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FE/13346

Monorail Bridge Conveyor

PHASE II REPORT

CONTRACTOR - GOODMAN EQUIPMENT CORP.

DATE: APRIL 30, 1982

CONTRACT NO. U.S.D.O.E. - DE-AC01-78ET13346

U. S. Department of Energy
Assistant Secretary for Energy Technology
Division of Fossil Fuel Extraction
Mining Research and Development

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FE/13346

MONORAIL BRIDGE CONVEYOR

PHASE II REPORT

AS OF

APRIL 30, 1982

This report represents work on a program that was originated by the Interior Department's Bureau of Mines and was transferred to the Department of Energy on October 1, 1977.

J. GONSKI

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DATE PUBLISHED: APRIL, 1982

U. S. DEPARTMENT OF ENERGY
ASSISTANT SECRETARY FOR ENERGY TECHNOLOGY

CONTRACT NO. U.S.D.O.E. DE-AC01-78ET13346

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ABSTRACT

This report covers the second phase of a four-phase contract to develop and test a roof hung monorail bridge conveyor coal haulage system working behind a continuous miner. Phase II covers the fabrication and assembly of all the components in making up the Monorail Bridge Conveyor System.

The original concept presented had to be analyzed before final design could proceed. The analysis revealed that 24 ft. long bridge conveyor segments were the optimum length, the suspension system must have the vertical hinge point between bridges, the impact point of the coal transfer point and the suspension point itself, coincidental. The propulsion system is such that each bridge is self propelled in order to minimize side loading on the monorail. The conveyor belt drive is simple since it only has to drive one single 24 ft. conveyor.

The entire assembly of twelve conveyors has been pre-tested in our Murfreesboro, Tennessee shop. The electric circuit proved successful to operate from a manual control or automatically, and successfully proved the cycle of sequential starting and stopping.

1.0 EXECUTIVE SUMMARY

The inability to move coal away from the face has been the greatest "bottleneck" in coal mining during recent years. It is well established that the continuous miner can cut coal faster than is currently produced because of the downtime resulting from inadequate haulage facilities. This shortcoming is quite serious and adds to the cost of the coal produced. With the national commitment to developing the country's coal resources to meet the energy needs, this drawback will become more prominent.

Several attempts have been made in the past to overcome these coal transportation problems. Various types of mobile bridge conveyors, piggyback bridge conveyors, and other systems have been developed by industry to overcome these difficulties. The latest among these is the Serpentix. However, none of these has been fully effective, and each suffers from certain drawbacks. The Bureau of Mines has, therefore, developed a concept incorporating the best features of many of these past developments, with the expectation that most of the shortcomings of the past devices have been eliminated. They have therefore awarded the above contract entitled "MONORAIL BRIDGE CONVEYOR" to Goodman Equipment Corporation.

The general nature of the problem of lack of continuous face haulage and its impact upon the coal industry in the U.S. has already been alluded to above. Specifically, the continuous miners can produce considerably more coal than the capacity of shuttle cars to haul away, which is the method most commonly used currently. Thus, continuous miners generally operated between 33 and 50 percent of the time. The shuttle car method is inherently inefficient since time is wasted while changing cars and the miner has to be turned on and off repeatedly. It is evident that a continuous mode of haulage would be more desirable.

Unfortunately, this is not easily achieved. Several methods have been tried, but all of them suffer from serious drawbacks. None of these have been good enough to have significant impact upon the shuttle car system.

The Bureau of Mines has long recognized this problem and have recently developed a concept of the Monorail Bridge Conveyor. In this concept many of the deficiencies of past systems have been overcome. Hence, it appears to offer considerable merit and is worthy of further development.

It was the intent of Phase I of this program to develp the details of this concept and finalize the design which was completed in June, 1980 and now have completed Phase II. Phase II included the fabrication and assembly of the entire concept.

1.1 Phase II Scope

In October, 1980, Goodman Equipment Corporation initiated taking a contract bill of material #437866. This bill of material authorizes the manufacture and purchasing of all materials to cover entire scope of contract DE-AC-01-78ET13346. It also was divided into three different groups in order to distribute the workload and adhere to the projected completion date.

Group I

Goodman Equipment Corporation purchase, manufacture and assemble all conveyor drives and all electrical enclosures.

Group II

Goodman Conveyor Corporation purchase, manufacture and assemble all conveyor frames and rollers. They will also implement all the final assembly of components from Goodman Equipment Corporation.

Group III

Cleveland Crane and Engineering, a subcontractor, will supply the monorail portion of the system, which includes the carriers, drives, brakes, switches, hangers and all rail components.

Included also in the Phase II scope is the anticipated surface test layout at the Murfreesboro plant. The layout will show the outline of the support structure itself and three units of the conveyor system, inby, intermediate, and outby.

Inby Conveyor Frame	#201179 - Fig. 1
Intermediate Conveyor Frame	#201239 - Fig. 2
Outby Conveyor Frame	#201238 - Fig. 3

