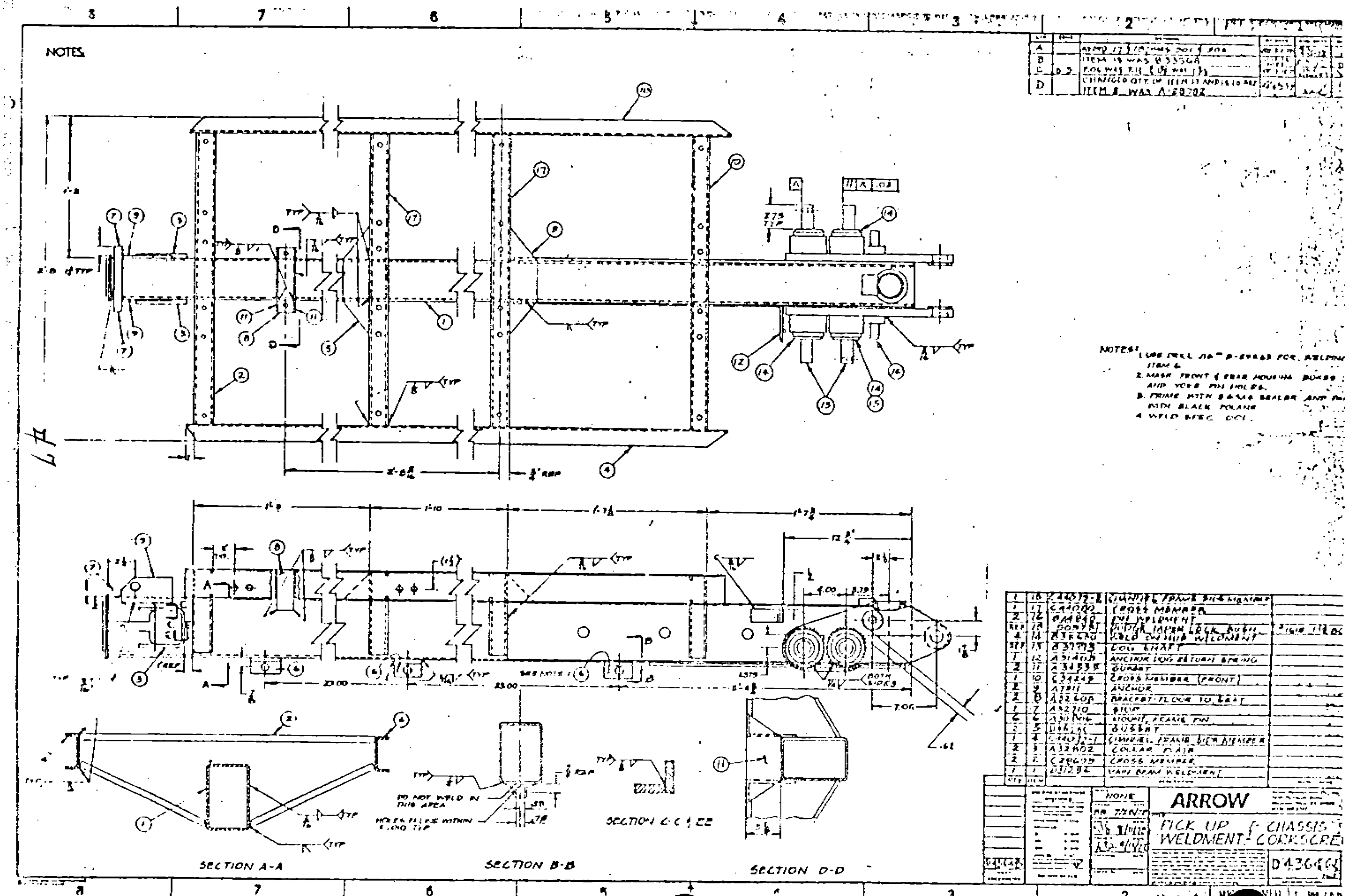


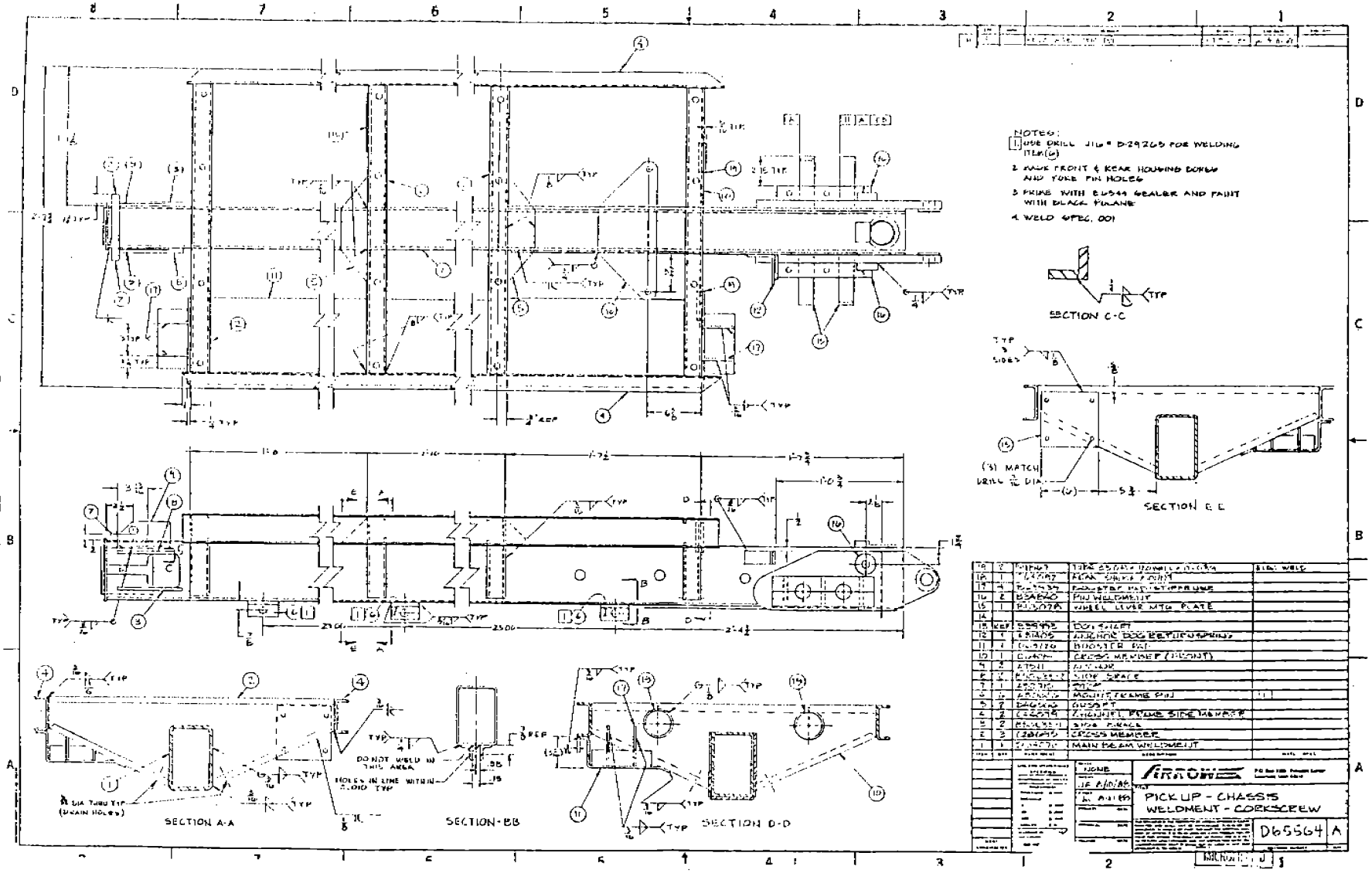






46


NOTES
NOTES:
2. MASK FRONT & REAR HOUSING BORES AND YOKE PIN HOLES.
4. WELD SPEC.
ITEM 19 WAS B33564
ITEM 8 WAS A128702
CROSS MEMBER
COIL SHAFT
ANCHOR
GUSSET
CROSS MEMBER (FRONT)
BRACKET-FLOOR TO SEAT
CROSS MEMBER
NONE
ARROW
PICK UP WELDMENT - CHASSIS & CORKSCREW
SECTION A-A
SECTION B-B
SECTION C-C & EE
SECTION D-D
#7


NOTES:
1. USE DRILL JIG # D-29265 FOR WELDING ITEM (6)
2. RACK FRONT & REAR HOUSING BORES AND YOKE PIN HOLES
3. PRIME WITH E-1544 SEALER AND PAINT WITH BLACK POLANE
4. WELD SPEC. 001
SECTION C-C
SECTION E-E
(3) MATCH DRILL 7/16 DIA
SECTION A-A
SECTION B-B
SECTION D-D
DO NOT WELD IN THIS AREA
HOLES IN LINE WITHIN .010 DIA TYP
PICK UP - CHASSIS WELDMENT - CORKSCREW
D65564 A

84

5. Shoulder Restraint Bar:

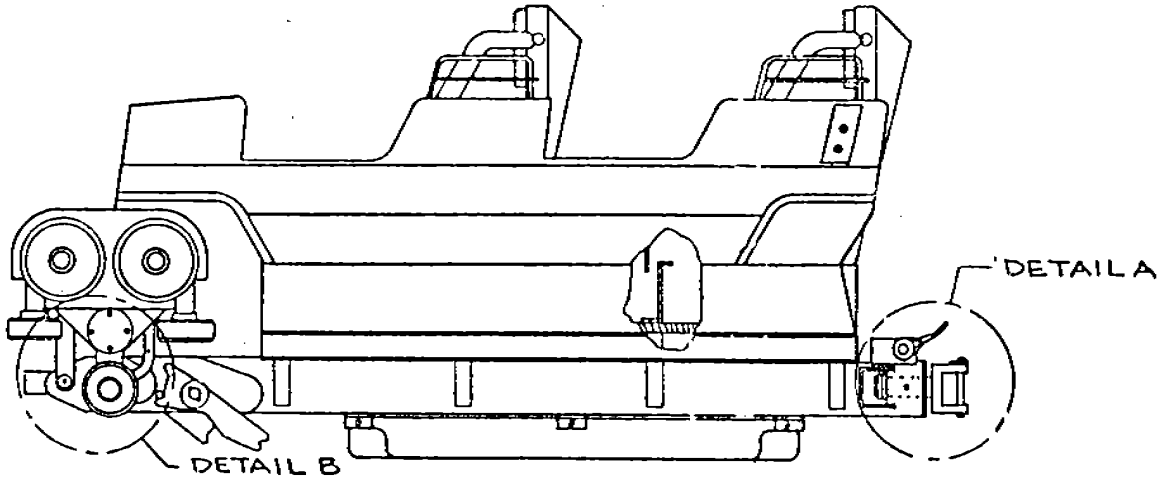
a. Bars should have all foam padding in place. Those with large sections missing should be replaced.

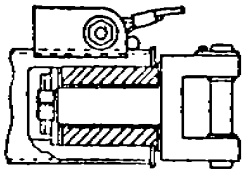
b. When unlocked the bars should move freely up. The bars should stay in any position without falling.

c. When locked the bars should move down only and resist any upward force. The bars should stay in any position without falling.

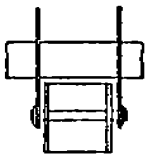
NOTES:

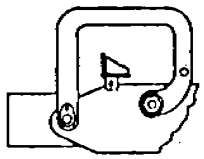
LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP





DETAIL A





DETAIL B

ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC

NEXT ASSEMBLIES

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS ± 1/16
DECIMALS:
.X ± .000
.XX ± .030
.XXX ± .010
ANGLES: ± ½°
MACHINE FINISH ▽▽
DO NOT SCALE

SCALE
DRAWN DATE
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW

Arrow Development Co., Inc.
1555 Plymouth Street
Mountain View, CA 94042
(415) 968 8342

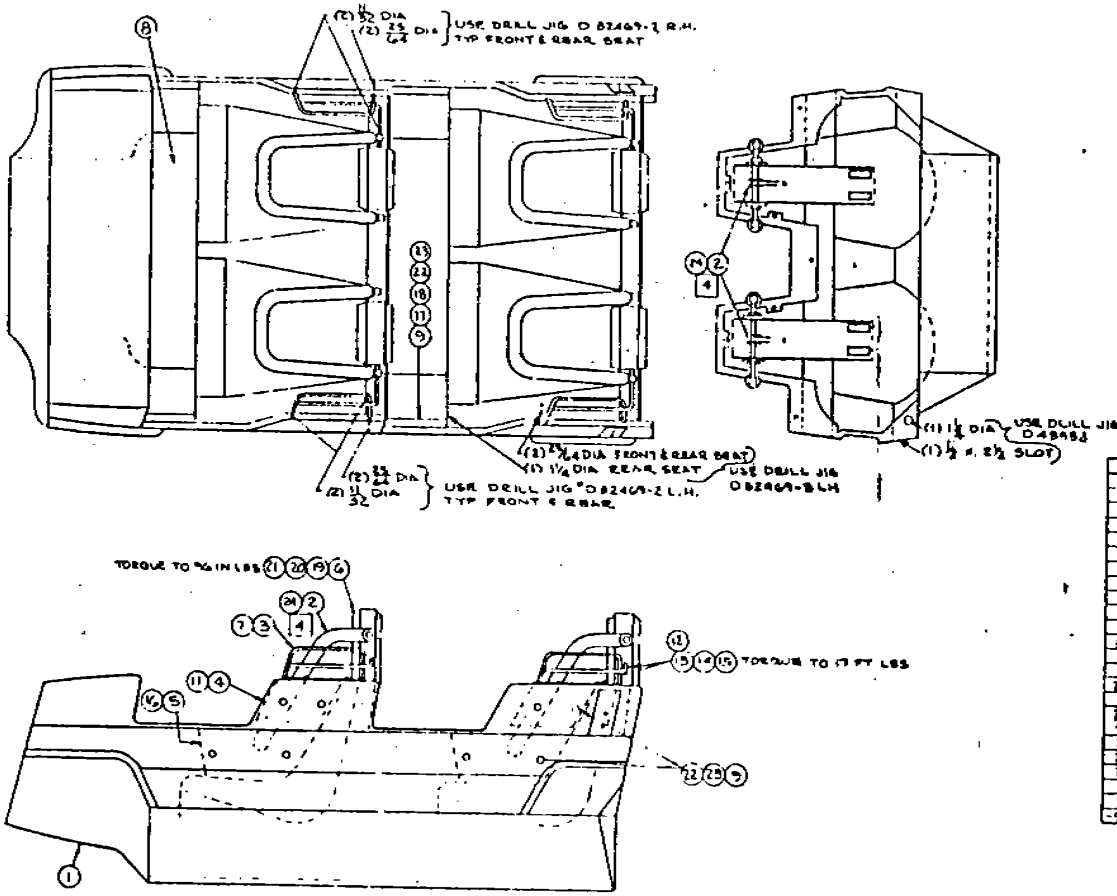
TITLE:
ASSEMBLY - COACH PICKUP

B

DRAWING NUMBER | REV

NOTES
1
2 USE GRIP ADHESIVE TO BOND FLOOR MAT (ITEM 8)
3 FROM PER PROJECT SPEC.