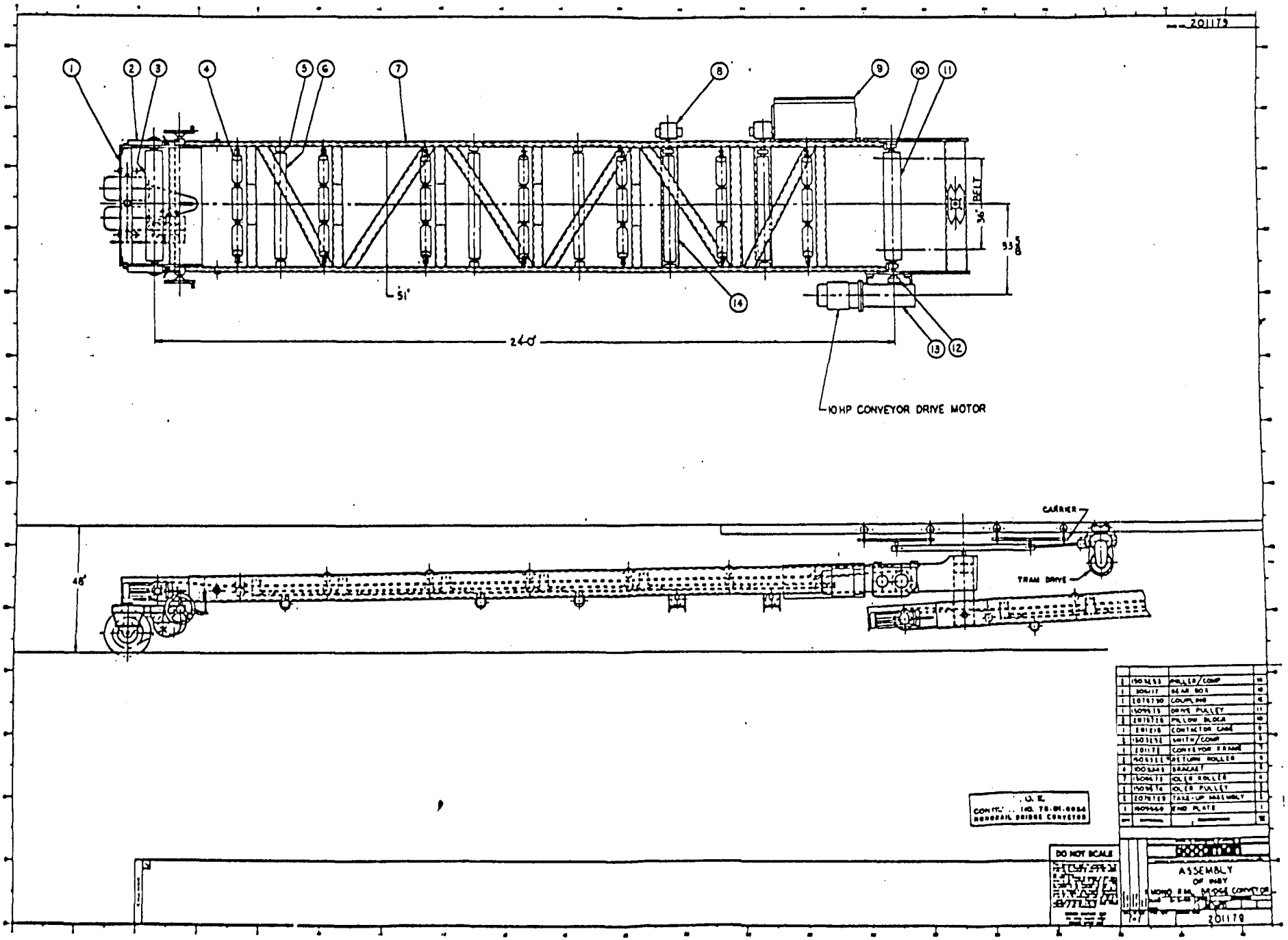

51'
240'
10 HP CONVEYOR DRIVE MOTOR
CARRIER
TRAM DRIVE
48"
DO NOT SCALE
ASSEMBLY

Figure 1

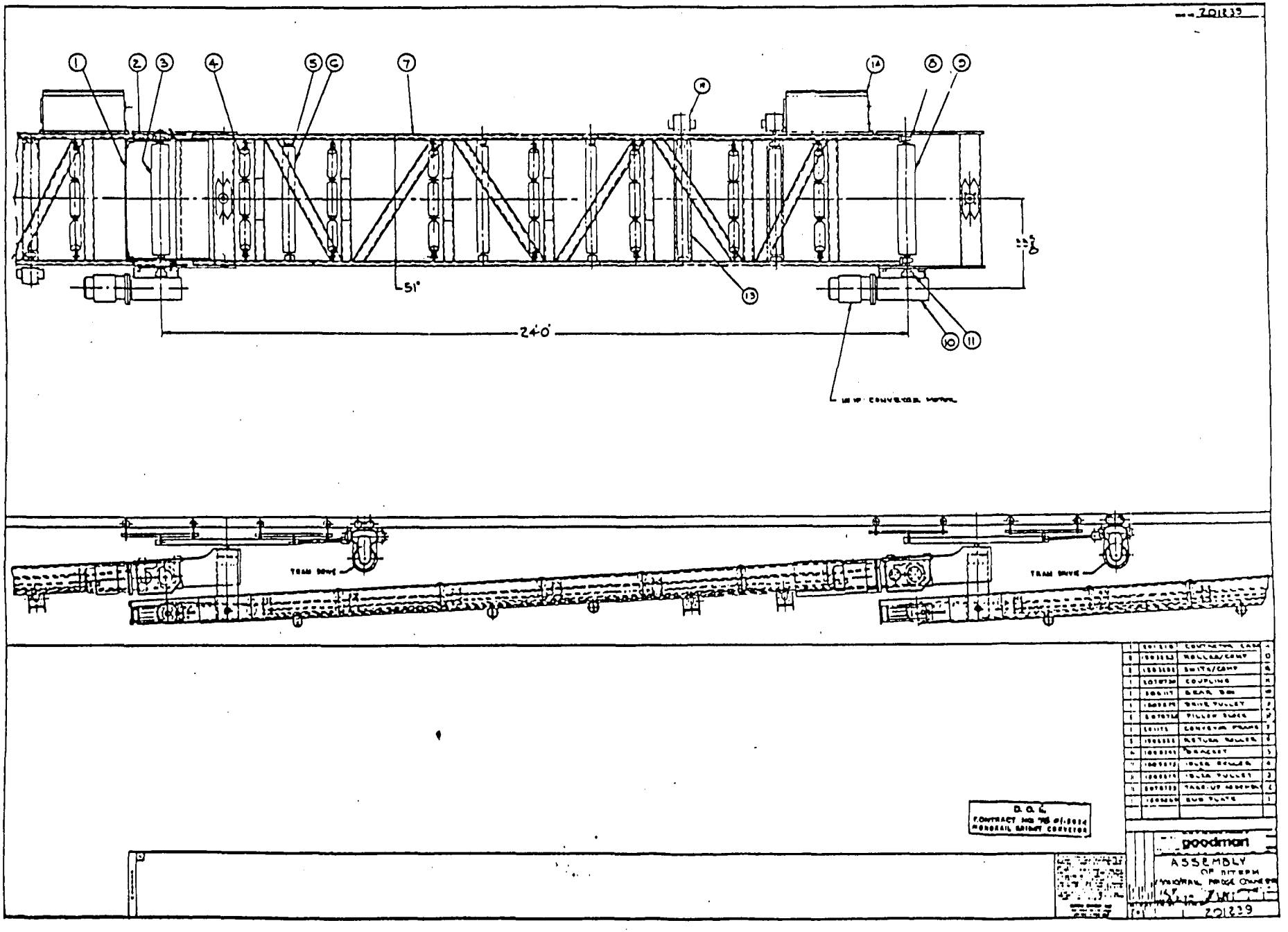

201239
240'
51'
TRAM DRIVE
TRAM DRIVE
goodman
ASSEMBLY
201239

Figure 2

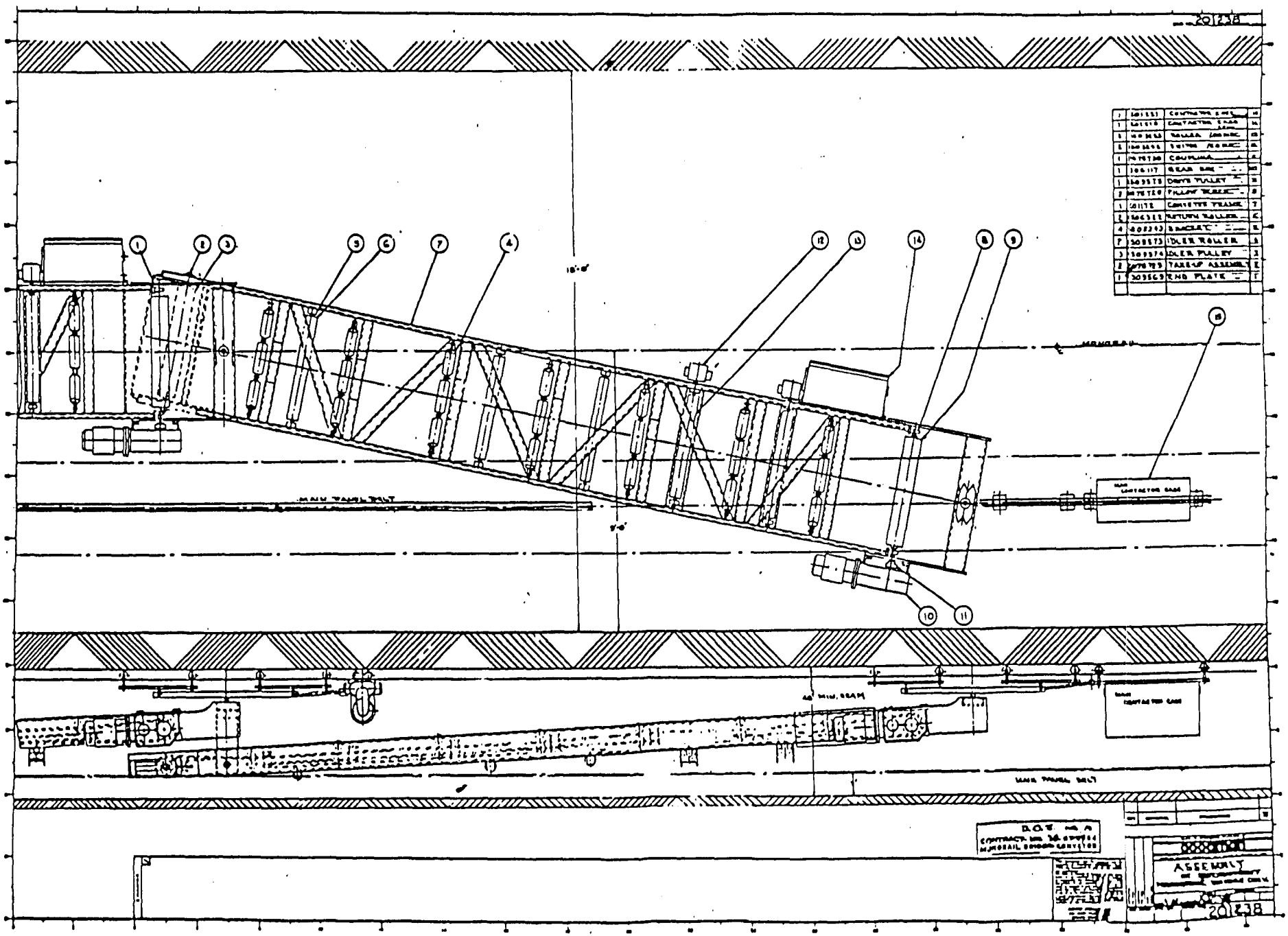


Figure 3

1.2 Phase II Summary

On August 19, 1980, Goodman Equipment Corporation received a letter of authorization to proceed with Phase II. Authorization came from Coleton Weirich, Contracting Officer, Office of Procurement Operations, Department of Energy, Washington D.C. 20585.

With this letter of authorization, Goodman Equipment Corporation proceeded to issue a contract bill of material to initiate the purchase and manufacture of all components in Phase II.

Phase II was divided into seven categories. They are as follows:

a. Fabrication
b. MSHA/Approv./Components
c. Update design drawings
d. Design/Plan/Surface Test
e. Prepare Phase II Report
f. T.P.O. Approval Phase II

1.2.1 Fabrication

Once authorization was given to proceed with Phase II, Goodman Equipment Corporation issued orders by initiating a bill of material. With this, materials were ordered to start fabrication. Work began September 1, 1980.

The major components were as follows:

1.	12 - Conveyor Frames	#201172 - Fig.	4
	a. 12 Take-up Frames	#306116 - Fig.	5
	b. 12 - Discharge Frames	#306114 - Fig.	6
2.	12 - Suspension Frames	#306115 - Fig.	7
3.	12 - Conveyor Drive Gear Case	#201174 - Fig.	8
4.	1 - Push Button Case	#306142 - Fig.	9
5.	1 - Headlight Switch Case	#306175 - Fig.	10
6.	12 - Motor Control Case	#201218 - Fig.	11
7.	1 - Master Control Case	#201220 - Fig.	12
8.	1 - Wheel Support	#306402 - Fig.	13

The above components were divided up in order to facilitate faster productivity. Therefore, the twelve conveyor frames, take-up frames, discharge frames and suspension frame were made at Goodman Conveyor Corporation in Murfreesboro, TN.

The remaining components, conveyor drive gear boxes, wheel support and all the electrical enclosures, push button case, headlight switch case, motor control case and master control case were made at Goodman Equipment Corporation in Chicago.

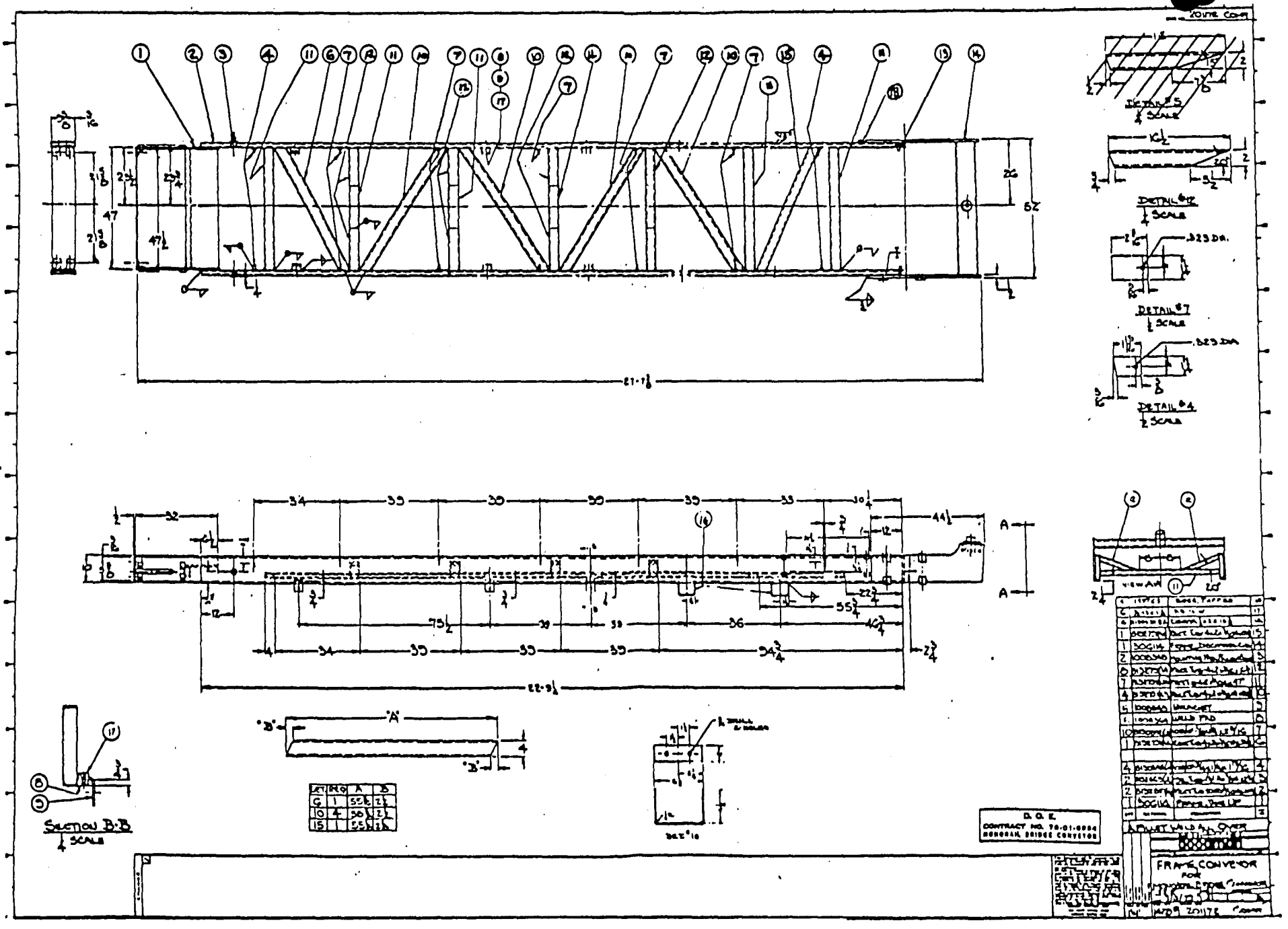

SECTION B-B
1/4 SCALE
DETAIL #5
1/4 SCALE
DETAIL #6
1/4 SCALE
DETAIL #7
1/4 SCALE
DETAIL #4
1/2 SCALE
FRAME, CONVEYOR

Figure 4

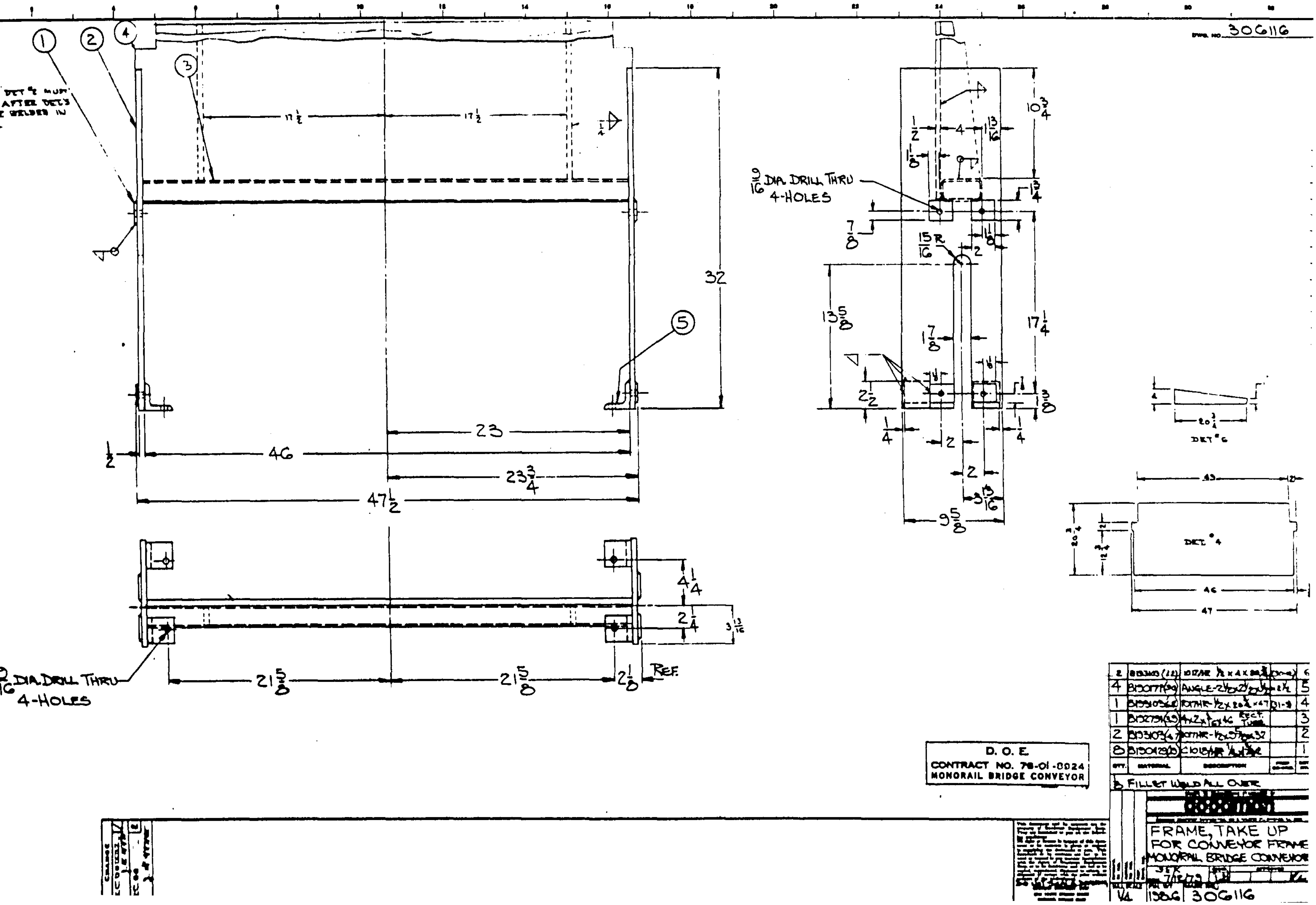
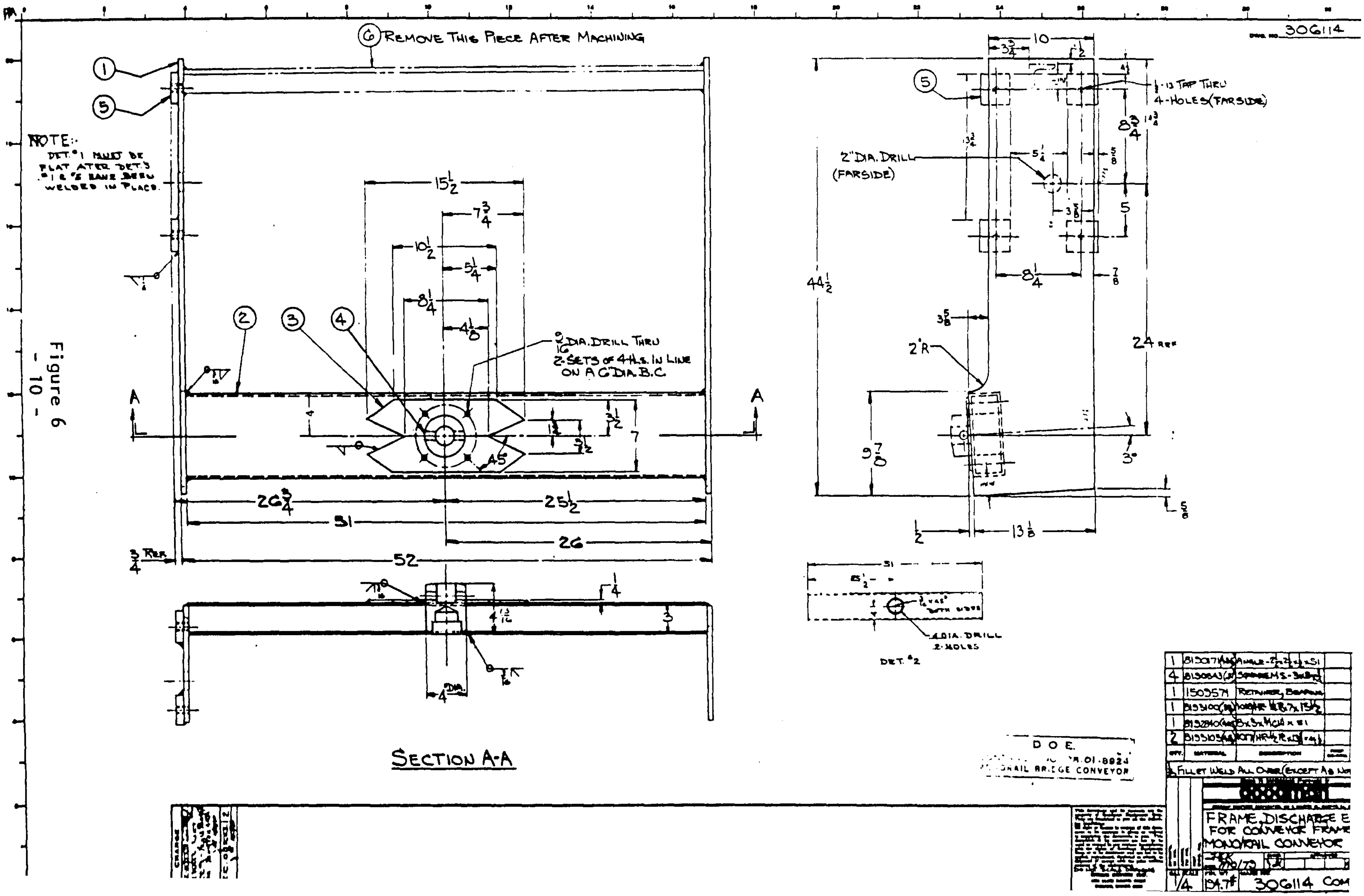

DWG. NO. 306116
NOTE: DET 2 MUST BE FLAT AFTER DETS 1 & 3 ARE WELDED IN PLACE.
9/16 DIA. DRILL THRU 4-HOLES
9/16 DIA. DRILL THRU 4-HOLES
REF.
DET 6
DET 4
D. O. E.
CONTRACT NO. 78-01-8024
MONORAIL BRIDGE CONVEYOR
FILLET WELD ALL OVER
FRAME, TAKE UP
FOR CONVEYOR FRAME
MONORAIL BRIDGE CONVEYOR
306116

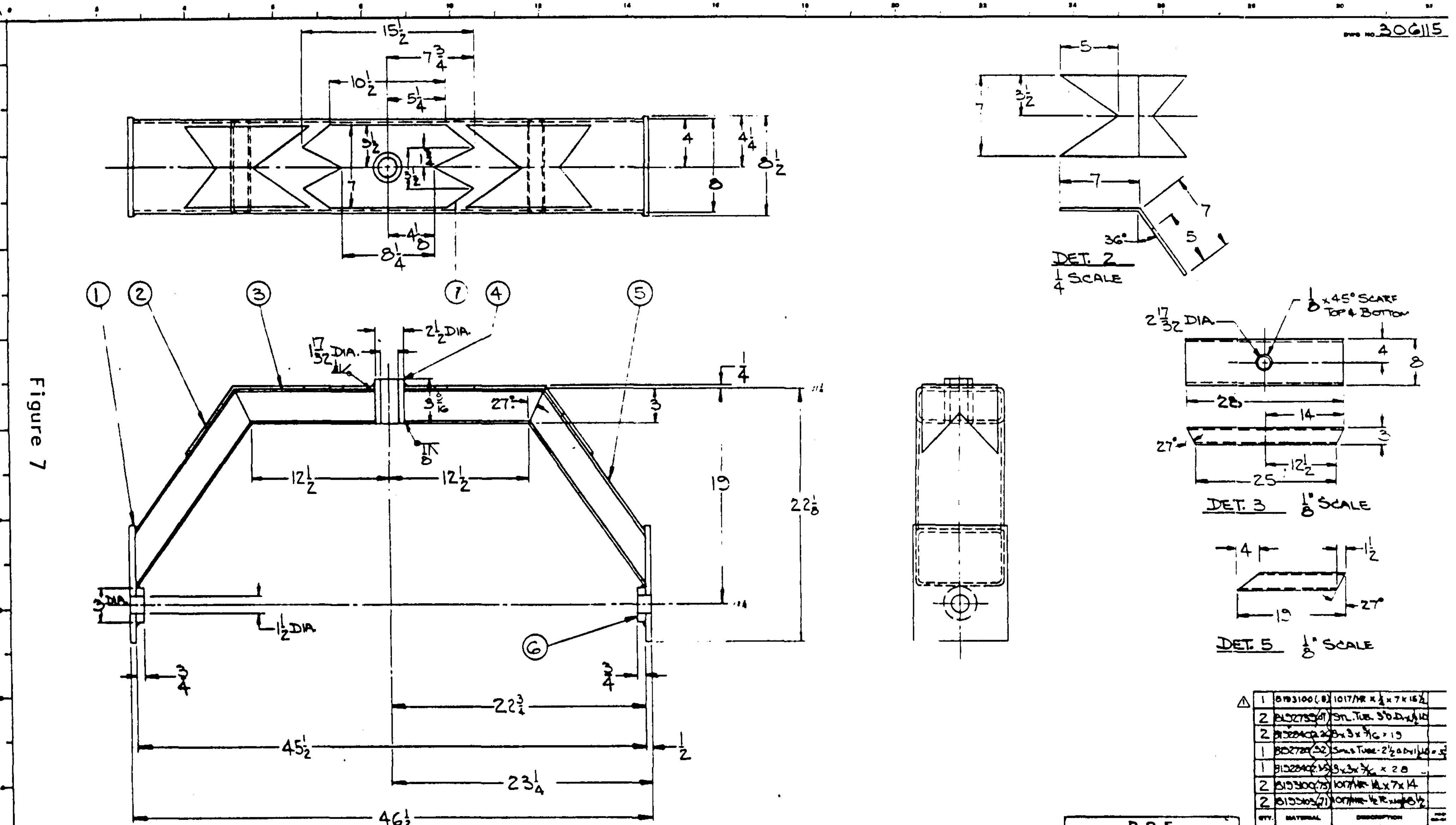
Figure 5



306114
⑥ REMOVE THIS PIECE AFTER MACHINING
NOTE:- DET. #1 MUST BE FLAT AFTER DET.'S #1 & #5 HAVE BEEN WELDED IN PLACE.
9/16 DIA. DRILL THRU
2-SETS OF 4 H.S. IN LINE
ON A 6" DIA. B.C.
SECTION A-A
1/2-13 TAP THRU
4-HOLES (FARSIDE)
2" DIA. DRILL
(FARSIDE)
2" R
24 REF
DET. #2
D O E.
FRAME, DISCHARGE END
FOR CONVEYOR FRAME
MONORAIL CONVEYOR
FILLET WELD ALL OVER (EXCEPT AS NOTED)

Figure 6
- 10 -

Figure 7



QTY.	MATERIAL	DESCRIPTION
1	8193100 (.8)	1017/HR x ½ x 7 x 16½
2	8132753 (41)	STL. TUB. 3"O.D. x ¼ x 10
2	8132840 (2.24)	3 x 3 x 3/16 x 19
1	8102720 (.32)	SMLS TUBE - 2½ O.D. x 1 ½ x 5¾
1	8132840 (2.45)	3 x 3 x 3/16 x 28
2	8193100 (.75)	1017/HR ½ x 7 x 14
2	8193103 (.71)	1017/HR ½ R x 8½

FILLET WELD ALL OVER (EXCEPT AS

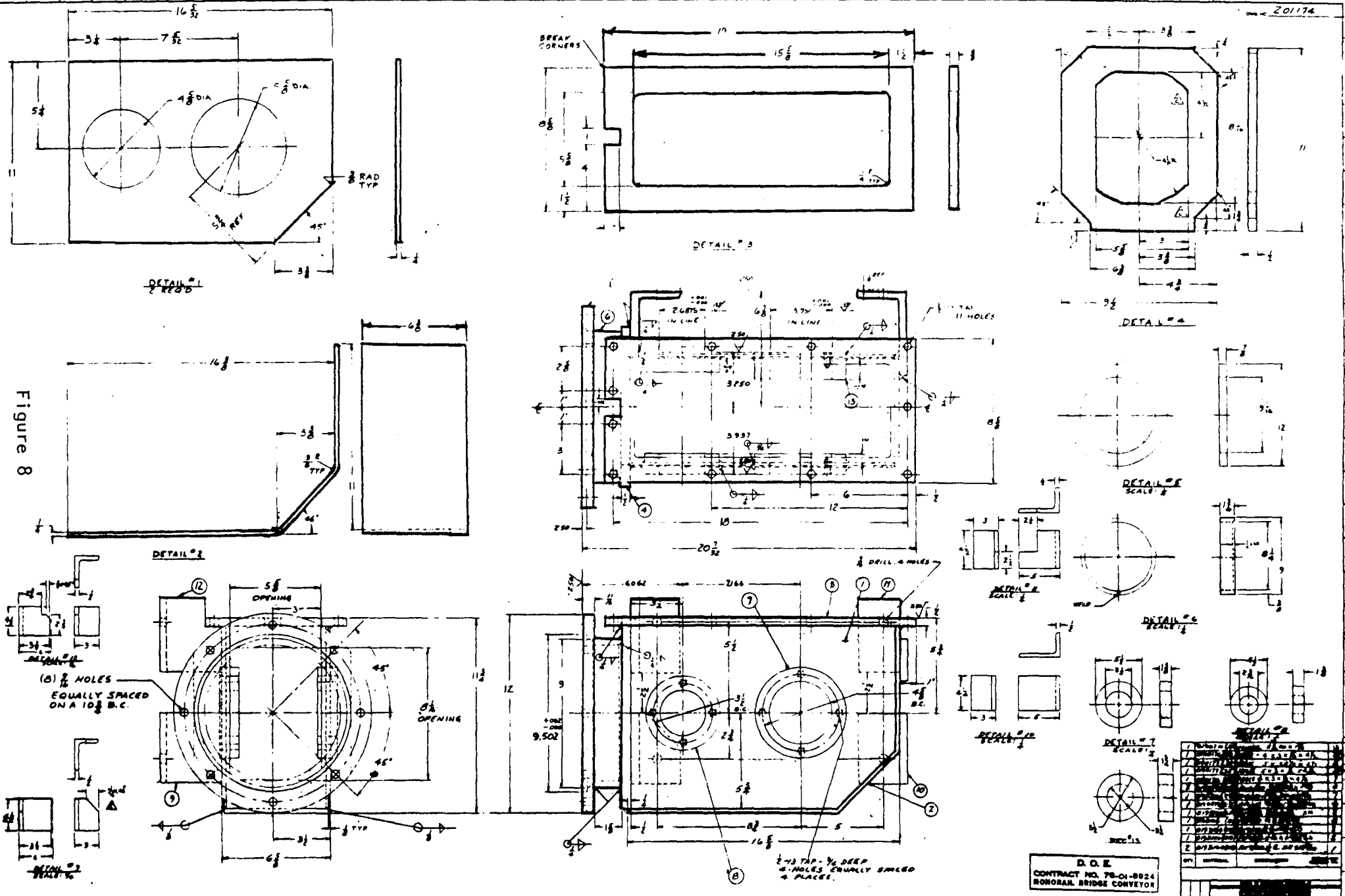
D. O. E.
CONTRACT NO. 78-01-8924
MONORAIL BRIDGE CONVEYOR