LTR		REVISION
A		[illegible] NOTE 4
B		DELETED ①, NUMBER
C		ITEM ⑦ WAS [illegible]
D		ADD ITEM 24 & NOTE 4
E		[illegible] DELETE NOTE [illegible]
F		ITEM ⑤ WAS [illegible]



-501	-901	ITEM	PART NO.	DESCRIPTION
		24	D48127	RESTRAINT ASSY W/O AUTO RELEASE
20	20	23	502617	1/4 FLATWASHER B.ST.
20	20	22	507845	1/4 - 20UNC - 1 PHMS B.ST.
12	12	21	501989	1/4 - 20UNC x 1 1/4 HHCS
12	12	20	502192	1/4 DIA LOCKWASHER
12	12	19	506091	1/4 DIA FLATWASHER
1	1	18	C41354-1	LINKAGE COVER
4	4	17	502609	1/4 - 20UNC [illegible] NUT B.ST.
2	2	16	C33230-501	KNEE PAD
12	12	15	[illegible]	5/16 - 18UNC [illegible] B.ST.
12	12	14	[illegible]	5/16 STD LOCKWASHER B.ST.
12	12	13	[illegible]	5/16 FLAT WASHER B.ST.
12	12	12	[illegible]	5/16 - 18UNC HEX NUT B.ST.
2	2	11	C49344-501	ARM PAD
20	20	9	502683	1/4 LOCKWASHER B.ST.
1	1	8	C52372	FLOOR MAT
2	2	7	D37092-501	ARM GUARD
4	4	6	D41601	HEAD REST
2	2	5	C51158-501	KNEE PAD
2	2	4	C49344-501	ARM PAD
2	2	3	D37092-501	ARM GUARD
	1	2	D48128	RESTRAINT BAR & LOCK ASSY
1	1	1	D45881	MOLDED BODY ASSY

D43837
D43838
D43817

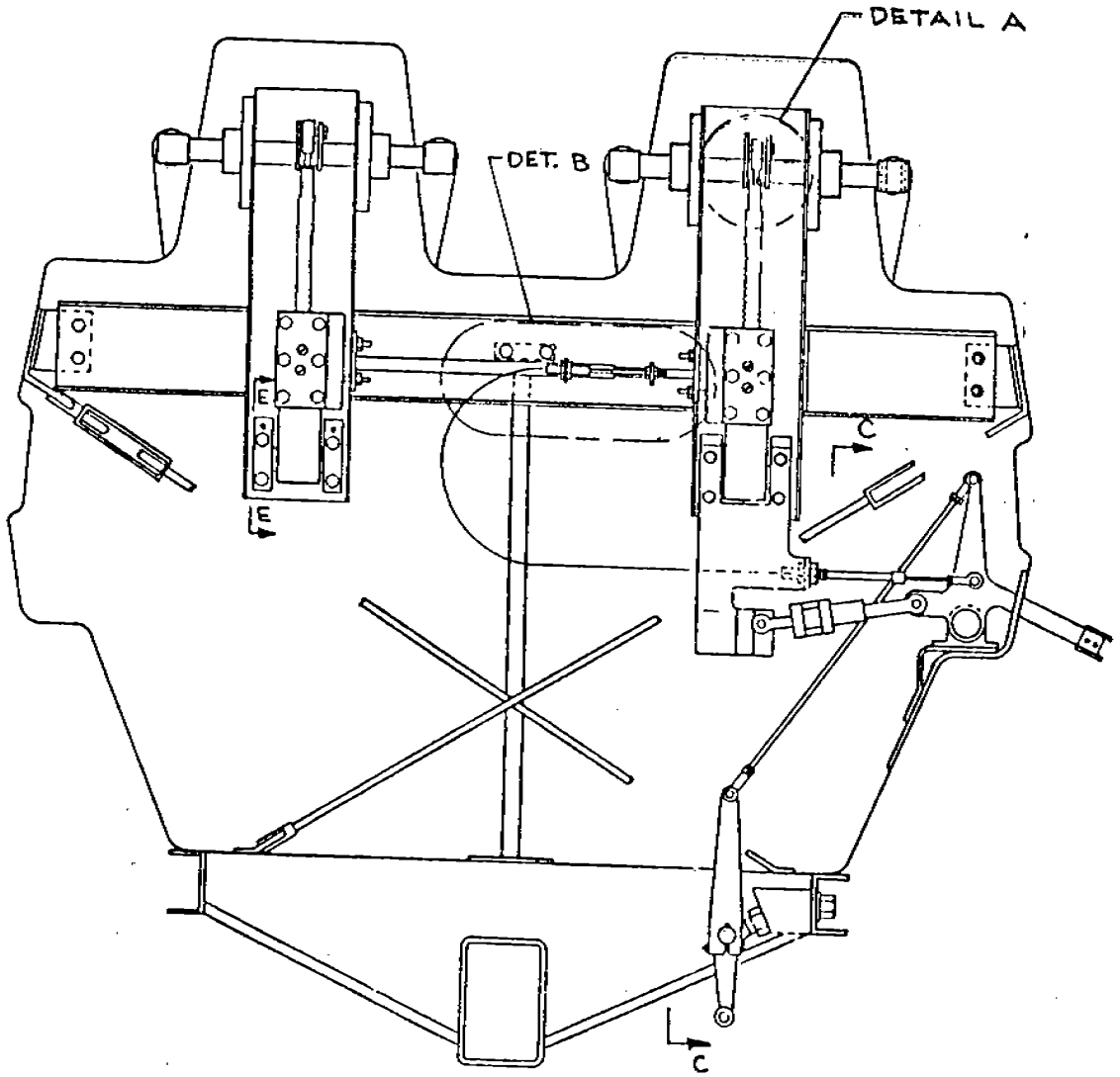
ARROW

COACH BODY ASS'Y
PEDAL ON LEFT SIDE

D45869

MICROFILMED

51



ARROW

Arrow Development Co., Inc.
1855 Plymouth Street
Mountain View, CA 94043
(415) 968 8342

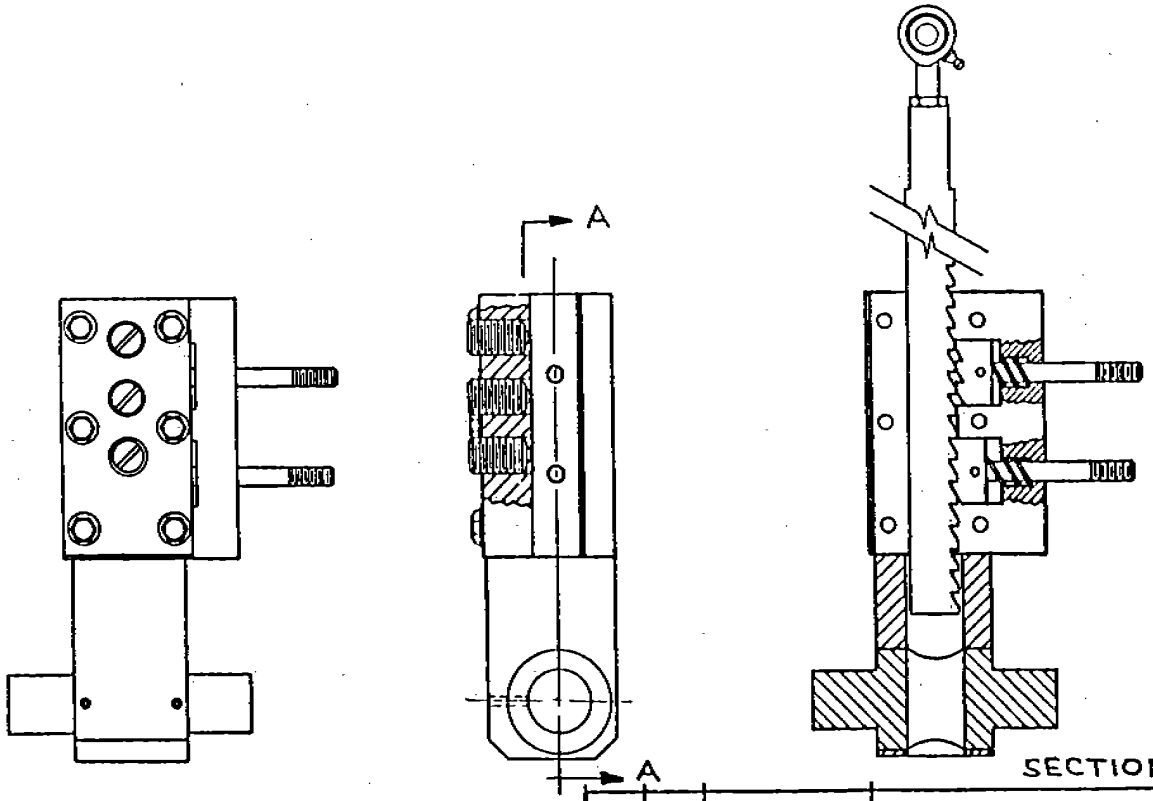
TITLE:

CORKSCREW VEHICLE - RATCHET RESTRAINT INSTALLATION - PEDAL ON RIGHT - AUTO RELEASE

DRAWING NUMBER

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP.

NOTES:



SECTION A-A

ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC

NEXT ASSEMBLIES

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS: ± 1/16
DECIMALS:
.X ± .030
.XX ± .010
.XXX ± .010
ANGLES: ± ½°
MACHINE FINISH 125
DO NOT SCALE

SCALE
DRAWN DATE
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW

Arrow Development Co., Inc.
1553 Plymouth Street
Mountain View, CA 94042
(415) 968 8342

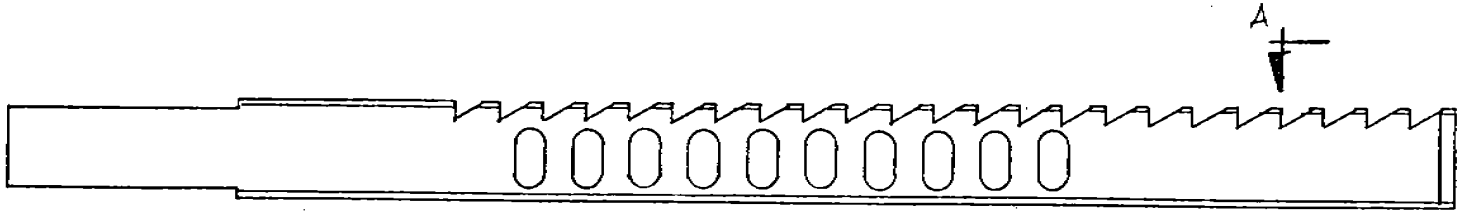
TITLE:
RACHET MODULE ASSEMBLY
CORKSCREW RESTRAINT

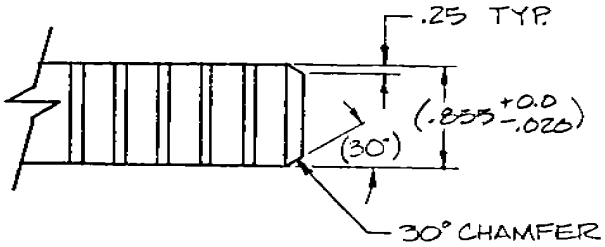
B
DRAWING NUMBER
11
REV

53

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP
A		CA7126 WAS CA7216	3-11-87	4-1-87	

NOTES:





ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC
1	1	CA7126	RATCHET SHAFT	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES
FRACTIONS ± 1/16
DECIMALS:
.X ± .080
.XX ± .030
.XXX ± .010
ANGLES: ± ½°
MACHINE FINISH 125
DO NOT SCALE

NEXT ASSEMBLIES

SCALE NONE
DRAWN DATE 7-8-86
CHECK DATE 7-8-86
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW Dynamics Inc.
P.O. Box 1386 - Freeport Center
Clearfield, Utah 84016

TITLE
RATCHET MODIFICATION

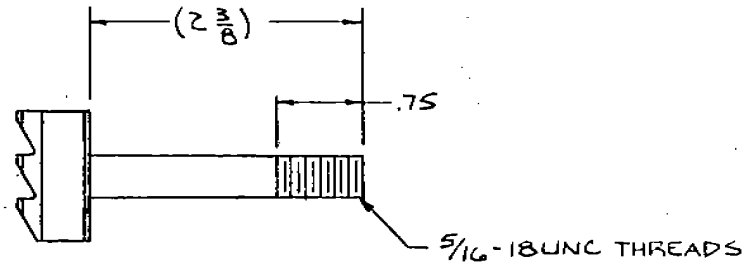
B59612 | A
DRAWING NUMBER | REV

DIETZGEN POST REORDER NO. 66430

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP
A		①②③ ADDED HEAT TREAT PROCEDURE WAS B47281 B47694 & 509596	SB 6-8-83	WK 6/6/83	WK 6/6/83
B		ADDED 2 3/8, 1.75, 5/16-18UNC THREADS	[illegible] 5-12-87	① 5-13-87	
C	C-4	ADDED NOTE #2	[illegible] 1-11-89	[illegible]	

NOTES:

1. HEAT TREAT AS FOLLOWS :
   - A) CARBURIZE .025 -.030
   - B) ATMOSPHERE COOL.
   - C) INDUCTION HARDEN RATCHET END ONLY.
   - D) TEMPER 50-55 R_C
   - E) GLASS BEAD HONE.
2. THIS PART MAY BE SUBSTITUTED WITH B 67119.



ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC
1	1	C90153	RATCHET BLOCK CASTING	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS ± 1/16
DECIMALS:
.X ± .060
.XX ± .030
.XXX ± .010
ANGLES: ± 1/2°
MACHINE FINISH 125
DO NOT SCALE

NEXT ASSEMBLIES

SCALE FULL
DRAWN TJ 12-7-79 DATE
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW DYNAMICS INC.
P.O. Box 1386 - Freeport Center
Clearfield, Utah 84016

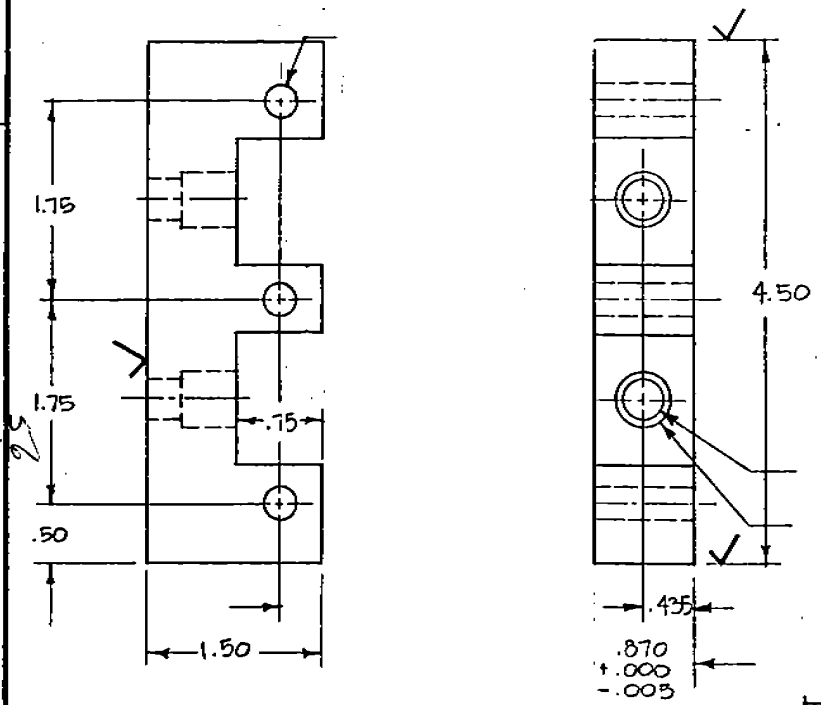
TITLE: RATCHET

B47695 — DRAWING NUMBER — C REV

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP.
L		REDREW AND ADDED DIM. .558	JON 9-17-89	h 9-26-89	
M		.468 WAS 15/32	h 8-22-89	RICK 8/22/89	

NOTES: 1. ALL FRACTIONAL TOLERANCES: $\pm \frac{1}{64}$

2. FINISH: CAP PLATE TYPE II



ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC
1	1	511609	BAR 1 3/4 x 7/8 x 0-49/16	CR 1018

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS ± 1/16
DECIMALS:
.X ± .060
.XX ± .030
.XXX ± .010
ANGLES: ± ½°
MACHINE FINISH 125
DO NOT SCALE

D-47239
NEXT ASSEMBLIES

SCALE FULL
DRAWN DATE TJ 9-27-71
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

ARROW ENGINEERING
P.O. Box 1386 - Freeport Center
Clearfield, Utah 84016

TITLE: RATCHET PLATE - RESTRAINT

D47229 M
DRAWING NUMBER REV

MICROFILMED

DIETZGEN POST REORDER NO. 80490

ARROW

TECHNICAL BULLETIN NO. 87-1

DATE: FEBRUARY 23, 1987

TO: OPERATORS OF CORKSCREW, LOOP, AND SUSPENDED COASTERS

SUBJECT: RESTRAINT-RATCHET MODULE MODIFICATION

TYPE OF CHANGE: MANDATORY - PRIOR 1987 OPERATING SEASON

DISCUSSION: TWO (2) ADDITIONAL BALL PLUNGERS ARE BEING ADDED TO EACH RATCHET MODULE ASSEMBLY. THIS MAKES A TOTAL OF FIVE (5) BALL PLUNGERS PER MODULE. PLEASE ORDER THE QUANTITY REQUIRED TO MODIFY YOUR COACHES FROM CAROLYN WEAVER (801)825-1618. THEY WILL BE FURNISHED AT NO CHARGE TO YOU.

ACTION REQUIRED:

1. REMOVE THE RATCHET MODULE ASSEMBLY FROM THE COACH.
2. REMOVE THE RATCHET SHAFT FROM THE RESTRAINT LATCH HOUSING.
3. USE DRAWING B59613 OR DRAWING D61636 TO IDENTIFY THE STYLE OF RESTRAINT HOUSING ON YOUR COASTER.
4. MODIFY THE RESTRAINT LATCH HOUSING, AS SHOWN ON DRAWING B59613 OR DRAWING D61636 BY ADDING TWO (2) ADDITIONAL HOLES.
5. MODIFY THE RATCHET SHAFT AS SHOWN ON DRAWING B59612-RATCHET MODIFICATION.
6. THOROUGHLY CLEAN ALL PARTS.
7. REASSEMBLE RATCHET MODULE. INSTALL NEW BALL PLUNGERS.
8. INSTALL COMPLETED RATCHET MODULES ON COACH.

PARTS REQUIRED: (2) BALL PLUNGERS - PT. NO. 509826 PER RATCHET MODULE.

ARROW CONTACT: ENGINEERING DEPARTMENT

ENCLOSURES: DRAWING B59612 - RATCHET MODIFICATION
DRAWING B59613 - RESTRAINT MODIFICATION NYLATRON BODY
DRAWING D61636 - RESTRAINT MODIFICATION STEEL BODY

DATE: _____

ARROW DYNAMICS INC.
Building G-11, Freeport Center
PO Box 1386
Clearfield, UT 84016

ATTENTION: Director of Engineering

Dear Sir:

As per your mandatory Technical Bulletin No. 87-1, please be advised we have completed all necessary modifications and inspection as per instructions on Bulletin.

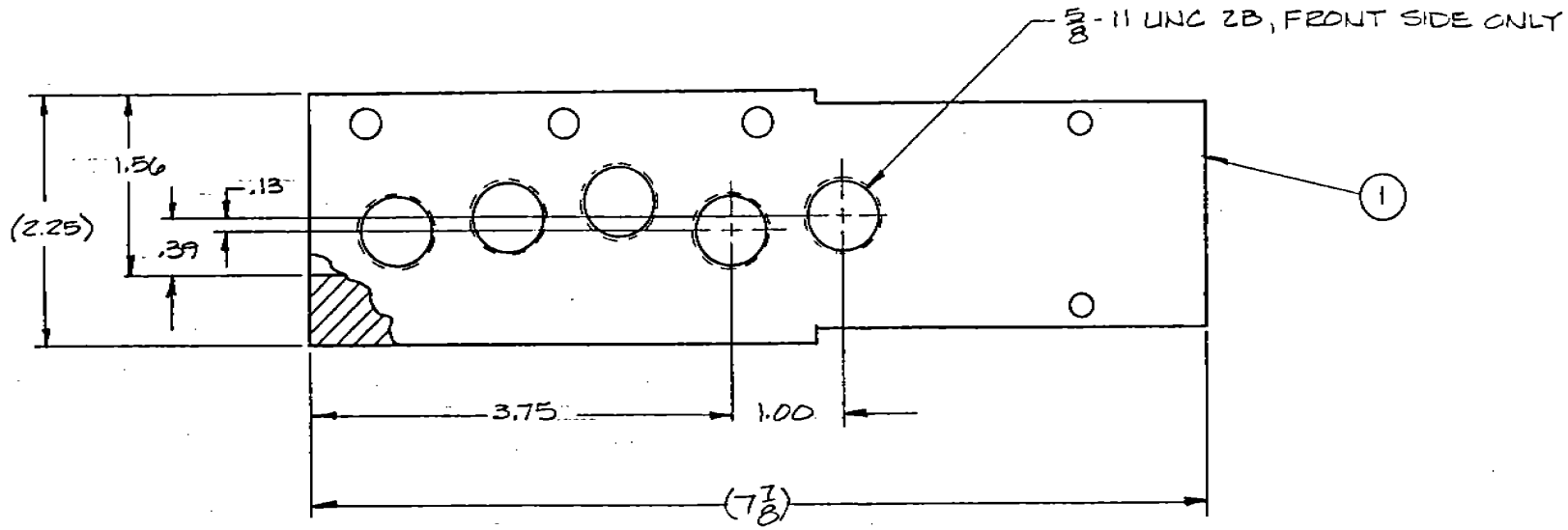
Sincerely,

_____
(Signed)

_____
(Name of Park)

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP

NOTES:
1. ITEM 1 AS SHOWN, ITEM 2 OPPOSITE.



ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC
2	1	C53870-2	RESTRAINT LATCH HOUSING	
1	1	C53870-1	RESTRAINT LATCH HOUSING	

NEXT ASSEMBLIES

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES
FRACTIONS ± 1/16
DECIMALS:
.X ± 060
.XX ± 030
.XXX ± 010
ANGLES: ± ½°
MACHINE FINISH 125
DO NOT SCALE

SCALE FULL
DRAWN DATE 7-8-86
CHECK DATE 7-8-86
PROJECT DATE
APPROVAL DATE
RELEASE DATE

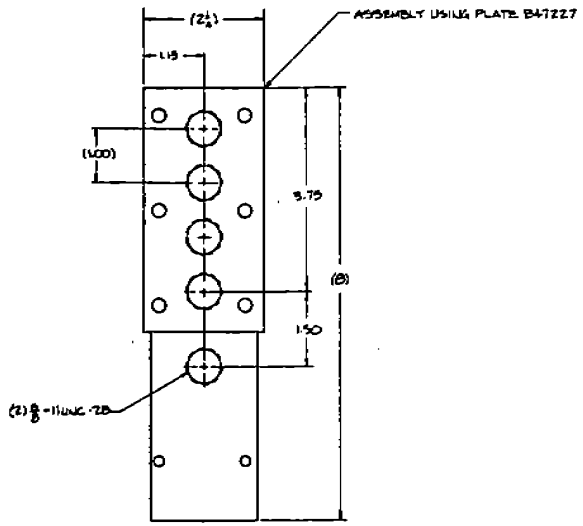
ARROW DYNAMICS INC
P.O. Box 1386 · Freeport Center
Clearfield, Utah 84016

TITLE
RESTRAINT MODIFICATION
NYLATRON BODY

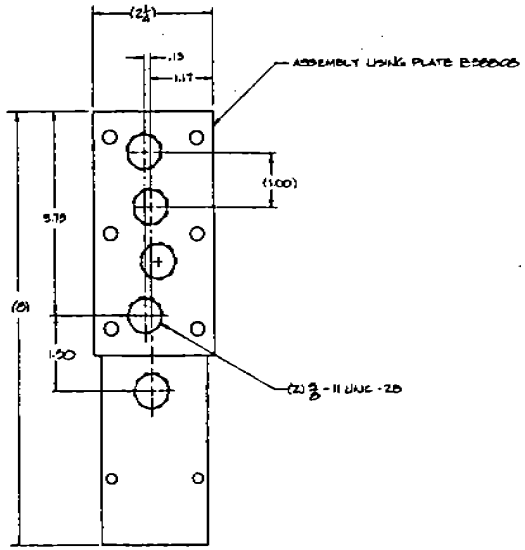
B59613
DRAWING NUMBER
REV

DETENT POST RECEIVER NO 86480

NOTES



STYLE 1



STYLE 2

REV	LTR	DESCRIPTION	DATE	APPROVED
	A	1.50 WAS 1.38	2-19-87	TS 2-19-87
	B	ADD 1" REF. DIM.	8-14-87	TS 8-14-87

FULL

ARROW

RESTRAINT MODIFICATION
STEEL BODY

D61636 B

07

ARROW

TECHNICAL BULLETIN NO. 87-2

DATE: DECEMBER 1, 1987

TO: OPERATORS OF CORKSCREW, LOOP, AND SUSPENDED COASTERS WITH NYLATRON RATCHET MODULES-PART NUMBER C-53870

SUBJECT: BALL PLUNGER REPLACEMENT

TYPE OF CHANGE: MANDATORY - PRIOR 1988 OPERATING SEASON

DISCUSSION: BALL PLUNGERS (FIVE PER RATCHET MODULE) WITH THE BLUE NYLON THREAD "PLUG" OR NO THREAD "PLUG", ARE BEING REPLACED WITH NEW BALL PLUNGERS WITH A WHITE TEFLON THREAD "PLUG". PLEASE ORDER THE QUANTITY REQUIRED TO MODIFY YOUR COACHES FROM CAROLYN WEAVER (801)825-1611. THEY WILL BE FURNISHED AT NO CHARGE TO YOU.

ACTION REQUIRED:

1. REMOVE AND DISCARD EXISTING BALL PLUNGERS (FIVE PER RATCHET MODULE).

2. USE AIR NOZZLE TO BLOW CLEAN TAPPED HOLES IN RATCHET MODULE HOUSING.

3. INSTALL NEW BALL PLUNGERS, PART NUMBER 509826 (FIVE PER RATCHET MODULE). NOTE! DO NOT REMOVE THE TEFLON THREAD PLUG.

4. TIGHTEN BALL PLUNGER UNTIL IT "BOTTOMS" ON THE RATCHET SHAFT. THEN BACK OUT 1/8 TURN FOR PROPER WORKING RELATIONSHIP.

PARTS REQUIRED: (5) BALL PLUNGERS - PT. NO. 509826 PER RATCHET MODULE.

ARROW CONTACT: ENGINEERING DEPARTMENT

Arrow Dynamics, Inc. dba Arrow Inc.
Clearfield, Utah 84016 P.O. Box 1386, Freeport Center Building G-11
Tel (801)825-1611 TLX 388411 Telecopier (801) 776-2671

ARROW

DATE: _____

ARROW DYNAMICS INC.
Building G-11, Freeport Center
PO Box 1386
Clearfield, UT 84016

ATTENTION: Director of Engineering

Dear Sir:

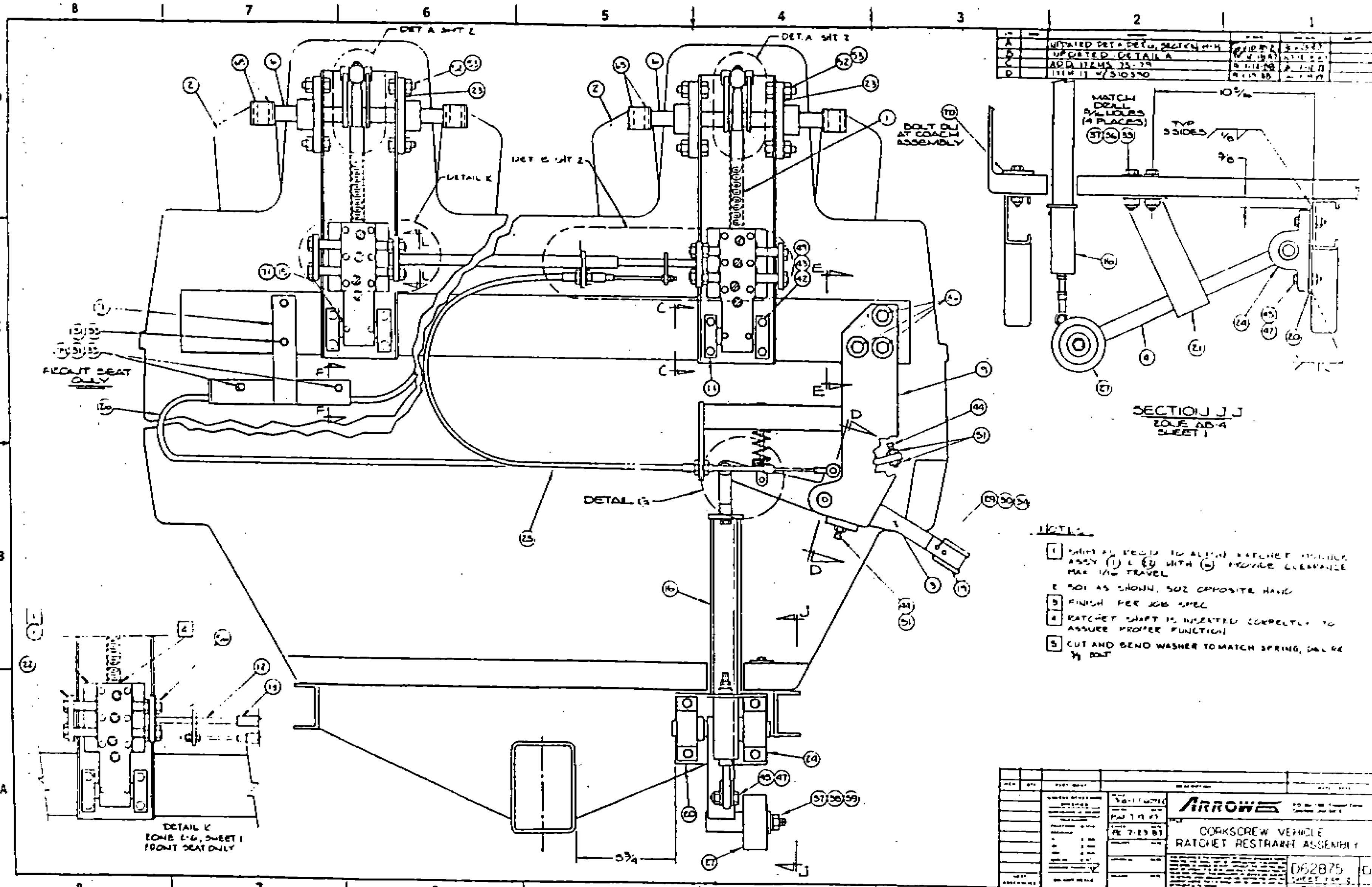
As per your mandatory Technical Bulletin No. 87-2, please be advised we have completed all necessary modifications and inspection as per instructions on Bulletin.

Sincerely,

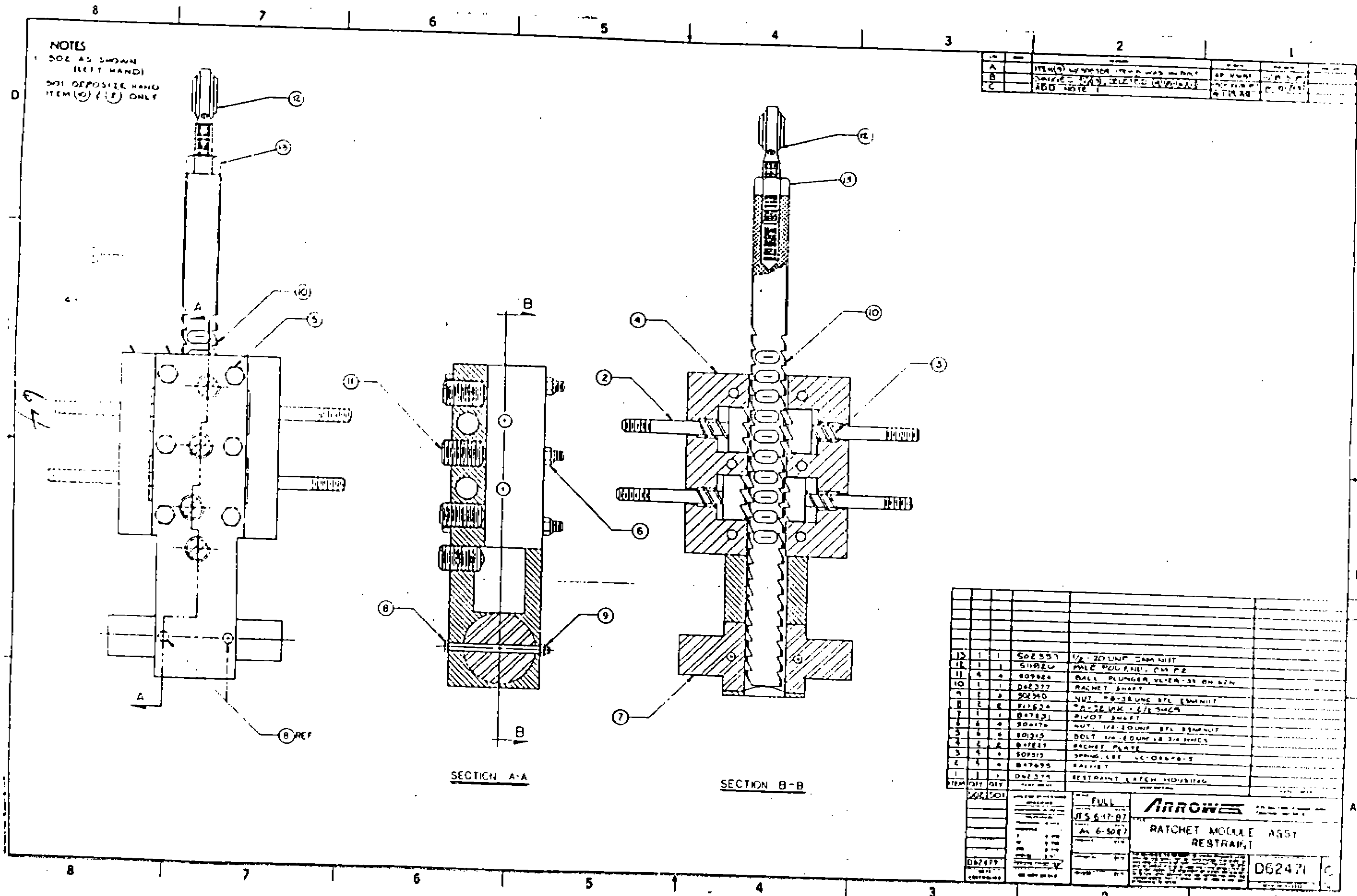
_____
(Signed)

_____
(Name of Park)

Arrow Dynamics, Inc. dba Arrow Inc
Clearfield, Utah 84016, P.O. Box 1386, Freeport Center Building G 11


SECTION J-J
ZONE AB-4
SHEET 1
DETAIL G
DETAIL K
FRONT SEAT ONLY
BOLT ON AT COACH ASSEMBLY
TYP 3 SIDES
NOTES
FINISH PER JOB SPEC
RATCHET SHAFT IS INSERTED CORRECTLY TO ASSURE PROPER FUNCTION
ADD ITEMS 25-29
UPDATED DETAIL A
ARROW
CORKSCREW VEHICLE
RATCHET RESTRAINT ASSEMBLY
D62875

63



ITEM	QTY 502	QTY 501	PART NO.	DESCRIPTION
12	1	1	502557	1/2-20 UNF JAM NUT
12	1	1	5U1B2G	MALE ROD END, CM F8
11	4	4	509824	BALL PLUNGER, VLIER-[illegible]
10	1	1	D62377	RACHET SHAFT
9	2	2	502540	NUT #8-32 UNC [illegible]
8	2	2	[illegible]	#8-32 UNC [illegible] SHCS
7	1	1	B47831	PIVOT SHAFT
6	4	4	[illegible]	NUT, 1/4-20 UNF [illegible]
5	6	6	[illegible]	BOLT 1/4-20 UNF [illegible]
4	2	2	[illegible]	RACHET PLATE
3	4	4	509313	SPRING, [illegible]
2	4	4	B47695	RACHET
1	1	1	D62379	RESTRAINT LATCH HOUSING