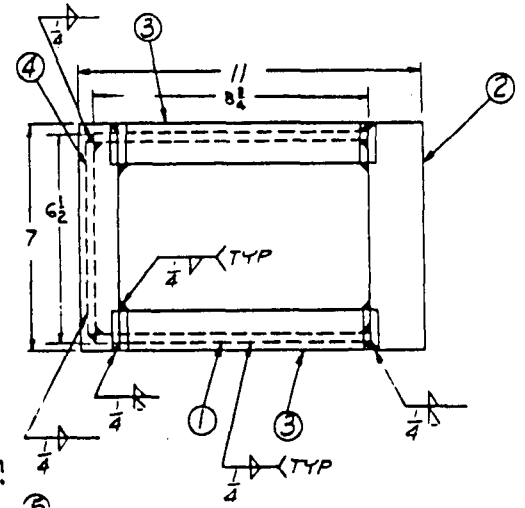
FRAME, SUSPENSI
FOR CONVEYORS
MONORAIL BRIDGE CONVE

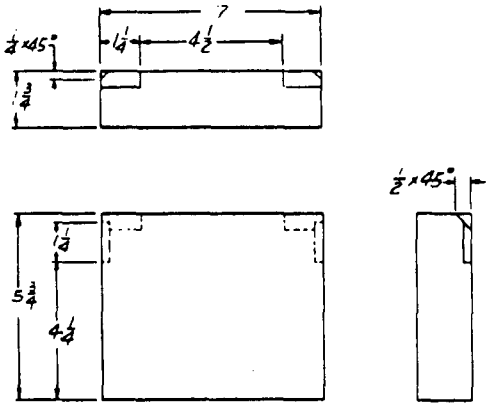
JEK 3/26/79

1/4 G1 # 306115

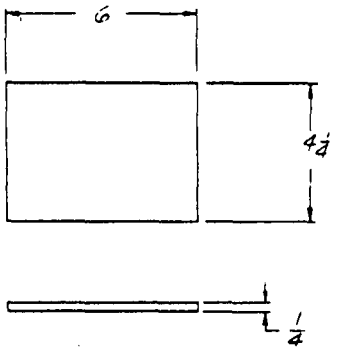
Figure 8


DETAIL "1
DETAIL "2
DETAIL "3
DETAIL "4
DETAIL "5
DETAIL "6
DETAIL "7
DETAIL "8
DETAIL "9
DETAIL "10
DETAIL "11
(8) 2/16 HOLES EQUALLY SPACED ON A 10 3/8 B.C.
5 5/8 OPENING
6 3/4 OPENING
4 DRILL & TAP HOLES
2-13 TAP - 3/4 DEEP 4 HOLES EQUALLY SPACED 4 PLACES.
D. O. E.
CONTRACT NO. 76-01-8024
MONORAIL BRIDGE CONVEYOR
GEAR BOX
FOR CROSS TRAVEL DRIVE
201174

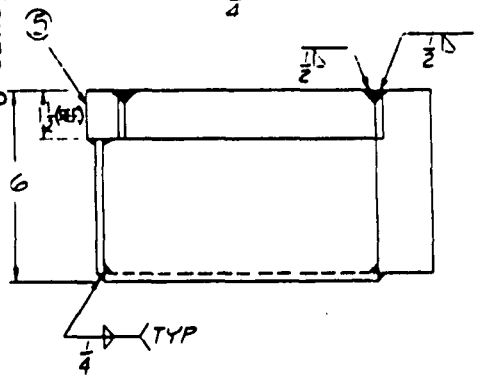


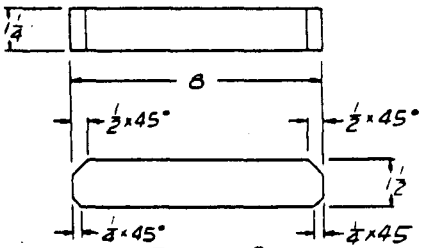


DETAIL #2

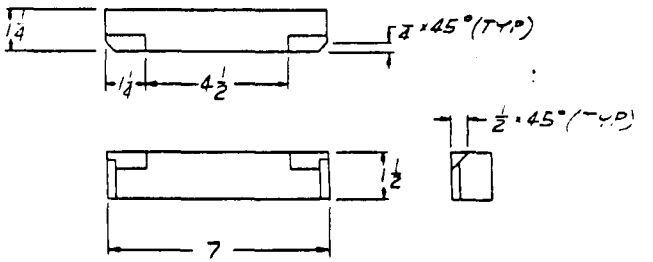


DETAIL #4





DETAIL #3



DETAIL #5

NOTE:
1) DIMENSIONAL TOLERANCES
   ± 1/64 FOR FRACTIONS
   .005 FOR DECIMAL DIM'S
   UNLESS OTHERWISE SPECIFIED
2) ALL WELDS MADE IN ACCORDANCE WITH AWS STANDARDS
   MUST BE CONTINUOUS & GAS TIGHT.

QTY.	MATERIAL	DESCRIPTION
1	893110(.026)	1017 HR 1½ R x 1¼ x 7
	893100(.19)	1017 HR ¼ R x 4¼ x 6
2	893110(.15)	1017 HR 1½ R x 1¼ x 8
1	893114(.3)	1017 HR 1¾ R x 5¾ x 7
1	1509680	BOTTOM & SIDES

WELD

CASE WELDMENT
FOR PUSHBUTTONS
MONORAIL

5-18-1979 MO

COMP. 306142

Figure 9

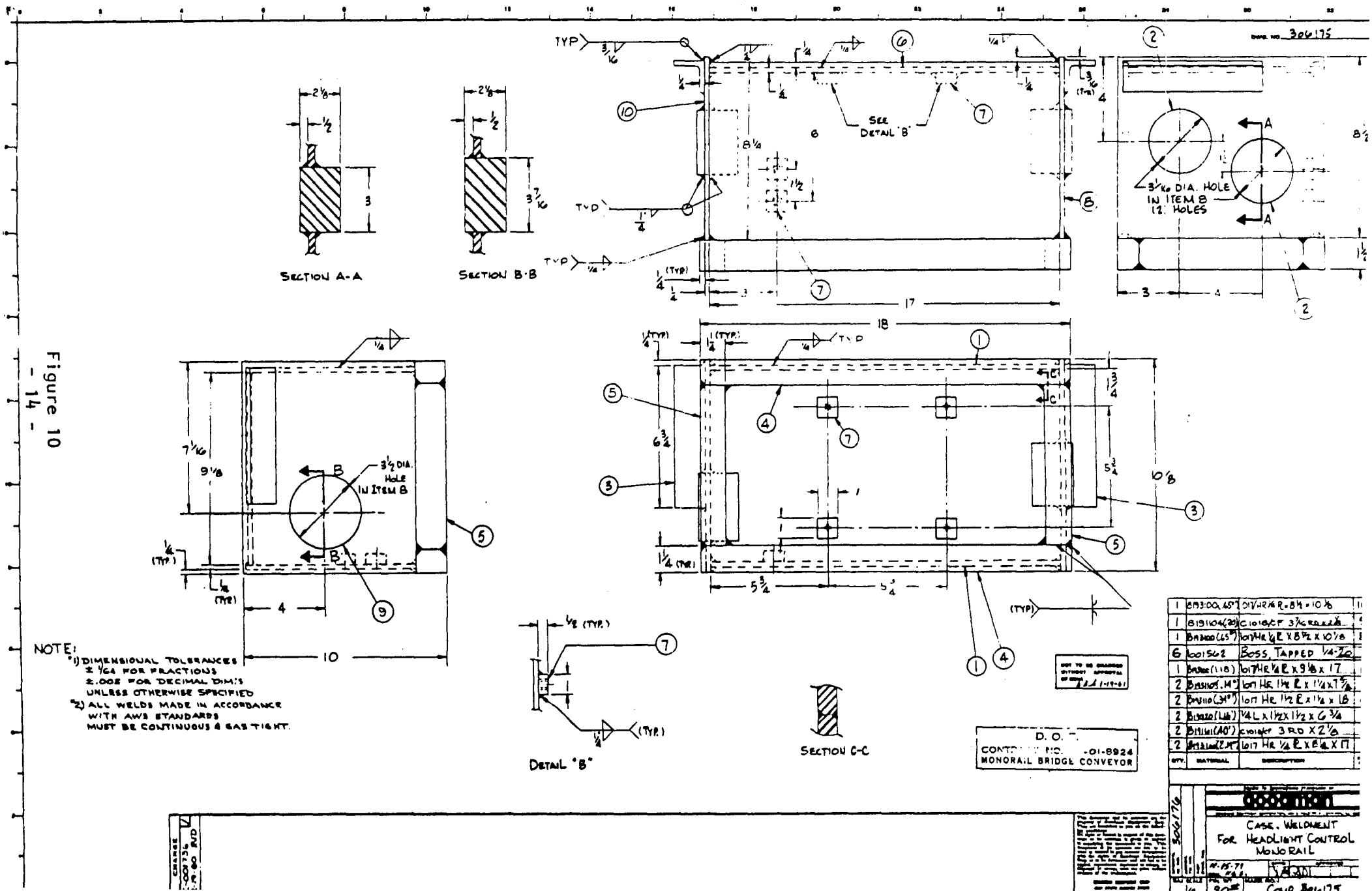

SECTION A-A
SECTION B-B
SEE DETAIL 'B'
3/16 DIA. HOLE IN ITEM 8 12 HOLES
DETAIL "B"
SECTION C-C
NOTE:
1) DIMENSIONAL TOLERANCES ± 1/64 FOR FRACTIONS ±.005 FOR DECIMAL DIM'S UNLESS OTHERWISE SPECIFIED
2) ALL WELDS MADE IN ACCORDANCE WITH AWS STANDARDS MUST BE CONTINUOUS & GAS TIGHT.
D. O. -
CONTR NO. -01-8924
MONORAIL BRIDGE CONVEYOR
CASE, WELDMENT FOR HEADLIGHT CONTROL MONORAIL
306175

Figure 10

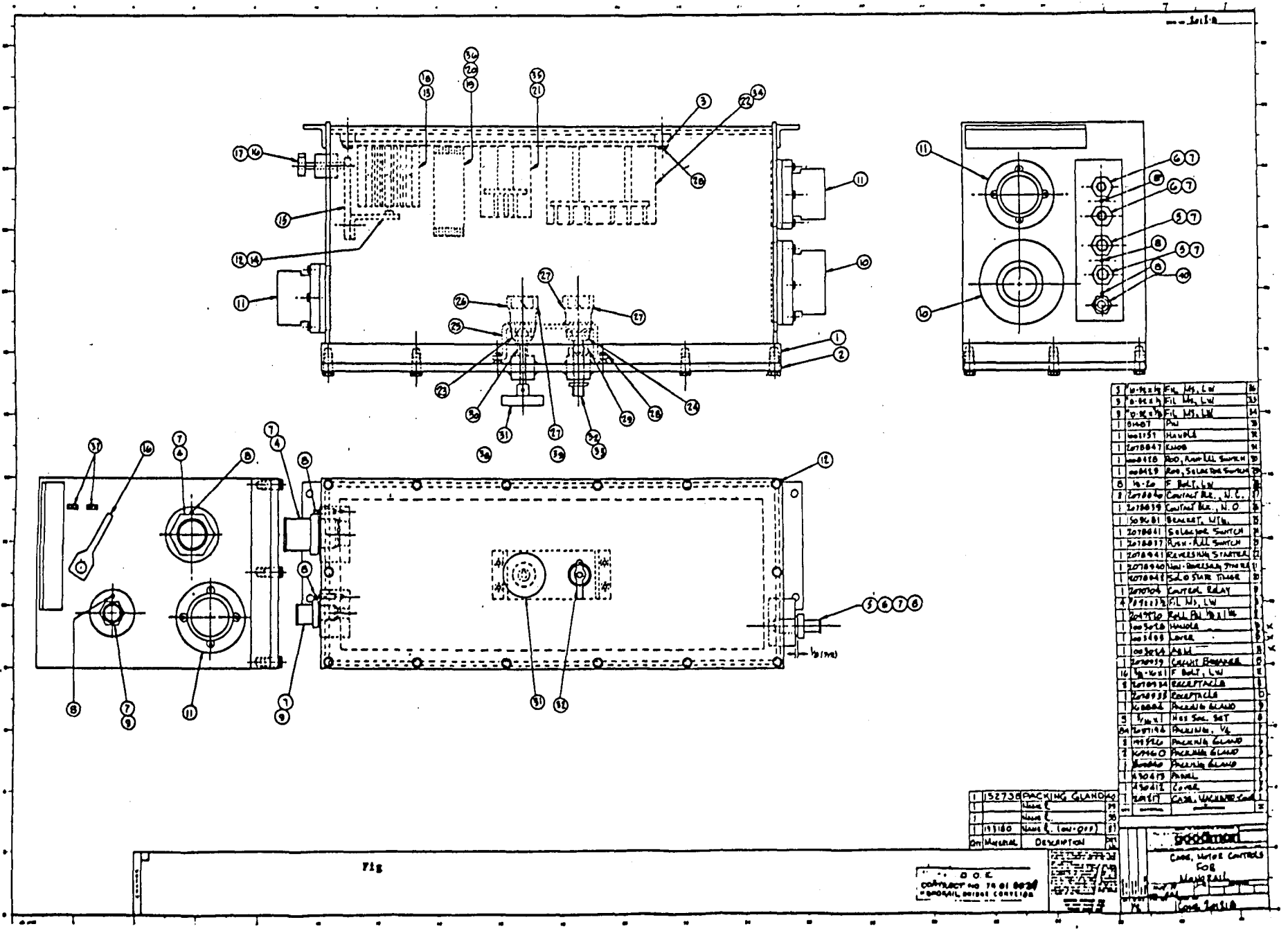
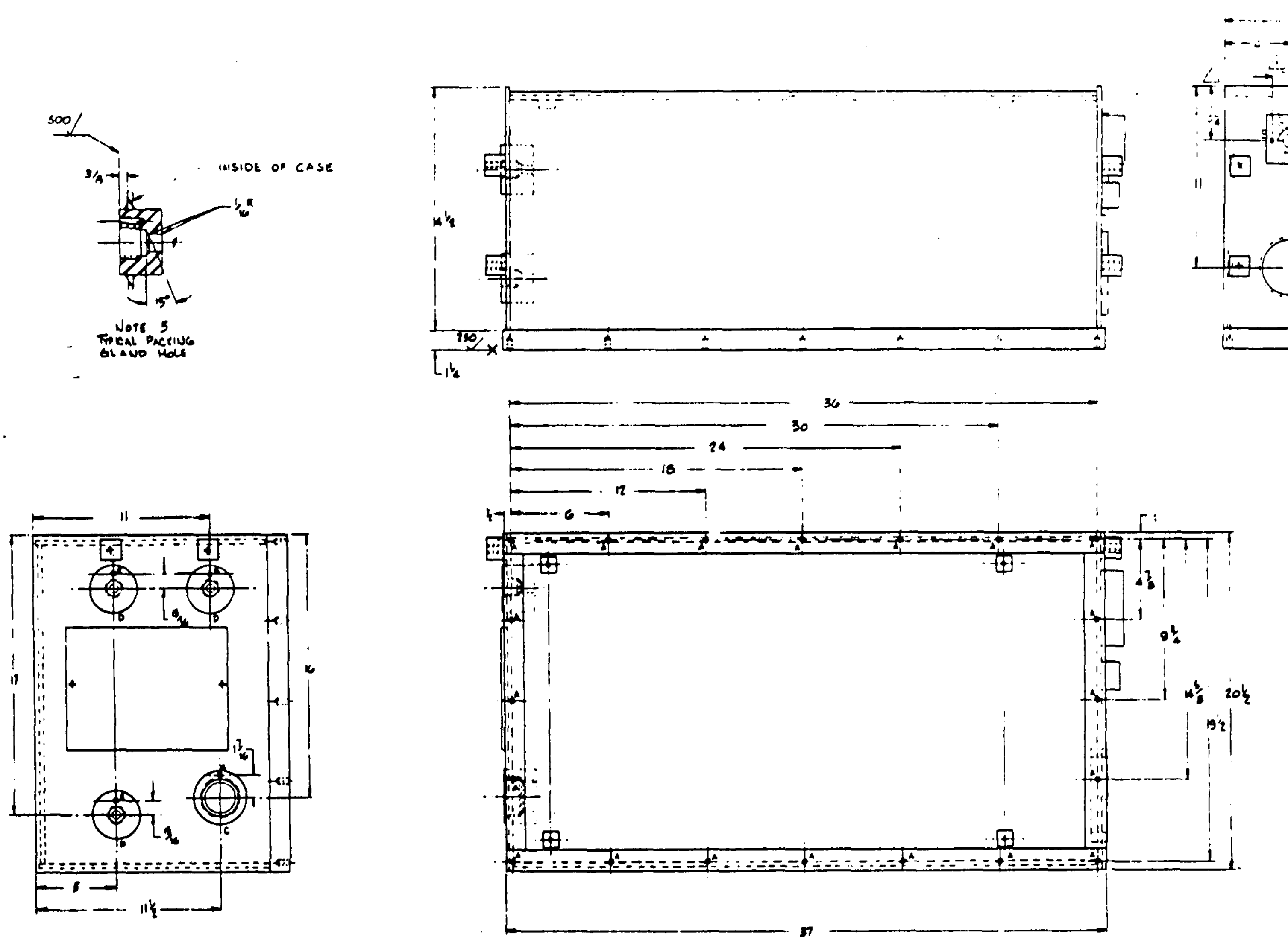
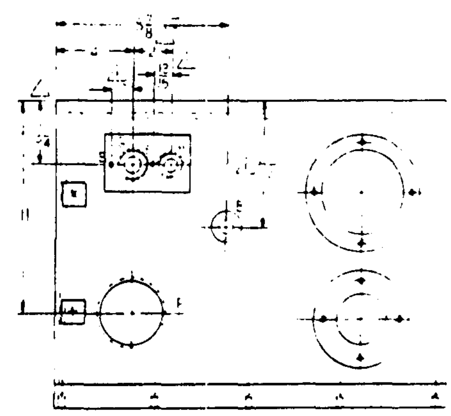


Figure 11





DRILL AND TAP LIST				
MARK	SIZE	DEPTH	QUANTITY	REMARKS
A	5/16 3/8 3/8-16	1 1/16 1/8	2C	
⚠ B	.752-.500	THRU		REAM
C	1 27/32 2.244 Bore 2 3/8-12	THRU 1 1/2 1	1	Note 5
D	9/16 1.044 Bore 1 1/8-12	THRU 1 3/8 1	3	Note 5
⚠ E	17/64 5/16-18	9/16 1/2	6	
F	3.419 Bore 3 1/2-12	THRU	1	
⚠ G	7/8 .415 BORE [illegible]	THRU [illegible]		NOTE 5
⚠ H	11/16 1.169 BORE 1 1/4-12	[illegible] 1 1/2 1		NOTE 5

NOTES (CONT.)

#7 ALL HOLES THAT AFFECT PLANARITY OF A SURFACE FORMING A FLAME ARRESTING PATH MUST BE DEBURRED.

Note:

1) Paint Inside With Coat Of Paint. Can Use Red Thermal Epoxy. Air Dry. Do Not Paint Machined Surfaces.
2) "X" Surface Must Be Flat Within .002 Between Bolt Holes.
3) Remove All Chips From Holes, Cavities, Etc. After Case Is Completed.
4) Blind Holes Must Not Go Thru. Depth Of Tap Drill Includes Drill Point. 1/8 Minimum Of Stock Remaining At Bottom Of Blind Holes
5) Dimensional Tolerances ±1/64 For Fractions ±.005 For Decimal Dim. Unless Otherwise Specified
6) See [illegible] (6-75).

1 | 20:219 | CASE, WELDMENT

goodman

CASE, MACHINED FOR MASTER CO...

Figure 12

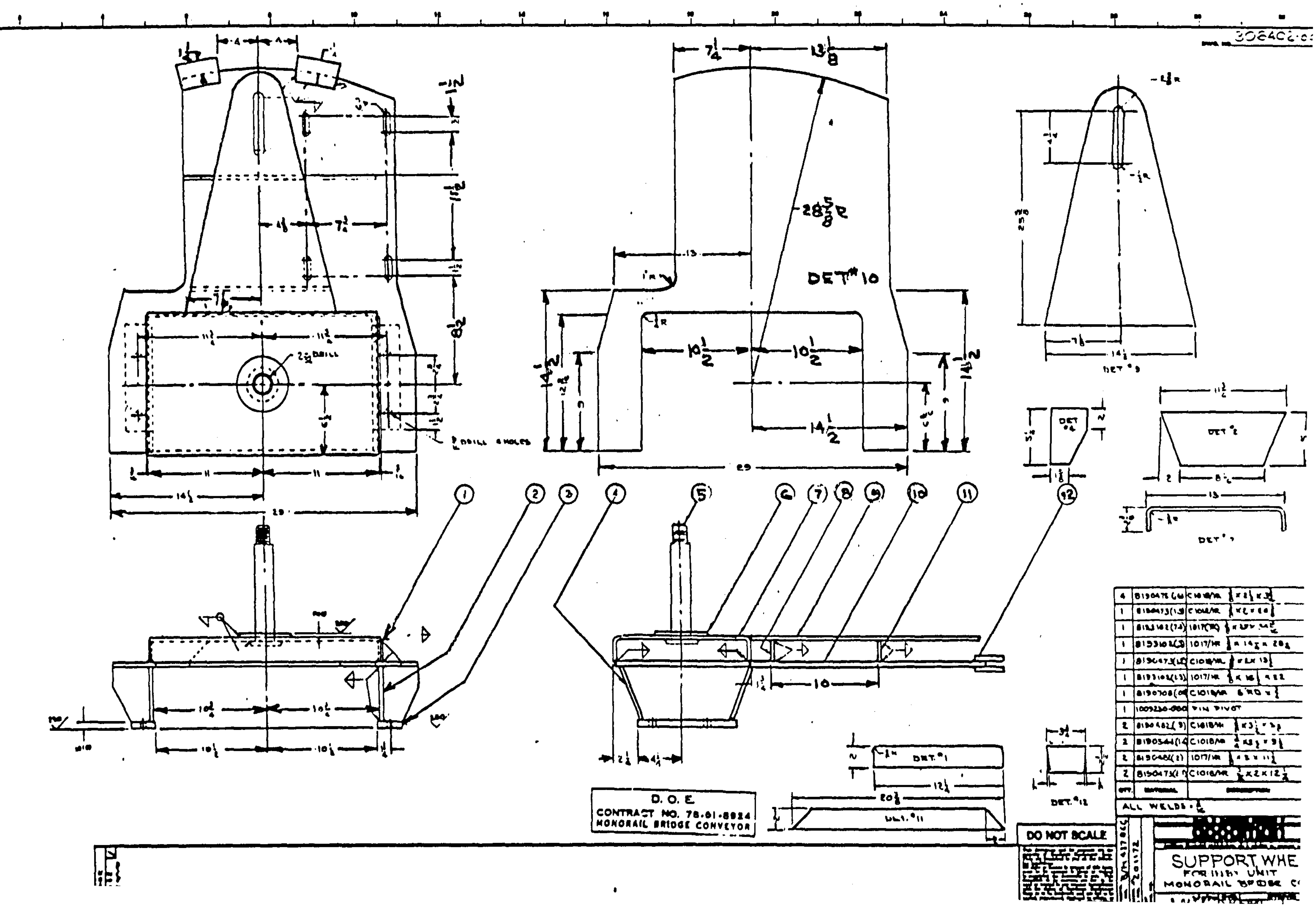

DET #10
DET #9
DET #2
DET #1
DET #11
DET #12
D. O. E.
CONTRACT NO. 78-81-8824
MONORAIL BRIDGE CONVEYOR
DO NOT SCALE
ALL WELDS
SUPPORT WHE
MONORAIL BRIDGE C

Figure 13

1.2.2 Update Design Drawings

All updating of drawings was done during their period of fabrication and assembly.

1.2.3 Design/Plan/Surface Test

Shown in Fig. 14.

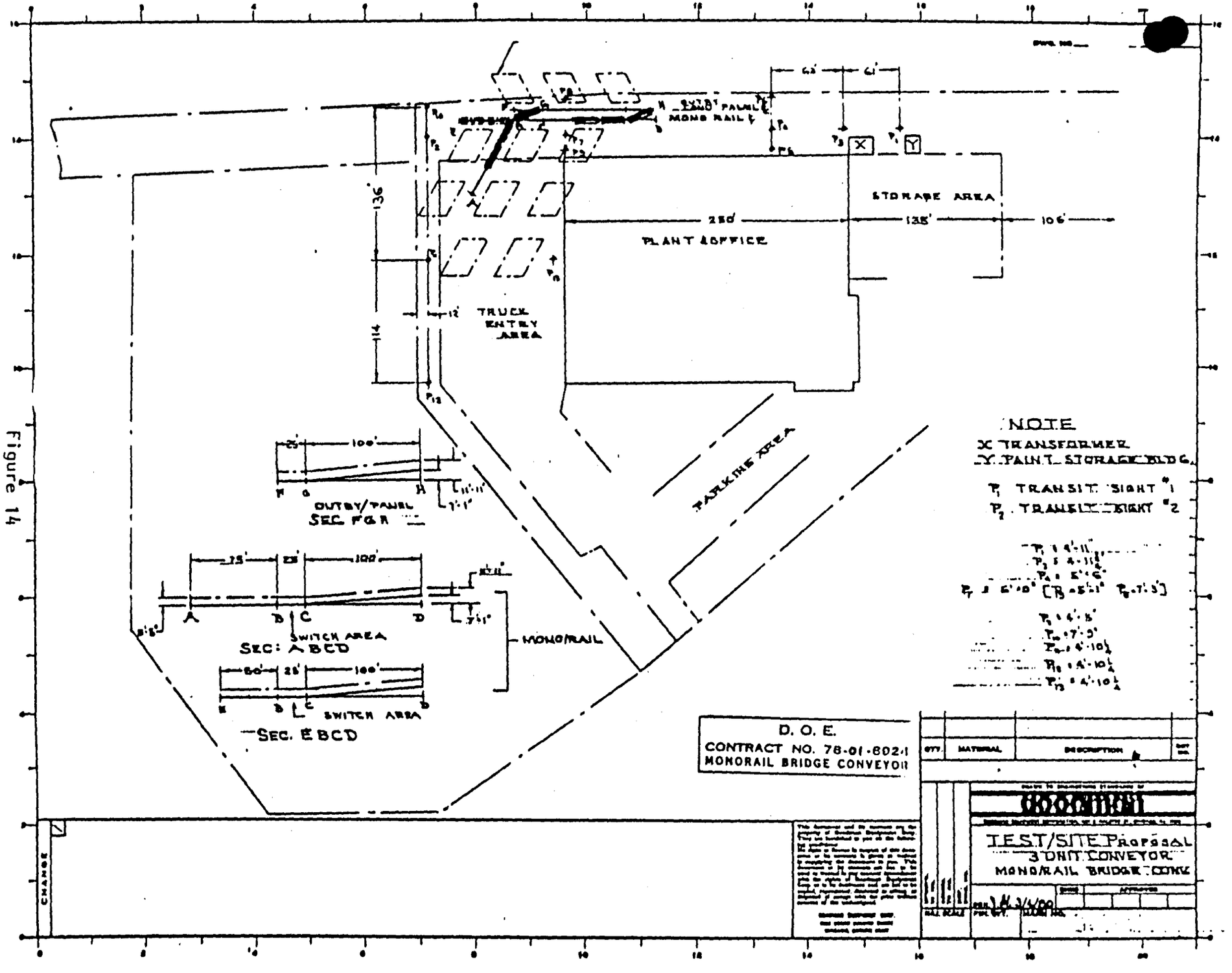

STORAGE AREA
250'
135'
100'
PLANT & OFFICE
136'
12'
TRUCK ENTRY AREA
114'
PARKING AREA
OUTBY/PANEL
SEC F & R
SWITCH AREA
SEC: A B C D
SWITCH AREA
SEC. E B C D
MONORAIL
NOTE
X TRANSFORMER
Y PAINT STORAGE BLDG.
P1 TRANSIT SIGHT #1
P2 TRANSIT SIGHT #2
D. O. E.
CONTRACT NO. 78-01-6021
MONORAIL BRIDGE CONVEYOR
T.E.S.T./SITE Proposal
3 UNIT CONVEYOR
MONORAIL BRIDGE CONVEYOR

Figure 14

2.0 FINAL FABRICATION

2.1 Conveyor Frame

The weldment of conveyor frame #201172 consists of a pair of 2" x 10" x 3/16" lengths of wall rectangular tubing for side members, with 2" x 4" x 3/16 wall rectangular tubing for struts and braces. The assembly in weldment of these pieces makes up the center portion of the structure. When this structure is put together, the take-up frame #306116 and the discharge frame #306114 are welded to each end to complete the structure. With the two frames in place, we now have a complete box structure.