FULL

JTS 6-17-87

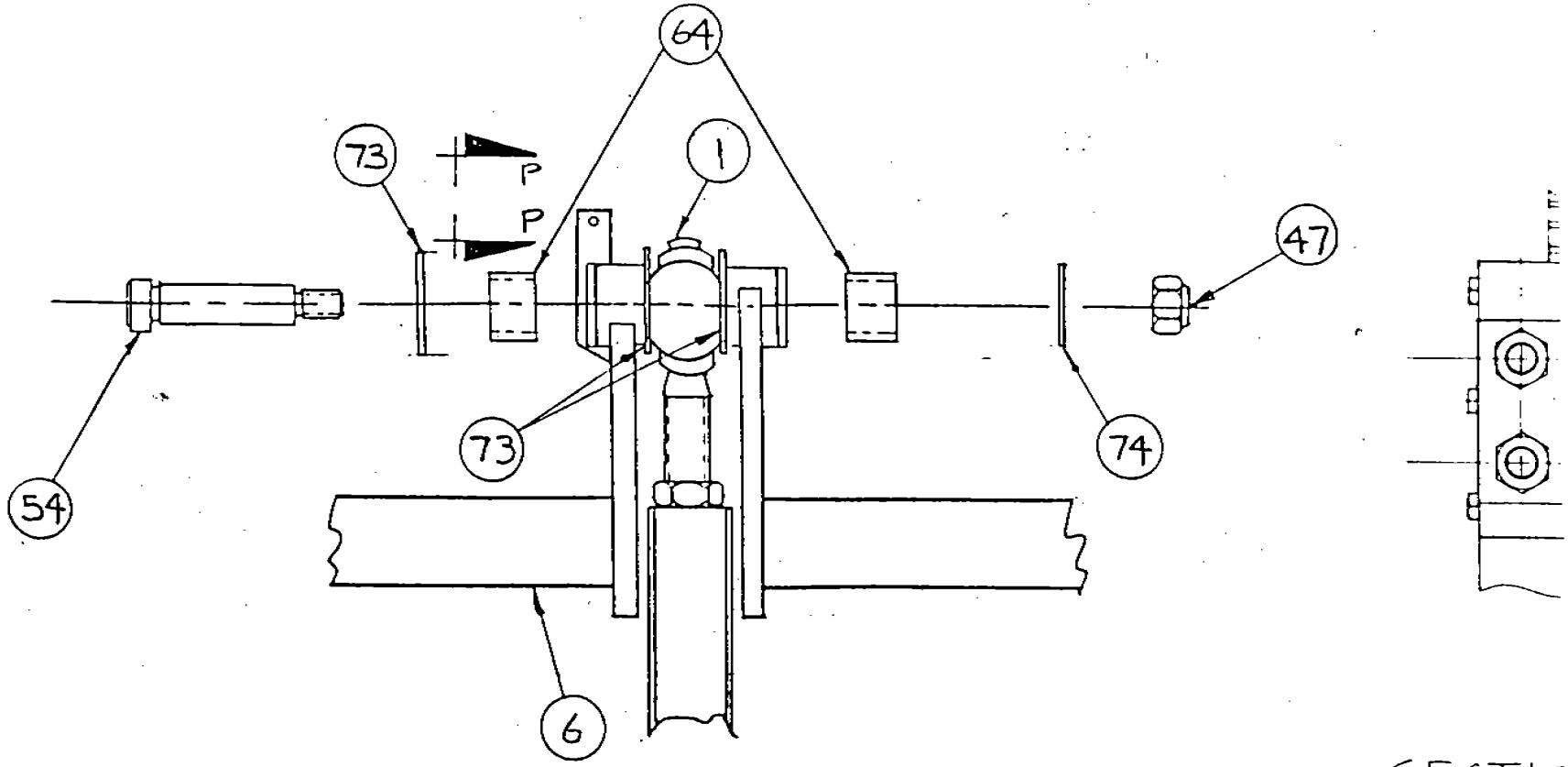
[illegible] 6-30-87

ARROW

RATCHET MODULE ASSY
RESTRAINT

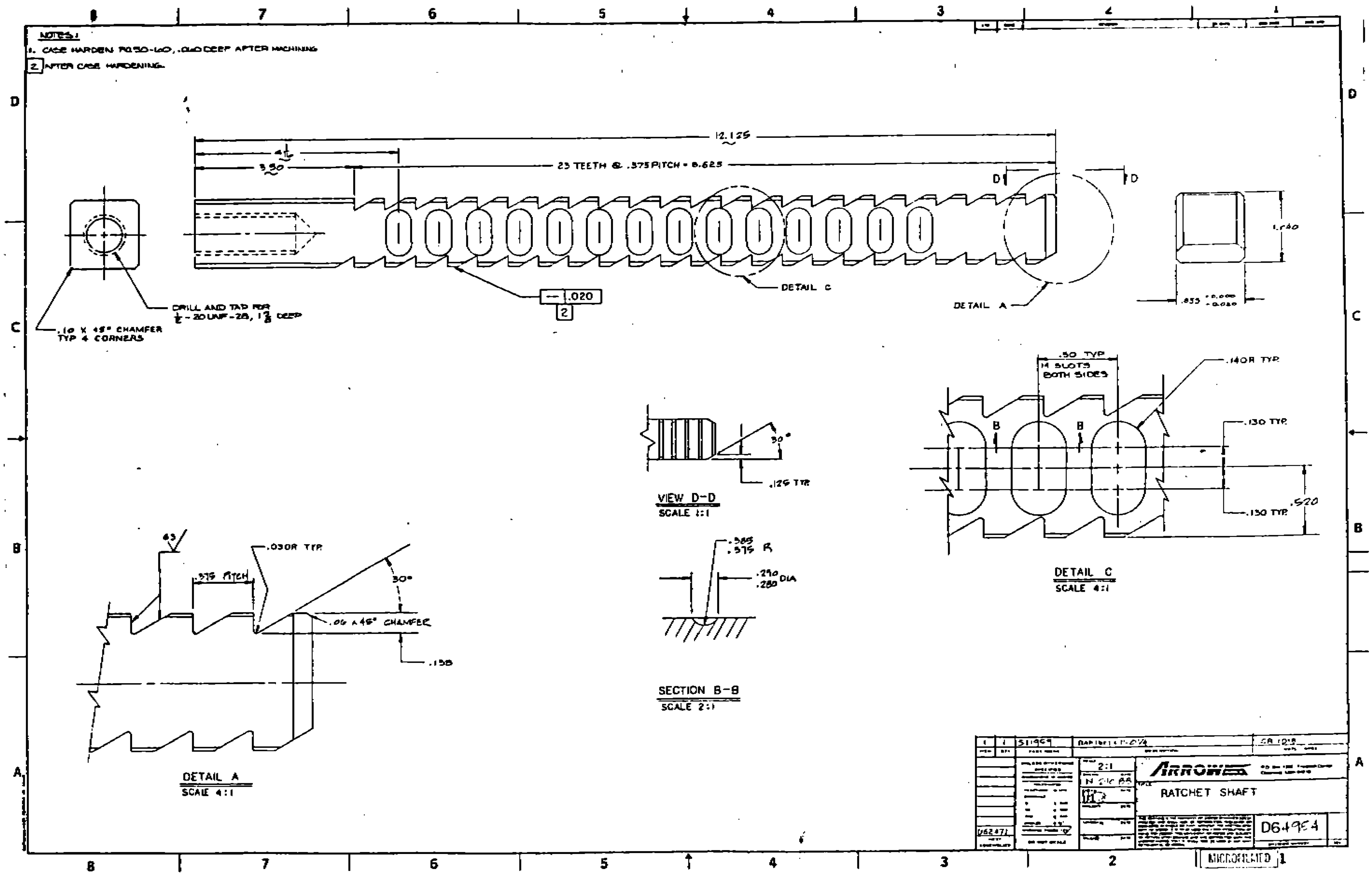
D62471 C

NOTES:



DETAIL A
ZONE D-4, SHEET 1
SCALE: 1/2=1

SECTIC
ZONE C-6,
SCALE: 1
TYP. 8 F


NOTES:
1. CASE HARDEN RC50-60, .040 DEEP AFTER MACHINING
2 AFTER CASE HARDENING.
12.125
4 1/2
3.50
23 TEETH @ .375 PITCH = 8.625
DRILL AND TAP FOR 1/4-20UNF-2B, 1 7/8 DEEP
.10 X 45° CHAMFER TYP 4 CORNERS
.020
2
DETAIL C
DETAIL A
1.240
.50 TYP
14 SLOTS BOTH SIDES
.140R TYP
.130 TYP
.130 TYP
.520
DETAIL C
SCALE 4:1
VIEW D-D
SCALE 1:1
30°
.125 TYP
.385
.375 R
.290
.280 DIA
SECTION B-B
SCALE 2:1
.375 PITCH
.030R TYP
30°
.06 x 45° CHAMFER
.158
DETAIL A
SCALE 4:1
511959
RATCHET SHAFT
2:1
D64954
MICROFILMED

77

ARROW

TECHNICAL BULLETIN NO.88-2

DATE: JANUARY 25, 1988

TO: OPERATOR'S OF CORKSCREW, LOOP, AND SUSPENDED COASTERS

SUBJECT: 1. NEW RATCHET MODULE THAT LOCKS RESTRAINT IN OPEN OR CLOSED POSITION.
2. RESTRAINT WITH CONTACT RELIEF.

TYPE OF CHANGE: AS MANUFACTURER, WE FEEL THAT THIS CHANGE IS NECESSARY TO PREVENT THE RESTRAINT BAR (WHEN IN THE UNLOCKED CONDITION) FROM FALLING OR BEING PUSHED DOWN ON TOP OF THE RIDERS. THE RELIEF IMPROVES RIDER COMFORT.

DISCUSSION: DESIGN AND PRODUCT TESTING HAS BEEN COMPLETED ON A NEW RATCHET MODULE THAT LOCKS THE RESTRAINT IN EITHER A LOCKED OPEN OR LOCKED CLOSED POSITION. THE NEW DESIGN WORKS AS FOLLOWS: TO UNLOAD, ACTIVATION OF EITHER THE FOOT PEDAL OR THE STATION AUTOMATIC RELEASE SETS THE RATCHET MODULE IN THE LOCKED OPEN CONDITION. THIS ALLOWS THE RESTRAINT TO BE PUSHED OPEN TO ANY POSITION, WHERE IT WILL REMAIN LOCKED, UNTIL RELEASED. ONCE THE COACH IS UNLOADED/LOADED, ACTIVATION OF THE FOOT PEDAL OR STATION AUTO RELEASE SETS THE RATCHET MODULE IN THE LOCKED CLOSED CONDITION. THIS ALLOWS THE RESTRAINT TO BE PULLED DOWN TO ANY DESIRED POSITION, INCLUDING ALL THE WAY CLOSED IF THE SEAT IS NOT OCCUPIED. THE RESTRAINT WILL STAY LOCKED IN THAT POSITION UNTIL THE RATCHET MODULE IS AGAIN PLACED INTO THE LOCKED OPEN CONDITION.

A NEW FLEXIBLE JOINT BETWEEN THE RATCHET BAR AND RESTRAINT SHAFT HAS BEEN DESIGNED AND SUCCESSFULLY TESTED. A SMALL AMOUNT OF MOVEMENT IN THIS JOINT ALLOWS THE RESTRAINT TO BE MOVED FROM ITS LOCKED POSITION ABOUT 1 TO 1-1/2 INCHES. THIS PROVIDES BODY CONTACT RELIEF IF THE RESTRAINT BECOMES TOO TIGHT DURING THE COURSE OF THE RIDE.

ACTION: CONTACT CAROLYN WEAVER (801)825-1618 FOR DETAILS.

ENCLOSURES: SAMPLE DETAILS ENCLOSED.

Arrow Dynamics, Inc. dba Arrow Inc.
Clearfield, Utah 84016 P.O. Box 1386, Freeport Center Building G-11
Telecopier (801) 776-2671

ARROW

LOCK OPEN/LOCK CLOSE

RATCHET RESTRAINT ASSEMBLY

(January 2, 1989)

I. Introduction

Step by step assembly instructions are provided by this document. These instructions will help you install the Lock Open/Lock Close Restraint System. Once installation is complete, minor adjustments may be required to tune each ratchet assembly. This will be simple if you follow the assembly instructions.

II. Drawings Required

Ratchet Restraint Assembly - D66093 (Sheet 1 of 2)
Ratchet Restraint Assembly - D66093 (Sheet 2 of 2)
Ratchet Module Assembly - D64890 (Sheet 1 of 2)
Ratchet Module Assembly - D64890 (Sheet 2 of 2)

III. Assembly Instructions

1. Check each "Ratchet Module Assembly" (D64890) to see that pre-assembly is correct. Check 5 inch and 1 3/16 inch dimensions. Adjust if required.

2. Install "Lap Bar Shaft" (D63892), Item 3 - D66093 into headrest using "Bearing" (504657), Item 24 - D66093. Tighten "Bearings" to headrest, but leave collar set screws loose.

3. Install "Ratchet Module Assembly" (D64890), Item 1 and 2 - D66093, to coach. Do not tighten mounting bolts.

4. Attach "Ratchet Shaft" (D62377), Item 1 - D64890 to "Lap Bar Shaft" (D63892), Item 3 - D66093. Follow Detail A - Drawing D66093.

5. Tighten mounting bolts on "Ratchet Module Assembly" (D64890), Item 1 and 2 - D66093.

Arrow Dynamics, Inc. dba Arrow Inc.
Clearfield, Utah 84016, P.O. Box 1386, Freeport Center Building G-11

III. Assembly Instructions (Continued)

6. Move "Lap Bar Shaft" (D63892), Item 3 - D66093, until the "Ratchet Shaft" (D62377), Item 1 - D64890 is centered in the hole in "Ratchet Module Assembly" (D64890), Item 1 and 2 - D66093. Tighten set screws in "Bearings" (504657), Item 24 - D66093.

7. Bench set the center screw (502125), Item 47 - D66093, so that "Pedal Lever" (D63984) Item 5 - D66093 is at 90 degrees relative to "Pedal Lever Bracket" (D63985), Item 4 - D66093. Bolt "Pedal Lever Bracket" to coach. Torque bolts as indicated.

8. Install "Rod End" (508914), Item 29 - D66093 on "Cable" (511426), Item 26 - D66093. Rotate "Rod End" seven turns onto "Cable". Set with lock nut.

9. Install "Cable" (511426), Item 26 - D66093 into "Pedal Lever Bracket" (D63985), Item 4 - D66093. Center threaded section in "Pedal Lever Bracket".

10. Attach "Release Arm Weldment" (C64878), Item 7 - D66093 and (C64877), Item 8 - D66093 to "Ratchet Module" (D64890), Item 1 and 2 - D66093. Tighten into place.

11. Install "Cable" (511426), Item 26 - D66093, into "Release Arm Weldment" (C64878), Item 7 - D66093. Center threaded section in "Release Arm Weldment".

12. Attach "Cable" (511426), Item 26 - D66093 to "Release Arm Weldment" (C64877), Item 8 - D66093 using jam nuts. Leave 1/16 inch thread out off "Esna Nut" (502335), Item 63 - D66093.