The conveyor frame, when completely welded per Drawing #201172, contains all the details necessary for supporting the cradled rollers, centrifugal switches, return rollers, take-up devices, conveyor drive and motor control cases.

The twelve frames required for the project were constructed at Goodman Conveyor Corporation, Murfreesboro, Tennessee.

Both ends of completely assembled conveyor frame shown in Fig. 23 and Fig. 24.

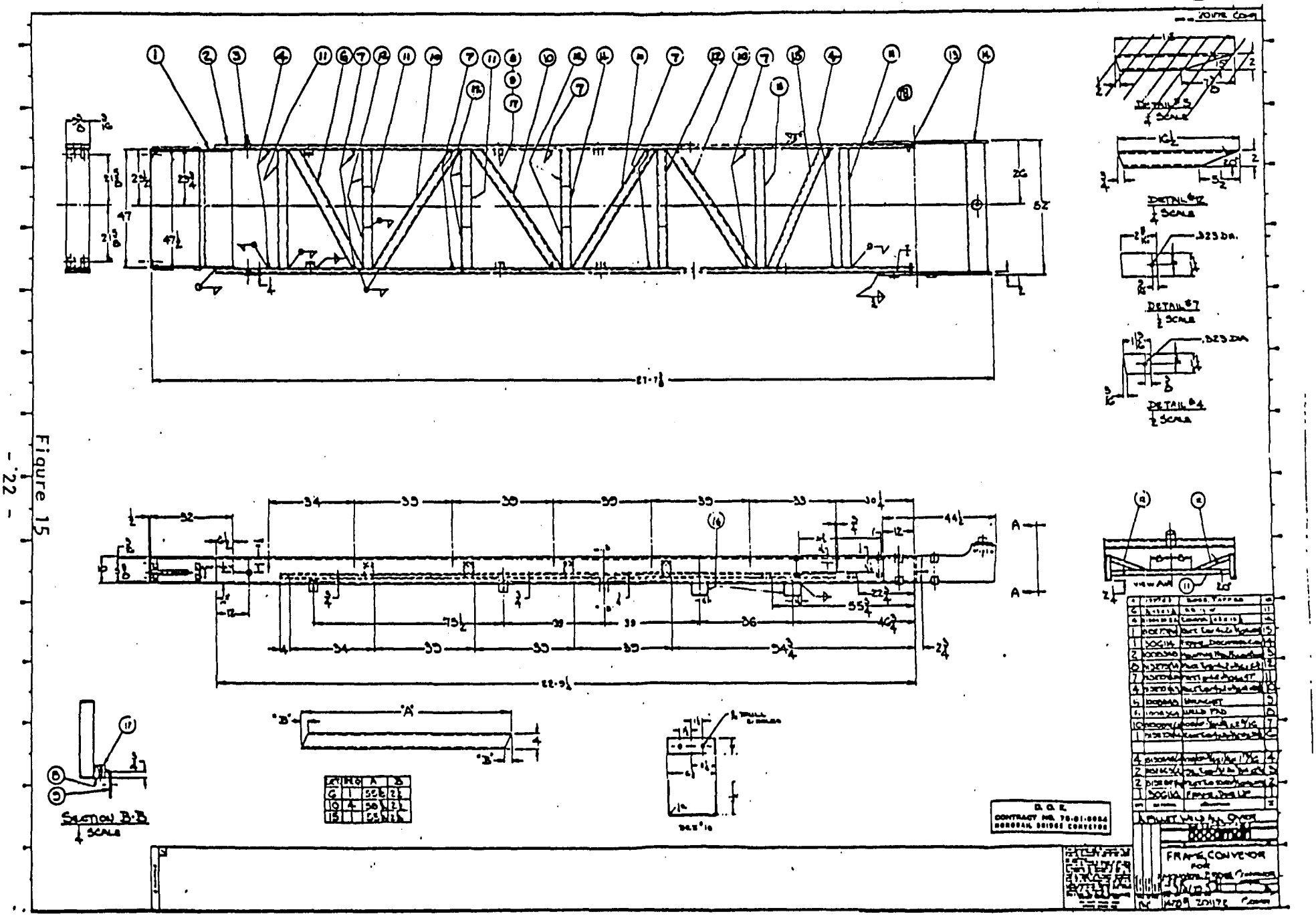


Figure 15

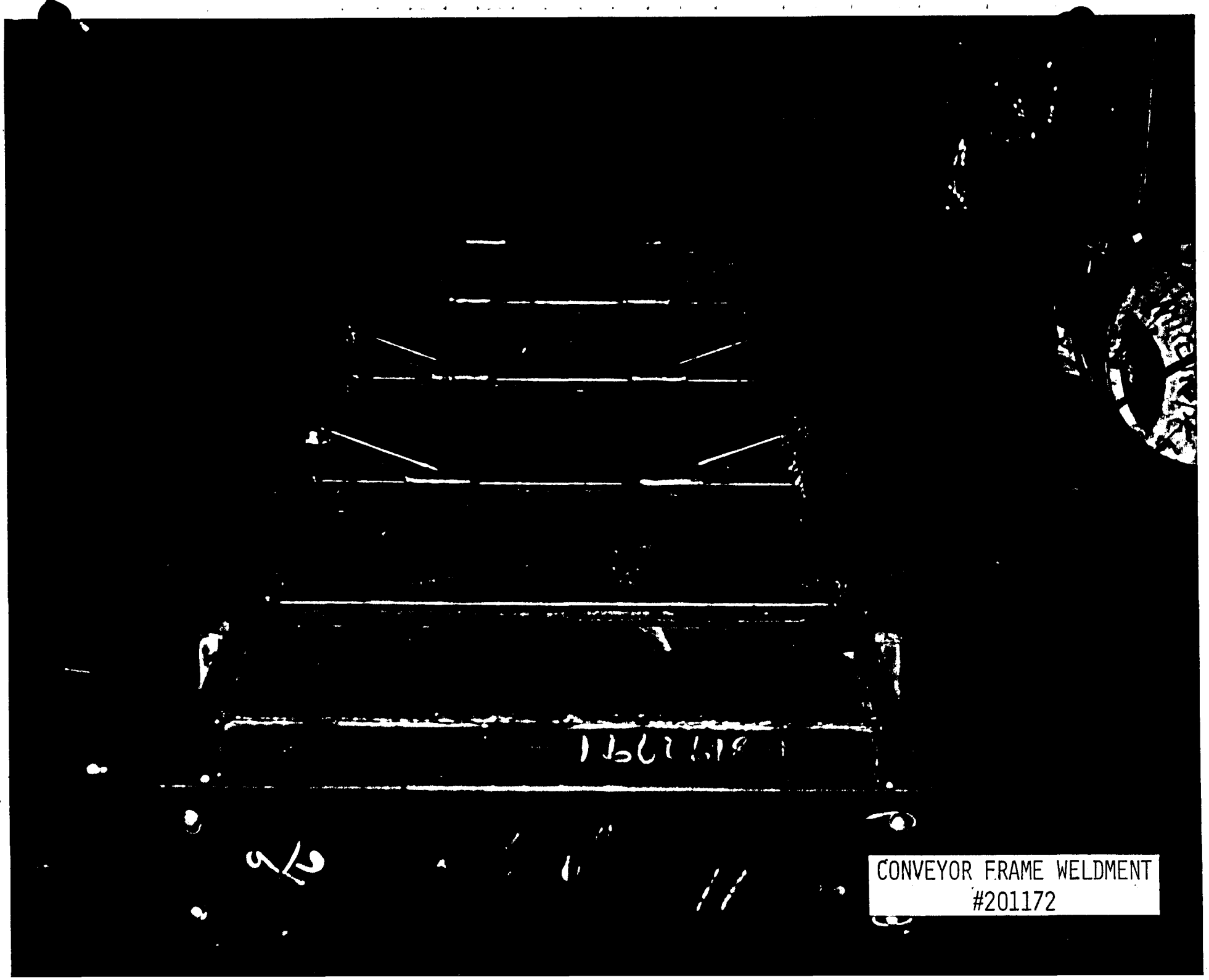


Figure 16

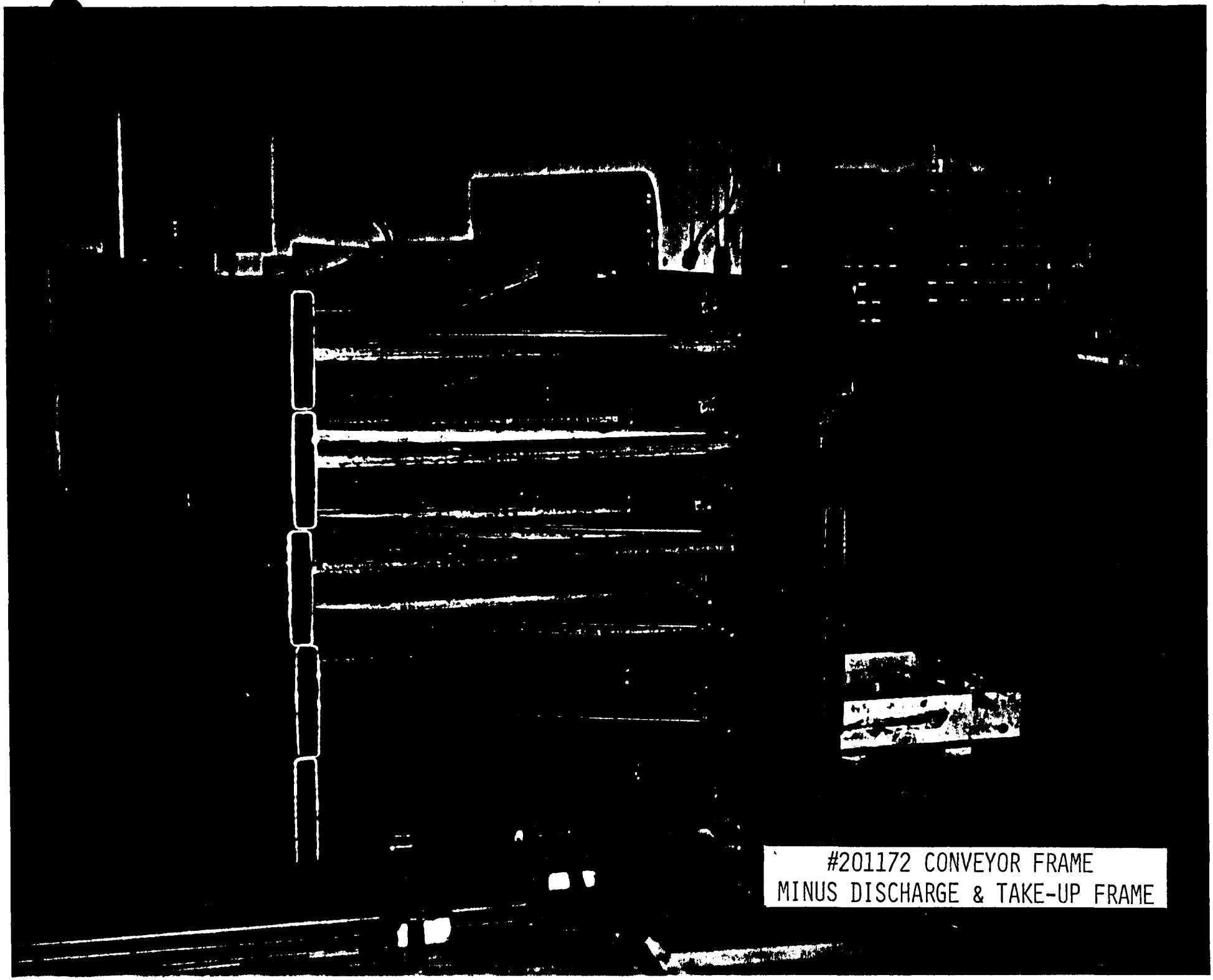


Figure 17

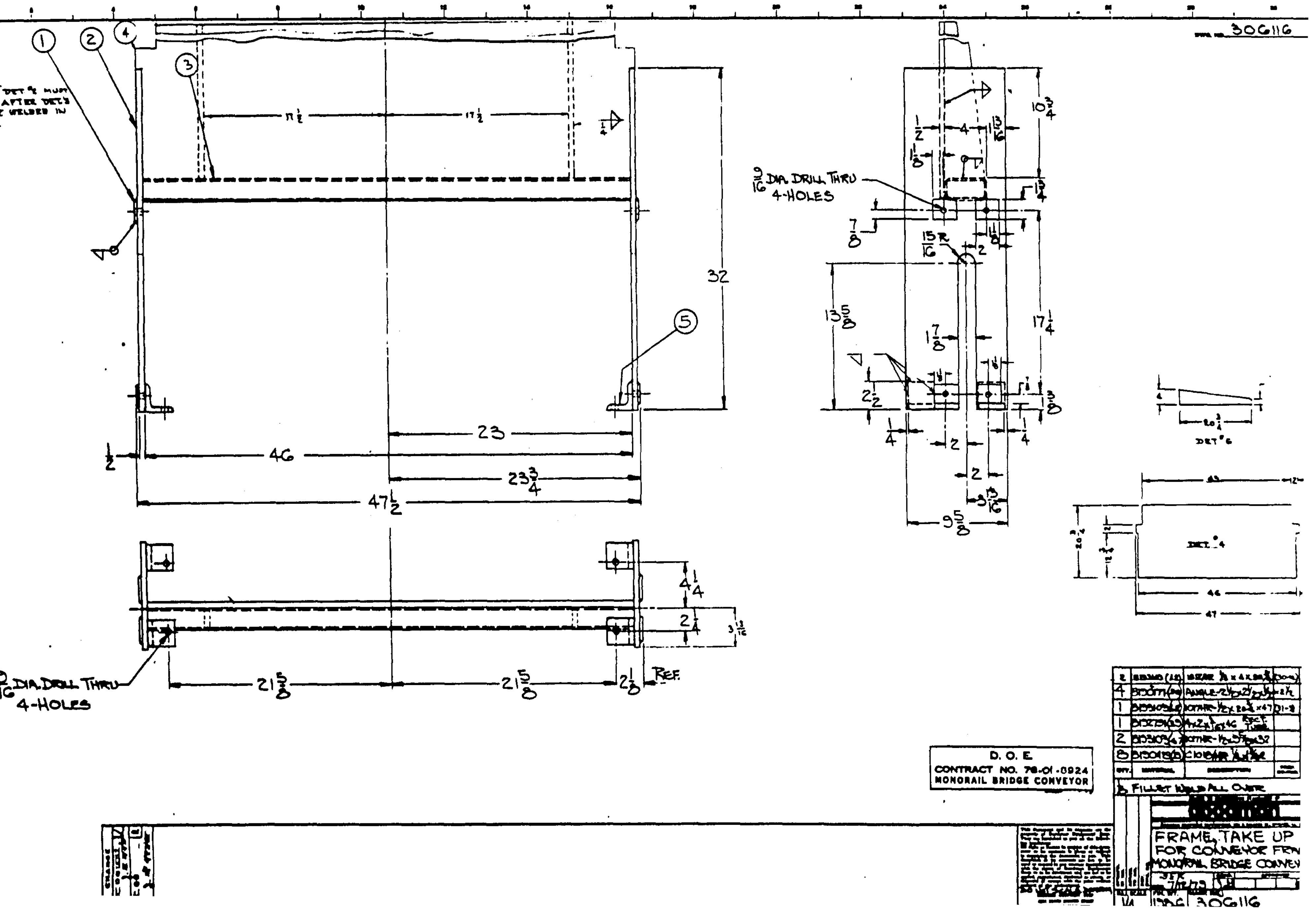

NOTE: DET 4 MUST BE FLAT AFTER DETS 1&2 ARE WELDED IN PLACE
9/16 DIA. DRILL THRU 4-HOLES
9/16 DIA. DRILL THRU 4-HOLES
DET 6
DET 4
D. O. E.
CONTRACT NO. 76-01-0924
MONORAIL BRIDGE CONVEYOR
FILLET WELD ALL OVER
FRAME, TAKE UP
FOR CONVEYOR FRM
MONORAIL BRIDGE CONVEY
306116

Figure 18

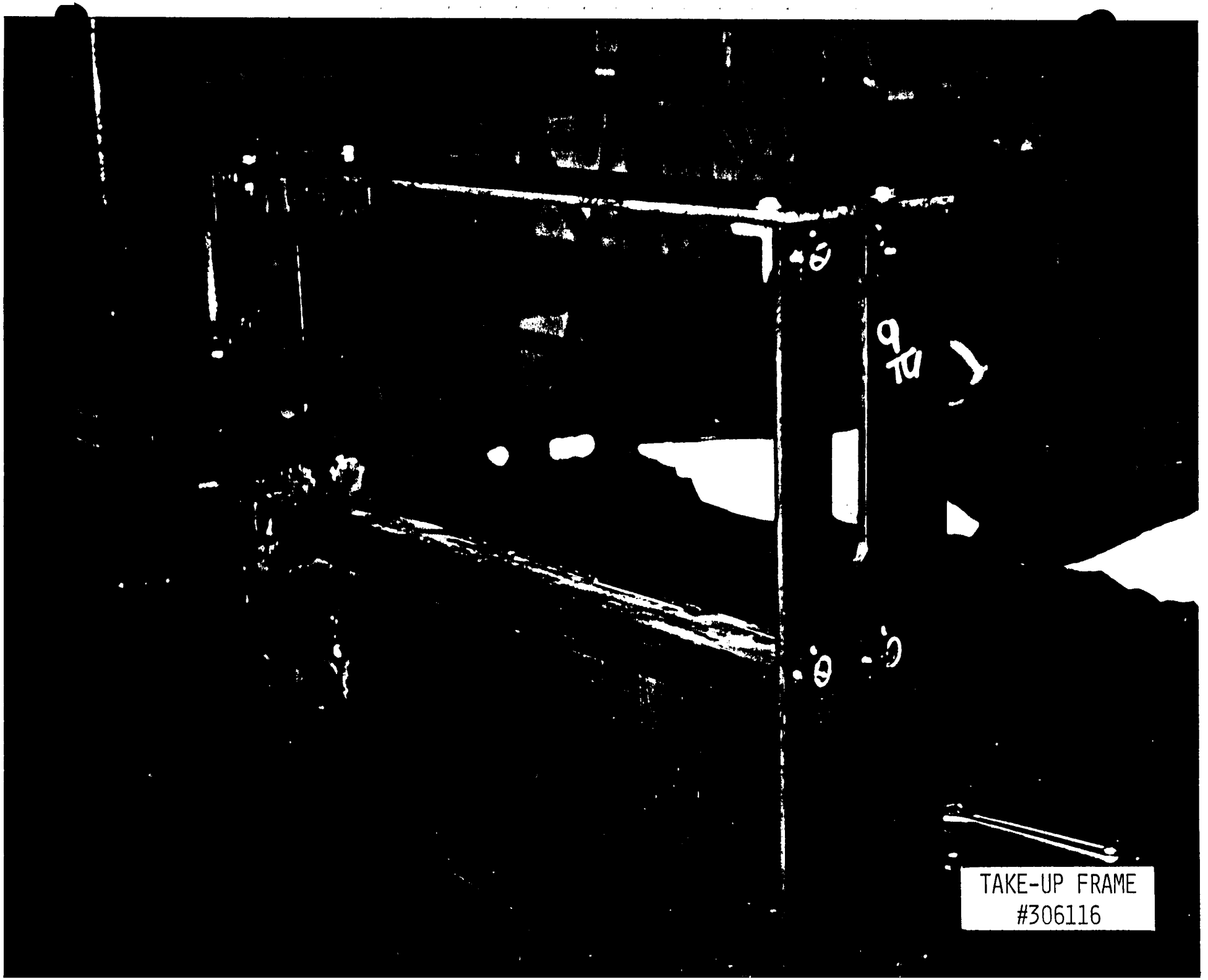


Figure 19

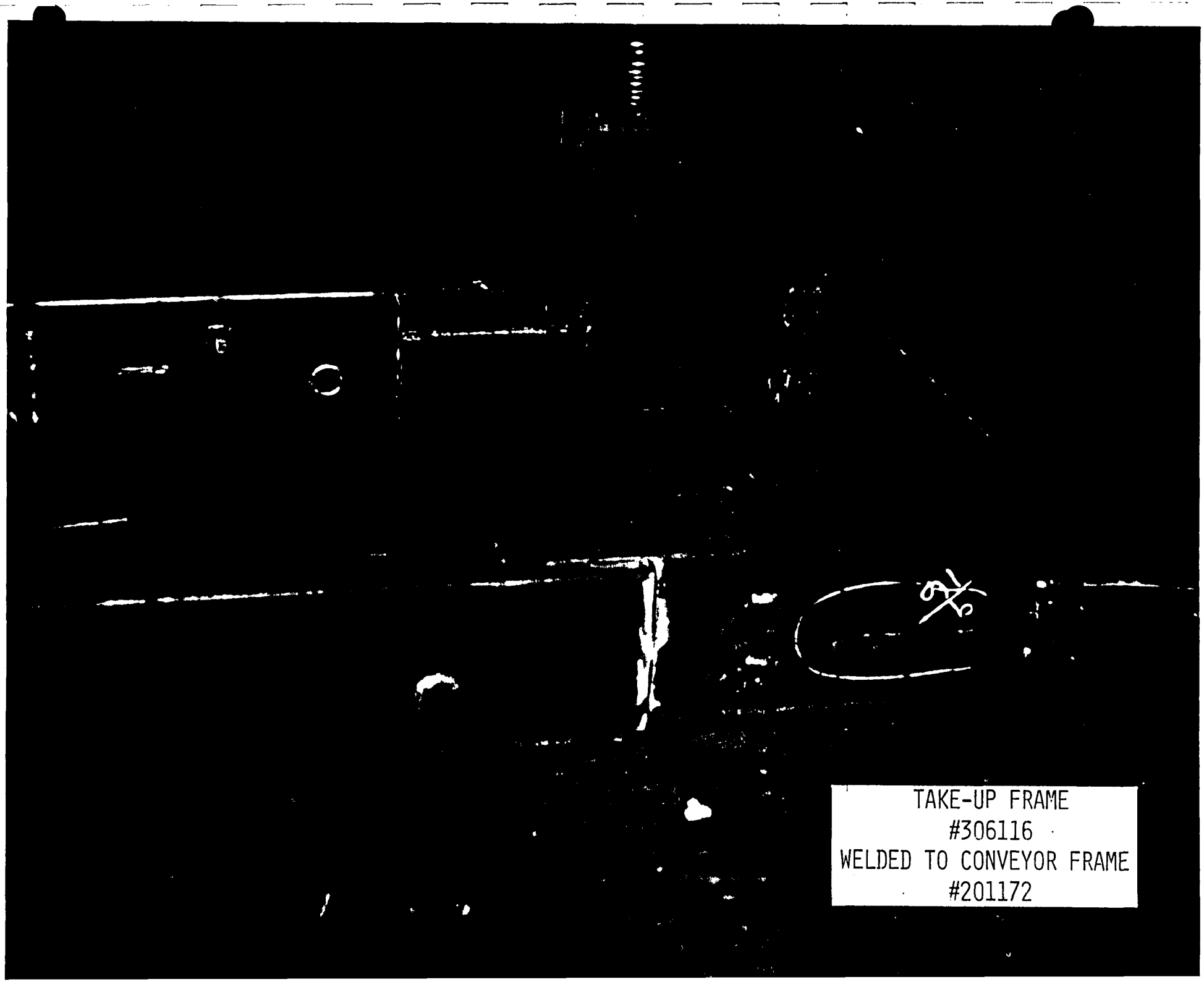


Figure 20

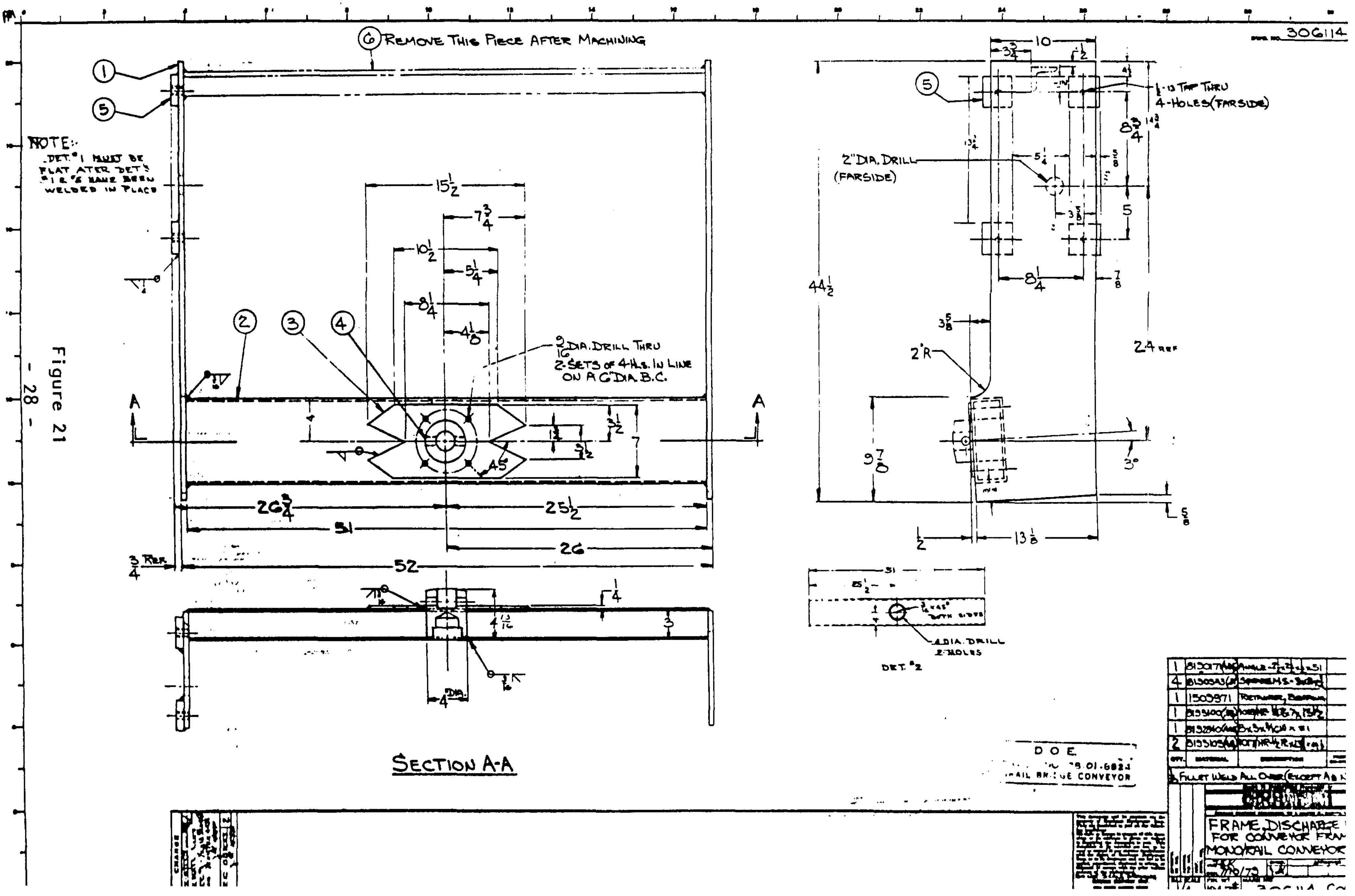

306114
REMOVE THIS PIECE AFTER MACHINING
NOTE:
DET. 1 MUST BE FLAT AFTER DET'S 1, 2 & 5 HAVE BEEN WELDED IN PLACE
9/16 DIA. DRILL THRU
2-SETS OF 4 HLS. IN LINE ON A 6" DIA. B.C.
1/2-13 TAP THRU
4-HOLES (FARSIDE)
2" DIA. DRILL
(FARSIDE)
2" R
24 REF
SECTION A-A
DET. 2
D O E
RAIL BRIDGE CONVEYOR
FRAME, DISCHARGE
FOR CONVEYOR FRAME
MONORAIL CONVEYOR