13. Depress "Pedal Lever" (D63984), Item 5 - D66093, to full down position. This should allow shoulder restraint to open to desired position. If the "Ratchet Module Assembly" (D64890), Item 1 or 2 - D66093 does not allow this action, adjust "Rod End" (506201), Item 15 - D64890 to pull "Ratchet Block" (B47695), Item 6 - D64890 away from the "Ratchet Shaft" (D62377), Item 1 - D64890.

III. Assembly Instructions (Continued)

14. Adjust "Set Screw" (502125) Item 47 - D66093, at the bottom of "Pedal Lever Bracket" (D63985) Item - 4 D66093, so that the "Pedal Lever" (D63984), Item 5 - D66093 bottoms on the "Set Screw", rather than the "Cable" (511426), Item 26 - D66093 linkage.

15. Return the "Pedal Lever" (D63984), Item 5 - D66093 to its full up position. Push the shoulder restraint to any closed position. If the "Ratchet Module Assembly" (D64890), Item 1 or 2 - D66093 does not allow this to happen, readjust the jam nuts on the "Cable" (511426), Item 26 - D66093 and/or the "Rod Ends" (506201), Item 15 - D64890 to cause the "Ratchet Block" (B47695), Item 6 - D64890 to push away from the "Ratchet Shaft" (D62377), Item 1 - D64890.

IV. This should complete the adjustment. Do not Change the 5 inch dimension on the "Ratchet Module Assembly" (D64890).

6. Limit Switch Actuator:

a. Limit switch actuators must be in place and show no signs of bending or looseness. These are to be found at the left front wheel of the first coach and the right rear wheel of the last coach in each train.

IV. PERIODIC INSPECTIONS - CORKSCREW AND LOOP

Items to be checked at other than daily intervals:

A. Coach under-carriage to be checked weekly.

1. Carefully examine each coach under-carriage for any signs of bending or cracks adjacent to or in welds. Particular attention must be given to the axle housing and wheel carrier weldment. It is important to use a strong light when working on the chassis area, axle housing or wheel carrier.

2. All fasteners on the chassis, axle housing and wheel carrier assembly must be in place and secure.

3. Brake fin fasteners must be in place and secure.

B. The vertical center spindle on the front axle of each coach requires a weekly check for any sign of looseness. This can be done by rocking the body of the coach from side to side. A firm resistance to this action should be felt. The coach should not rock at all.

The cause of any looseness is either a loose bearing adjustment on top of the spindle or a broken spindle. Any motion must be investigated at once and corrected.

C. The Vlier rubber springs that cushion the wheel carrier must be replaced at the start of each operating season and every six months for those parks that are on a year-round schedule.

The rubber tends to get stiff with use and take on a permanent deformation. The stiffness results in a harder ride while the deformation allows the chassis to run lower and may cause some chassis to rub or scrape on top of the brake assemblies

ARROW

TECHNICAL BULLETIN - NO. 88-1

DATE: JANUARY 4, 1988

TO: OPERATORS OF CORKSCREW, LOOP, AND SUSPENDED COASTERS

SUBJECT: CHASSIS SPINDLE INSPECTION AND INSTALLATION PROCEDURE

TYPE OF ACTION: RECOMMENDED AS PART OF NEXT ANNUAL N.D.T. INSPECTION AND THEREAFTER.

DISCUSSION: THE CHASSIS SPINDLE IS TO BE INSPECTED FOR CORROSION AT THE SEAT FILLETS. SPINDLES WITH PITTING CORROSION ARE TO BE REPLACED. THE SPINDLE AND CHASSIS HOUSING ARE TO BE COATED WITH A CORROSION INHIBITOR FOR INSTALLATION.

ACTION REQUIRED:

1. REMOVE THE CHASSIS-AXLE SPINDLE
   SUSPENDED COASTER - PART NO. C54849
   CORKSCREW COASTER - PART NO. C33639

2. CLEAN SPINDLE AND BORE OF CHASSIS HOUSING WITH SOLVENT (METHYL ETHYL KETONE, NAPHTHA, 1, 1, 1 - TRICHLOROETHANE).

3. DRY SPINDLE AND BORE OF CHASSIS HOUSING.

4. INSPECT SPINDLE FOR PITTING CORROSION, AT FILLET RADIUS, ON BOTH SIDES OF THE SHAFT "SEAT" (SEAT IS LARGEST SHAFT DIAMETER).

5. IF SURFACE PITTING IS OBSERVED, REPLACE WITH NEW SPINDLE.

6. INSTALL SPINDLE USING ONE OF THE FOLLOWING SEALANTS: RHONE - POULENC RHODORSIL CAF 440F OR GENERAL ELECTRIC N-SIL RTV 128.

7. APPLY TWO (2) 1/4 INCH BEADS OF SEALANT TO TOP INSIDE OF BORE IN CHASSIS HOUSING AROUND ENTIRE CIRCUMFERENCE. APPLY SMALL BEAD ON TOP OF CHASSIS HOUSING.

8. APPLY 3/16 INCH BEAD OF SEALANT TO THE SPINDLE, 1/2 INCH BELOW THE BOTTOM OF THE SEAT.

9. SLIDE SPINDLE INTO CHASSIS HOUSING. EXCESS SEALANT SHOULD BE VISIBLE AT THE TOP AND BOTTOM OF THE CHASSIS HOUSING. IF NOT, REMOVE SPINDLE AND REPEAT STEPS 7 AND 8.

10. REMOVE EXCESS SEALANT. ALLOW TO CURE FOR 12 HOURS BEFORE USE.

11. THE REMOVAL OF SEALANTS DURING FUTURE N.D.T. INSPECTIONS CAN BE ACCOMPLISHED USING TOLUENE OR XYLENE. THEN FOLLOW PROCEDURES 1 THROUGH 10 FOR INSTALLATION.

ARROW CONTACT: ENGINEERING DEPARTMENT

ENCLOSURES: DRAWING C54849 - CHASSIS SPINDLE, DRAWING C33639-SPINDLE, CENTER AXLE.

74

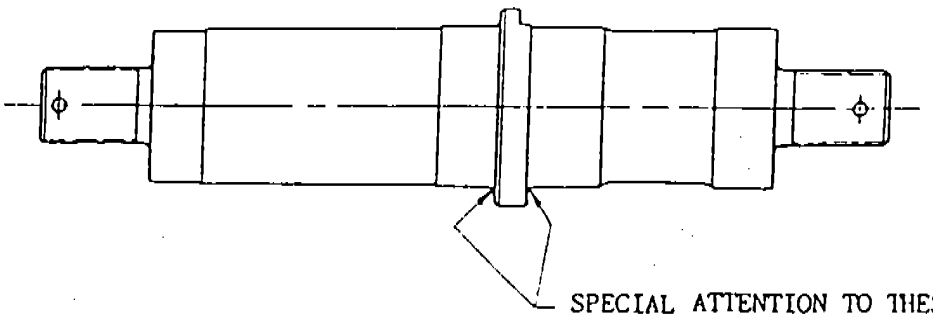
Arrow Inc
Telecopier (801) 776-2671

DATE: JANUARY 4, 1988

TO: OPERATORS OF CORKSCREW, LOOP AND SUSPENDED COASTERS

SUBJECT: CHASSIS SPINDLE INSPECTION AND INSTALLATION PROCEDURE

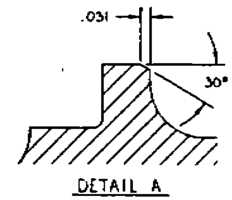
NOTE: SEE ARROW TECHNICAL BULLETIN NO. 88-1

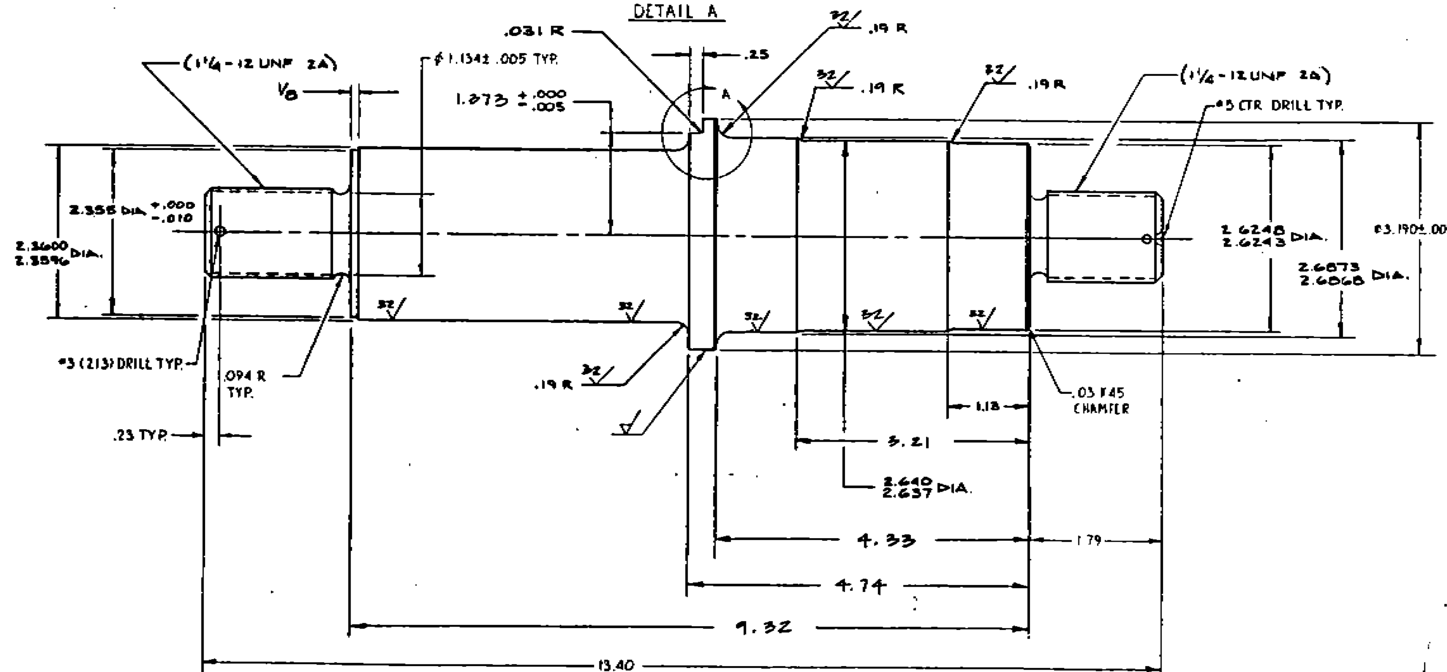


NOTES:

1. BEFORE STORAGE APPLY LIGHT COAT OF RUST PREVENTING OIL.
2. C33639 IS A PART OF CRITICAL NATURE & MUST CONFORM TO S.P. # 8-1-1.
3. ALL INSIDE RADII TO BE GROUND. NO UNDERCUTS OR TOOL MARKS.
4. HEAT TREAT TO Rc 38-42 IN CONTROLLED ATMOSPHERE PRIOR TO FINAL MACHINE.
5. MAGNETIC PARTICLE INSPECT AFTER HEAT TREAT AND BEFORE FINAL MACHINE. INSPECTION RESULTS REQUIRED.
6. CERTIFIED MILL TEST REPORTS REQUIRED.

LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP
L	B-2	ADDED 2.640/2.637 DIA	8-10-17-81	RT	RT
—	—	REDRAWN FOR CLARITY			
M	C-3	1.375 DIM WAS: ±.001	MG 3-8-82	3-8-82	
N	B,2-3	ADDED 4.58, .41 & 4.83	5-3-83	RFB 5-3-83	RFD
P	C/3	REVISED PICTURE TO SHOW THREAD RELIEF			
Q	C-3	ADDED .195 DIM. DELETED 1.375			
R	C 3	CORRECTED PICTURE (THREADS)			
S	D3:4	ADDED NOTE 4.			
T		ADDED RELIEF & MACH. FINISHES			
U	C-3	ADDED .094 R & ø 1.1342 .005. DELETE	RDH 1-5-90		





ITEM	QTY	PART IDENT	DESCRIPTION	MAT'L SPEC
1	1	509684	BAR 3½ DIA X 13.40	4340 H.R. ANN.

ARROW — P.O. Box 1388, Freeport Center, Clearfield, Utah 84016

SCALE: FULL

TITLE: SPINDLE, CENTER AXLE CORKSCREW

DRAWING NUMBER: C33639 U

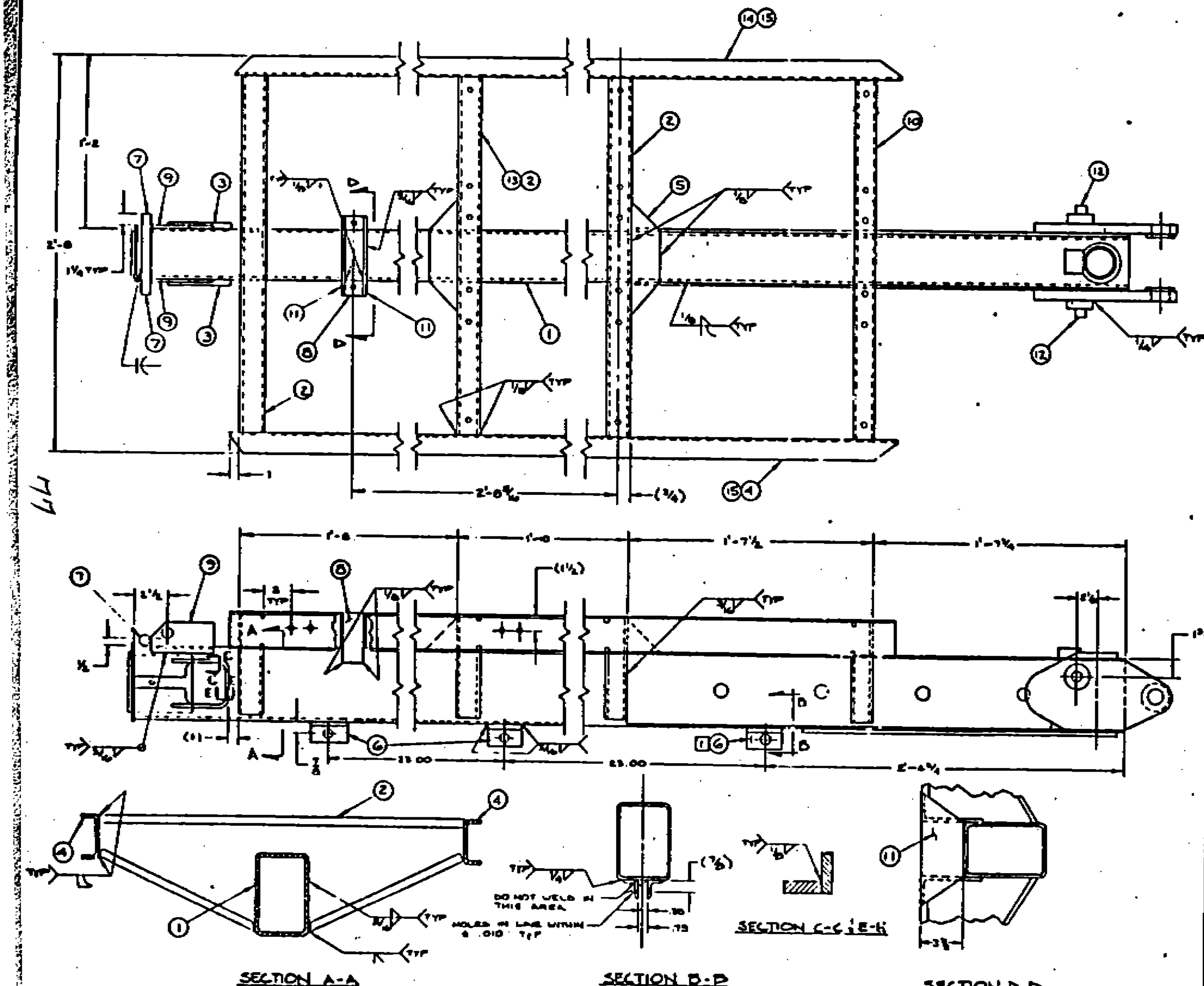
NEXT ASSEMBLIES: C33665

DO NOT SCALE

MICROFILMED

76

C	—	ITEM ⑤ WAS A18702
—	—	REDRAWN WITHOUT CHANGE



NOTES:

1. USE DRILL JIG B29163 FOR WELDING ITEM 6.
2. MASK FRONT & REAR HOUSING BORES AND YOKE PIN HOLES.
3. PRIME WITH RUSSAN SEALER AND PAINT WITH BLACK POLANE.
4. WELD SPEC 001.
5. 801 ASSY FOR CORK TRAIN ONLY. 802 ASSY FOR LOOP TRAIN AND CORK TRAIN WITHOUT AUTOMATIC RELEASE.

ITEM			PART NUMBER	DESCRIPTION
15	1	—	B18694	CHANNEL
14	—	1	C44079-2	CHANNEL, FRAME SIDE MEMBER
13	—	1	C44080	CROSS MEMBER
12	2	2	B32713	SAFETY CABLE MTG. WELDMENT
11	6	2	A34808	GUSSET
10	1	1	C34248	CROSS MEMBER (FRONT)
9	1	2	A7611	ANCHOR
8	2	2	A31408	BRACKET-FLOOR TO SEAT
7	1	1	A23710	STOP
6	6	6	A30006	MOUNT, FRAME PIN
5	1	1	D40606	GUSSET
4	—	1	C44079-1	CHANNEL, FRAME SIDE MEMBER
3	2	2	A31802	COLLAR PLATE
2	3	2	C20695	CROSS MEMBER
1	1	1	D31291	MAIN BEAM WELDMENT

SCALE: NONE

ARROW

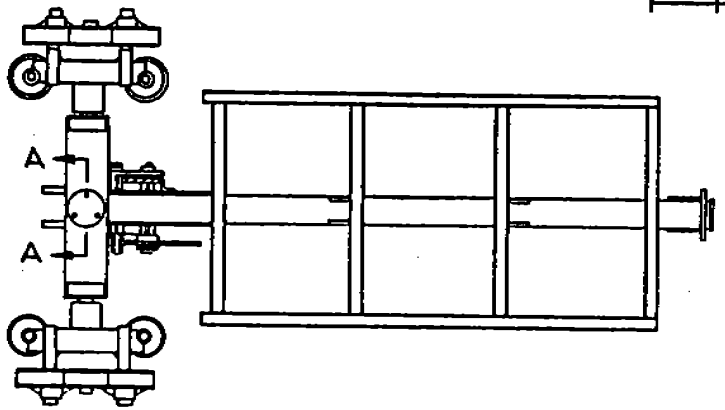
INTERMEDIATE - CHASSIS WELDMENT - CORKSCREW

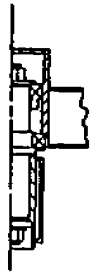
D43645 C

77

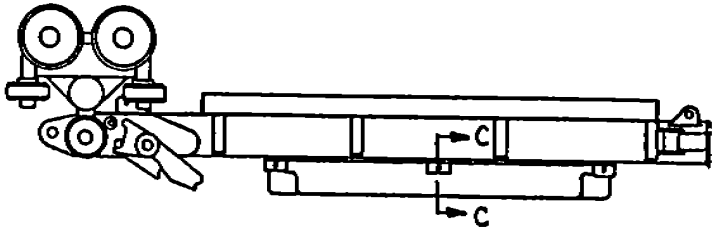
LTR	ZONE	REVISION	BY DATE	CHK DATE	ENG APP

NOTES:





SECTION A-A



SECTION C-C

ITEM	QTY	PART IDENT	DESCRIPTION	MATL SPEC

NEXT ASSEMBLIES

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS IN INCHES
TOLERANCES:
FRACTIONS ± 1/16
DECIMALS:
X ± .060
XX ± .030
XXX ± .010
ANGLES: ± ½°
MACHINE FINISH 125
DO NOT SCALE

SCALE
DRAWN DATE
CHECK DATE
PROJECT DATE
APPROVAL DATE
RELEASE DATE

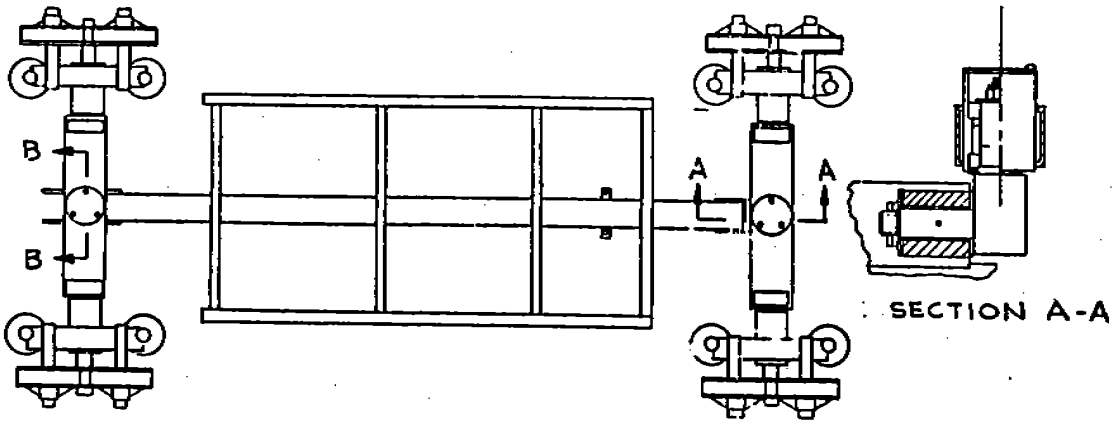
ARROW

Arrow Development Co., Inc.
1838 Plymouth Street
Mountain View, CA 94043
(415) 968 8342

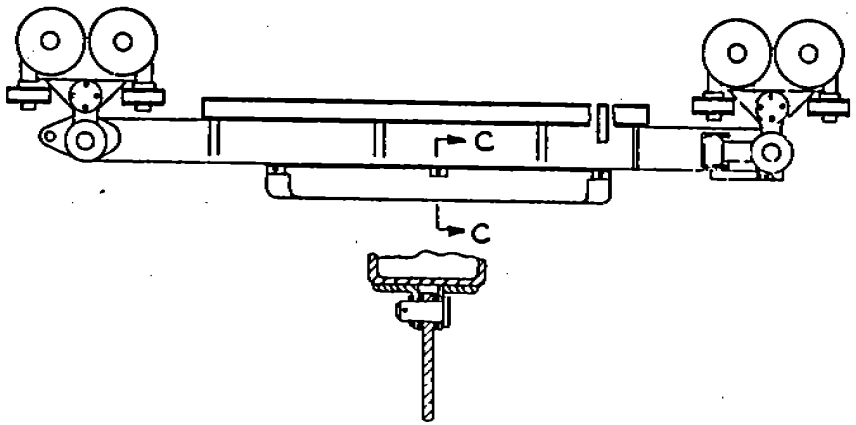
TITLE
PICK-UP CHASSIS ASSY
CORKSCREW

B
DRAWING NUMBER
REV

78



SECTION A-A



SECTION C-C

SECTION B-B

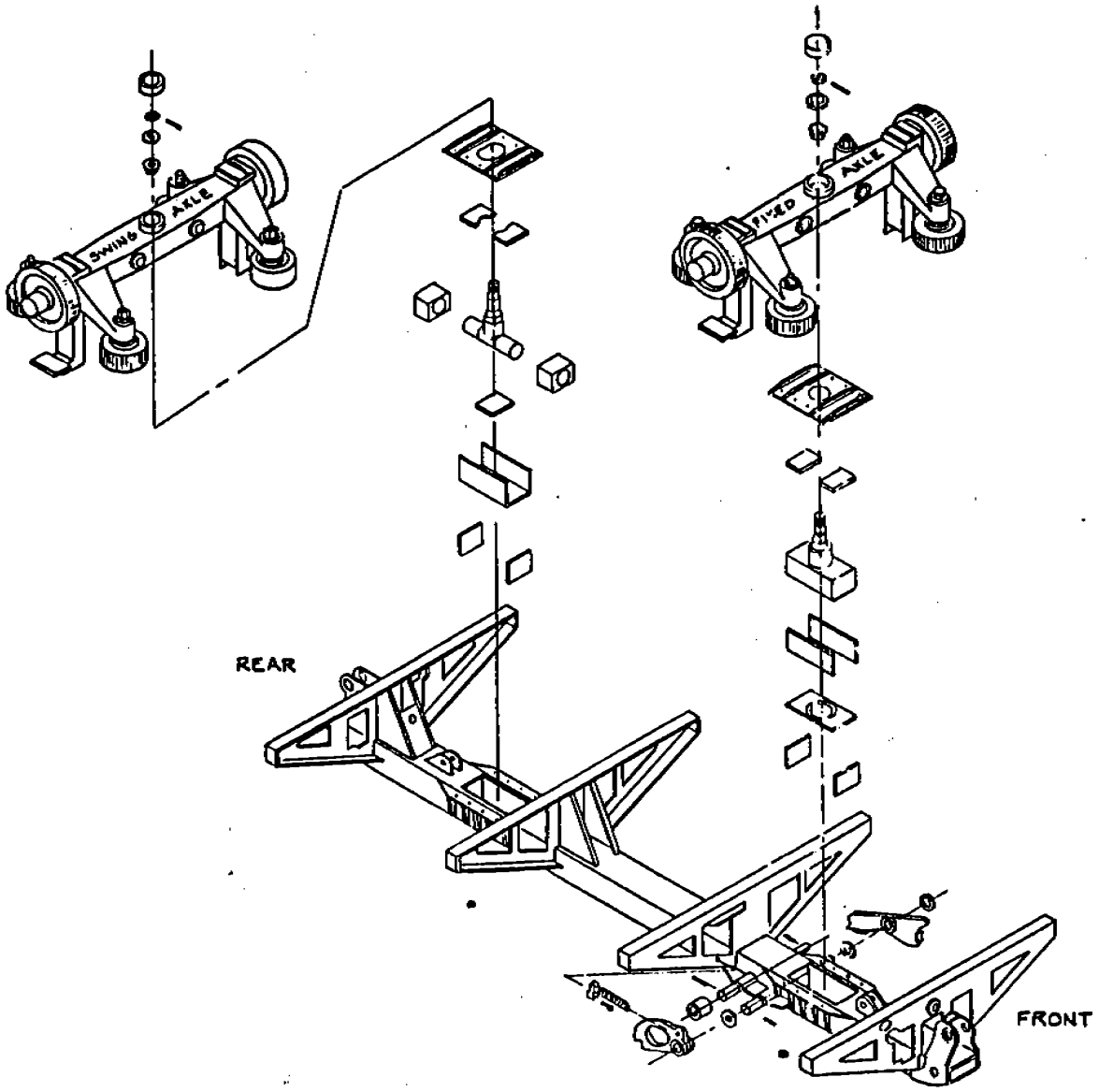
ARROW

Arrow Development Co., Inc.
1555 Plymouth Street
Mountain View, CA 94043
(415) 968-8343

TITLE:

TRAILING CHASSIS ASSEMBLY
CORKSCREW

DRAWING NUMBER



08

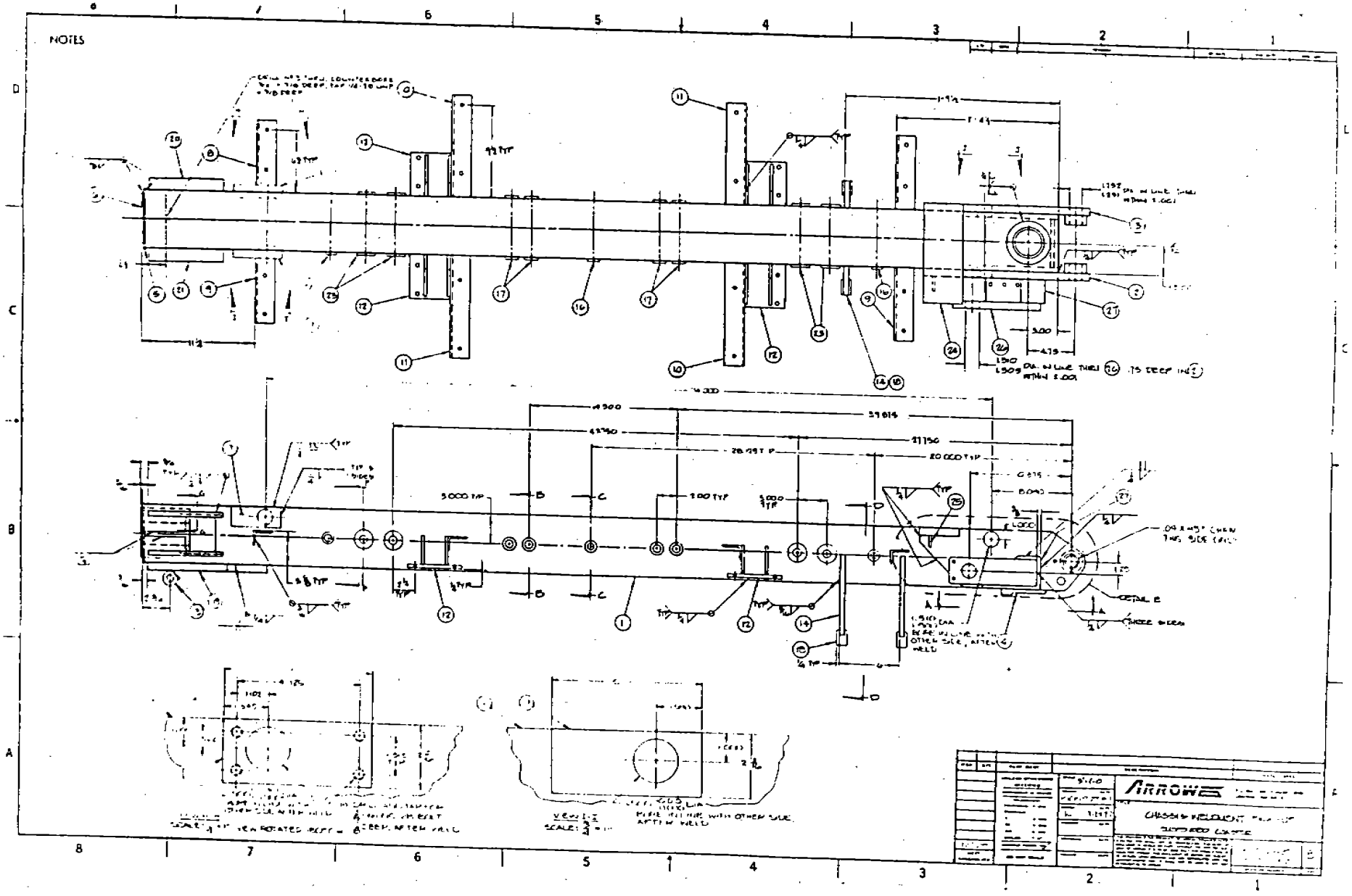
ARROW

Arrow Development Co., Inc.
1555 Plymouth Street
Mountain View, CA 94042
(415) 968 8242

TITLE:

CHASSIS SUB-ASSY 2ND & 4TH COACH RUN-AWAY TRAIN

DRAWING NUMBER


NOTES
ARROW

V. YEARLY INSPECTION - CORKSCREW AND LOOP

Once each year, normally during the winter shutdown, the following inspection is required.

A. Track And Lifts

1. Welded areas on the track including joints in the rails, tie to rail joints, tie to 12" beam and welding around the column saddle are to be inspected by magnetic particle or dye penetrant methods. Special attention should be given to high speed curves and pullout areas where the loads are the highest. If no signs of cracks are found in these areas, the slow speed spots require no more than a visual check.

   Track splice joints should be checked all around the pipe for small cracks starting in or adjacent to the weld. These joints should be checked over the entire course.

2. The lifts should be inspected in the same areas described for the track in general. In addition, the welding on the anti-rollback units and the chain guide should be subjected to magnetic particle or dye penetrant inspection.

B. Trains

Two coaches, including the number two coach from one train, that have been used the most must be completely disassembled and subjected to a thorough inspection as follows:

1. Check all wheel spindles for cracks using magnetic particle or dye penetrant.

2. Check all wheel spindles for wear caused by rotation of bearings on shaft. If this is a problem, use the inside bearing to the shaft.

3. The entire axle housing and wheel carrier weldments are to be subjected to a thorough magnetic particle inspection to detect any cracks that may be present.

4. Subject the wheel carrier spindle to a complete magnetic particle inspection.

5. Chassis Weldment.

a. Remove the main vertical spindle from the chassis member, this should slip out easily. (There is a Technical Bulletin that called for modification of this spindle so that it does not press into the chassis). Subject it to a complete magnetic particle or dye penetrant inspection to detect any cracks.

b. Check all welds around hubs that hold dog shafts and all welds between the body support frames and the main chassis member using magnetic particle or dye penetrant.

c. Remove the hitch yoke from the chassis and subject it to a complete magnetic particle or dye penetrant inspection.

Check the bushings in the hitch yoke and in the chassis for wear, looseness or scoring. Replace bushings as required.

d. Check welding of anchors for safety cable attachment.

6. A close visual inspection of all remaining chassis parts should be made.

7. If the above procedure uncovers any problems, then all remaining coaches must be examined in those areas that show trouble.

   If no problems are found, then the remaining coaches must be disassembled so that all of the following items can be inspected using magnetic particle or dye penetrant methods.

   a. All wheel spindles

   b. All main vertical spindles

   c. All hitch yokes

   d. All wheel carrier spindles

   e. All axle housings at welds around central hub, top and bottom

   In addition all spindles are to be examined carefully for wear caused by rotating bearing races.

8. Inspect the cushion block bearing for wear. If the bronze backing is visible, replace the bushing.

9. All reassembly of coaches must be in accordance to the pertinent Arrow Dynamics, Inc. assembly drawings. Careful attention must be paid to all torque values for fasteners.

VI. LIFT CHAIN & DRIVE

A. Storage

Care should be taken to store the chain in a corrosion free environment. Rust on the chain may adversely affect the strength and life of the chain. Grease should not be applied to stored chain to prevent corrosion. The chain should not be exposed to abrasives such as dirt, sand, etc.

B. Lubrication

1. Purposes Of Lubrication

a. To assure design chain life

b. To reduce friction between chain and guides

c. To reduce impact between roller and bushing in high speed drives

d. To mitigate corrosion

e. To reduce noise

Wear caused by articulation of the pins in the bushings as the links flex onto and off the sprockets causes the chain to become longer. Only a relatively small increase in chain length can be accommodated before the chain will not wrap the sprockets properly, or some other problem occurs.

2. Preferred Lubricants

The lift chains have been lubricated with Molykote 321-R which is a semi-permanent dry lubricant.

The chain can be lubricated by hand with a brush while the chain is moving or an automatic chain oiler can be used. Use a good grade, non-detergent, 30 weight oil. Do not use reprocessed or used oil.

Lift chains and chain guides must be free of sand and dirt to avoid excessive wear on the sliding surfaces.

Except for chains specially designed to have their joints hand lubricated with a pressure gun, grease should not be used as a chain lubricant.

3. Effect Of Lubrication On Chain Wear

Need for a longer wear life is by far the most important and most frequent factor that directs that a chain be lubricated. As for all machinery, lubrication has a dramatic effect on the rate at which a chain wears. Proper lubrication increases chain wear life more than ten times if the chain were run dry.

Care must be exercised to insure that every joint gets lubricated. If one or more joints do not get oiled they obviously wear much more rapidly than those that do. Differential wear elongation within the strand causes rough operation. Many more chains are replaced because of rough and/or erratic operation from this cause than are replaced because they have worn so much that they no longer wrap the sprockets properly.

4. Manual (Or Intermittent) Chain Lubrication

As much oil should be put into the chain as can be tolerated by its surroundings. However much oil can be tolerated, put it on in "slugs" and then let it work. This is particularly true in dirty environments. Lubricating with a stream of oil cleans some of the dirt off of the chain. If the same amount of oil is dripped slowly onto it, the paste of oil and dirt that forms, plugs the spaces between the sidebars through which the oil must pass in order to get into the joints. Then it becomes impossible to get anything into them.

Even for intermittent lubrication in a clean environment, lubricating with a stream of oil makes it more certain that every joint gets oiled than is the case for dripping it slowly onto the chain.

To be effective, the oil applied to a chain must reach the live bearing surfaces of the pins and bushings. The only pathway to this area is between the sidebars; therefore it is necessary to direct the lubricant to this pathway. An oil can most commonly is used to lubricate a chain manually, and it can do an excellent job. Brushing it on works equally well.

When a chain is operating on a lift, it is sometimes necessary to lubricate from a single location with the chain in operation, and this can be hazardous if done manually. An effective substitute is to locate an oil reservoir at a convenient point in the chain path (preferably at a location where tension is lov), with drain tubes directing a stream of oil between the chain sidebars. The reservoir is then manually filled at selected intervals, and the oil allowed the drain on the chain in two continuous streams (not in droplets). The reservoir should contain enough oil so the chain can make at least two continuous circuits while the oil is flowing.

Lubrication specialists can supply devices that cause jets of oil to be synchronously directed to the access spaces of each chain joint. If these devices are used as a substitute for manual lubrication, they need be actuated only intermittently at selected intervals.

C. Chain Installation

1. The chain and sprockets should be replaced or installed at the same time. Arrow does not advise installing new chain on old sprockets or old chain on new sprockets. Sprockets shall not be turned around to "use the other side". chain damage will result. Additionally, a new length of chain should not be installed in an old chain or visa-versa.

2. Before installation of a new chain, the lift system should be inspected. The following items should be checked:

   a. The alignment of the chain guide channels should be checked. The chain guide channel going up the lift and the return chain guide should be straight without any horizontal bows, rises or dips greater than 1/4 inch.

   b. All entries and exits to the chain guide channels should be flared, including the cap angles and bottoms and sides of the channel.

   c. Insure that the chain liners are installed properly in the chain channels and that there is not potential for contact between the chain and the steel channels or chain liner fasteners.

WARNING: ANY CONTRACT BETWEEN THE CHAIN AND A STEEL PART, OTHER THAN THE SPROCKETS, CAN CAUSE SERIOUS DAMAGE TO THE CHAIN.

3. Installation Of The Chain

a. Place protective material on the ground at the bottom of the lift around the tailstock sprocket and drive motor area. The chain may be installed at the opening at the tailstock sprocket.

b. Provide some means of pulling the chain up the lift return chain guide channel.

c. Starting at the bottom of the lift return chain guide, lay the chain sections in the chain guide channel. Link pins can then be installed. The direction of travel for the offset type chain is open end pointing in the direction of chain travel.

d. The link pins should be installed per the chain manufacturers recommended method. This involves using a hydraulic press and fixture to seat the pins. The chain is designed such that the pins press into the side bars with a very heavy press fit. The pins should never be altered to minimize this press fit. The pins should not be hammered in during installation. The pins should be installed in the same direction. For example, all cotter keys should be installed on either the left side of the chain or the right side of the chain. Do not secure the link pins until assured the chain is straight.

e. As the installation proceeds going opposite to the normal direction of travel, pass the chain over the headstock sprocket (top of lift) and render into chain guide channel. Continue process until the end of the chain is again at ground level.

f. The air spring on the chain tensioner on the lift drive platform should not be pressurized until after the chain is installed through the drive unit and the loop is closed. Add chain around the tailstock and through the drive unit to close the loop.

g. After the chain installation is complete, the chain tensioner air spring may be pressurized. The chain channels should again be inspected to insure that there is not any metal to metal contact with the chain.

D. Maintenance Of The Lift Drive

The lift drive performance parameters are established and adjusted by Arrow engineering. There should not be any adjustments, repairs, or modifications made to the lift drive motor, drive, gearbox, sensors, sprockets or other related components without the authorization of Arrow.

E. Inspection Of The Chain

This ride has a 4.08 pitch R1268 engineering class roller chain installed as original equipment. (Reference Arrow part number 513687).

The chain may be inspected periodically by measuring a "Maximum Length". Once the chain exceeds the "Maximum Length" more precise measurements should be made to estimate the effective near life remaining in the chain. For the R1268 chain the recommendation is:

Measure Over	Maximum Length
28 Links	116.5 Inches

The chain should not have any slack in it when the measurement is made. 100 pounds or more of tension should be sufficient.