Figure 21

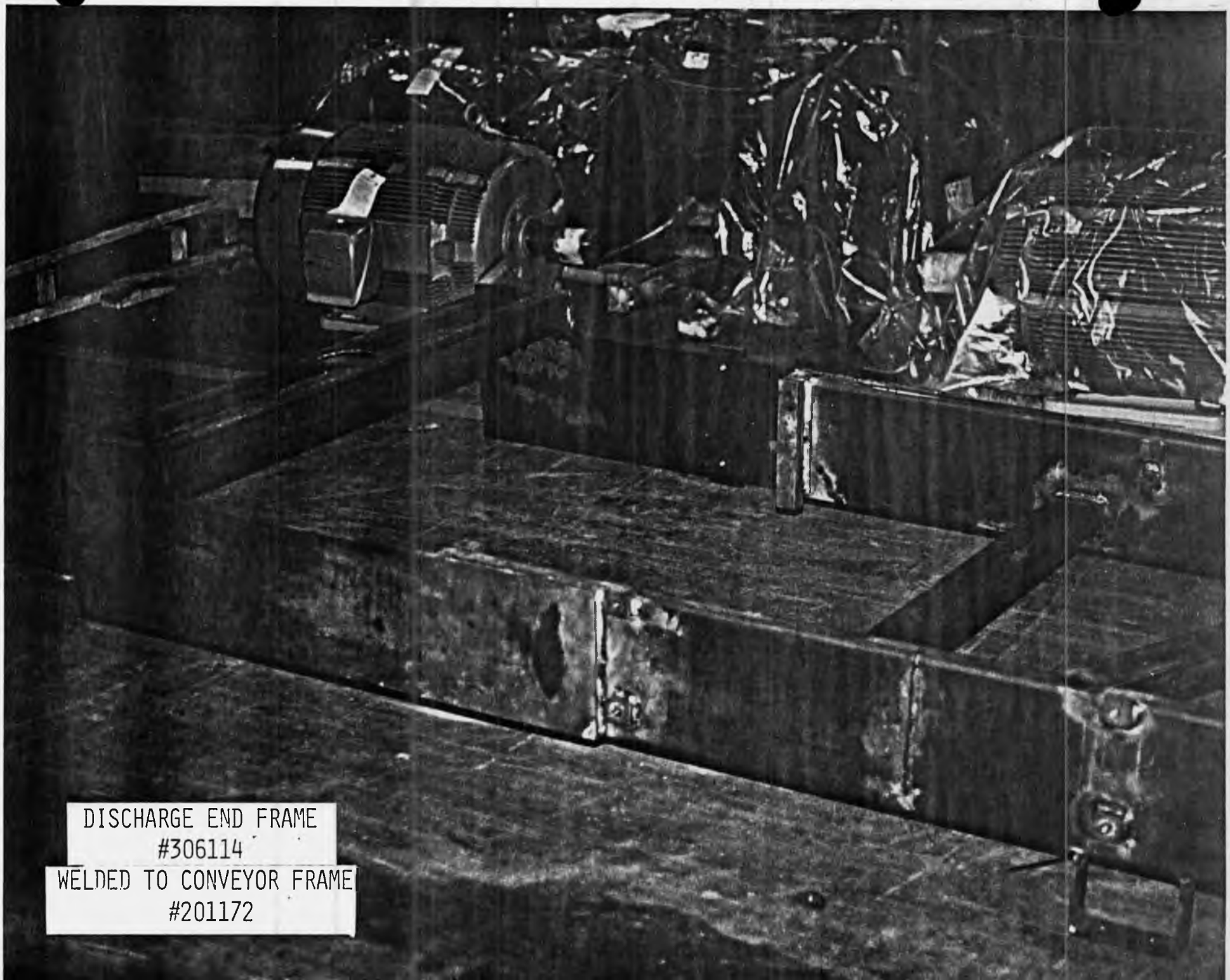

DISCHARGE END FRAME
#306114
WELDED TO CONVEYOR FRAME
#201172

Figure 22

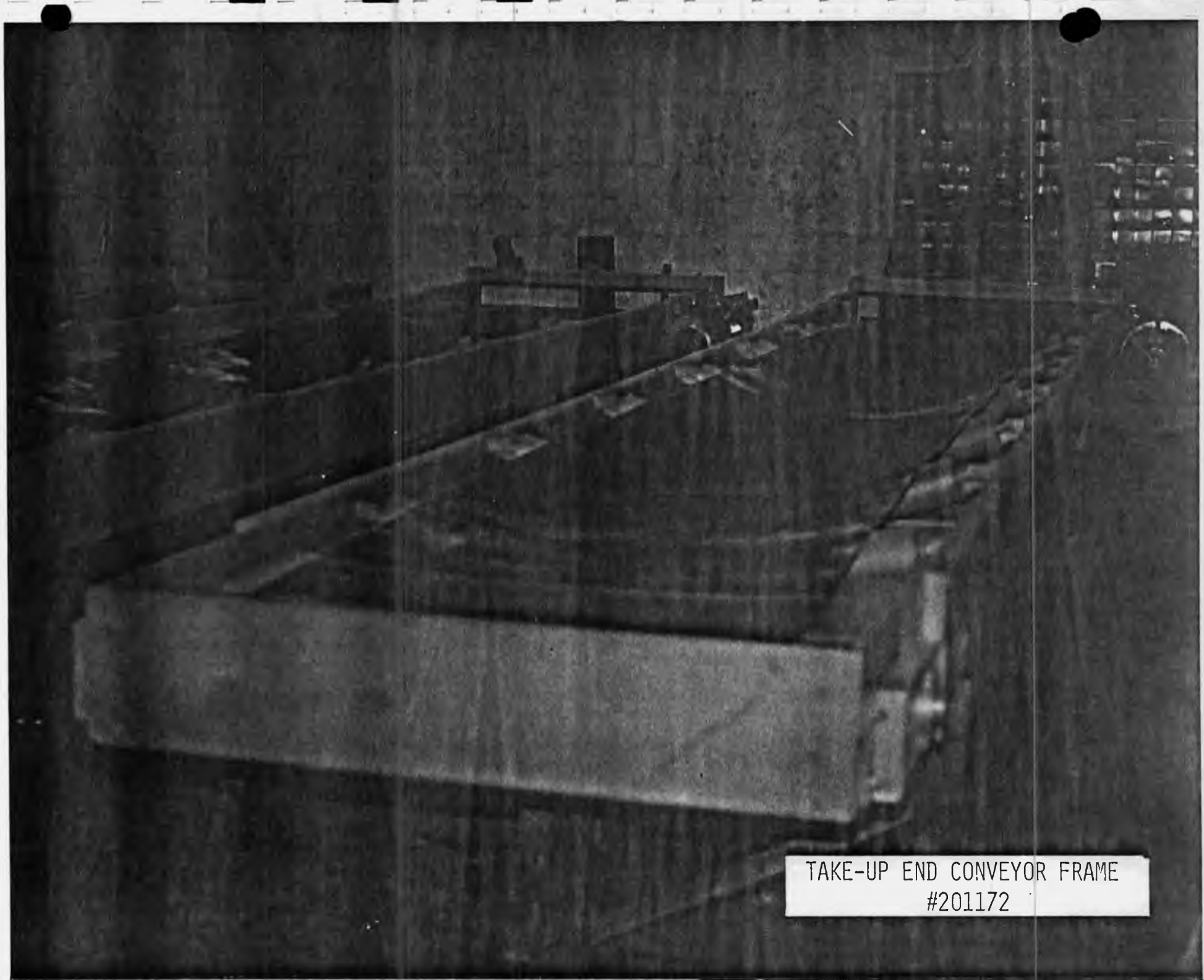


Figure 23

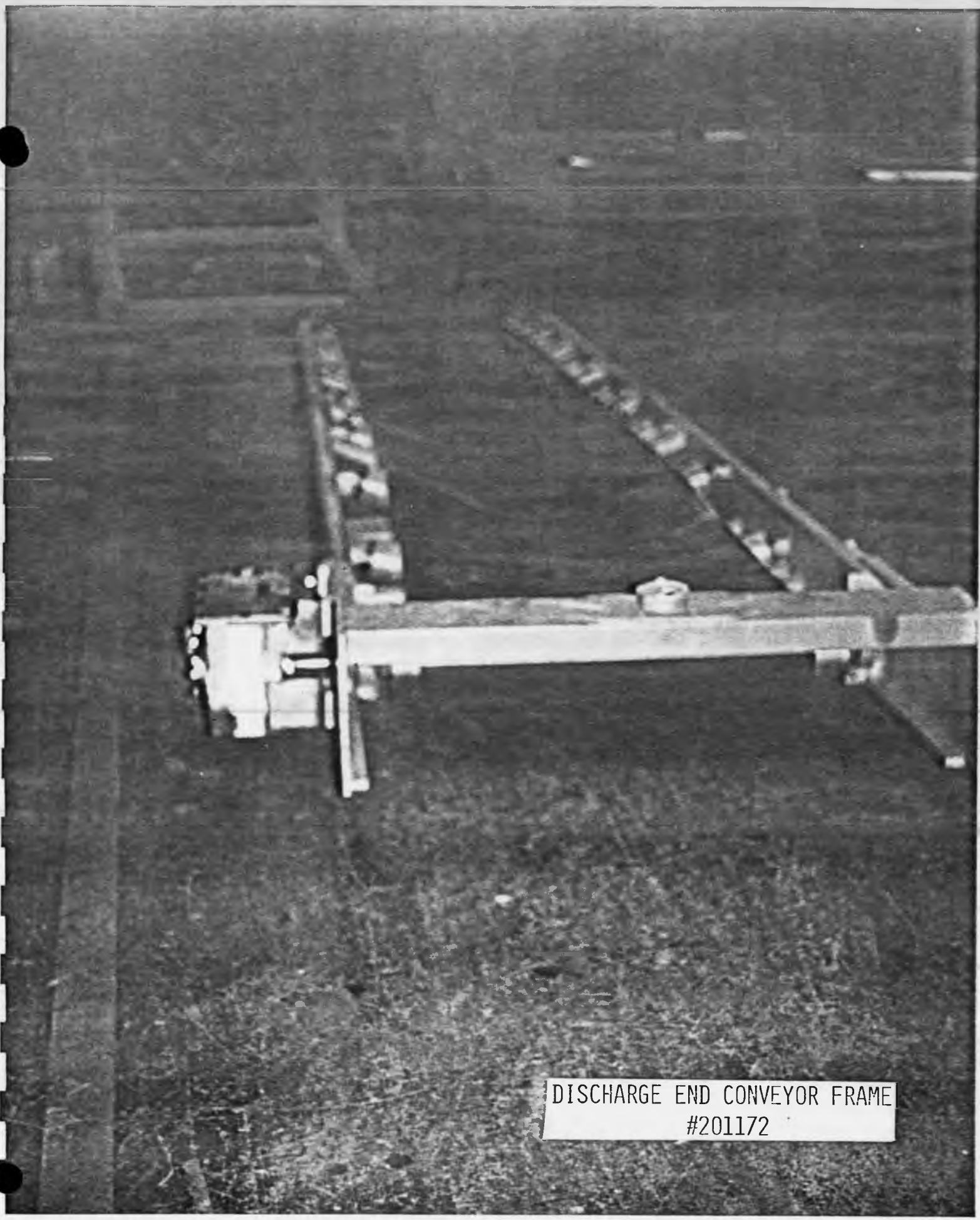


Figure 24

2.2 Conveyor Drive Gear Box

The twelve conveyor drive gear boxes #201174 were fabricated at the Goodman Equipment Corporation plant in Chicago. Design of the box lended itself to be made strictly of plate. The plate size can be used as flat, or could be bent or rolled to a specific form.

When the case is completed per drawing #201174, the case has provisions for a cover, motor mount, bearing retainers and a support structure for mounting to the side plate of conveyor frame.

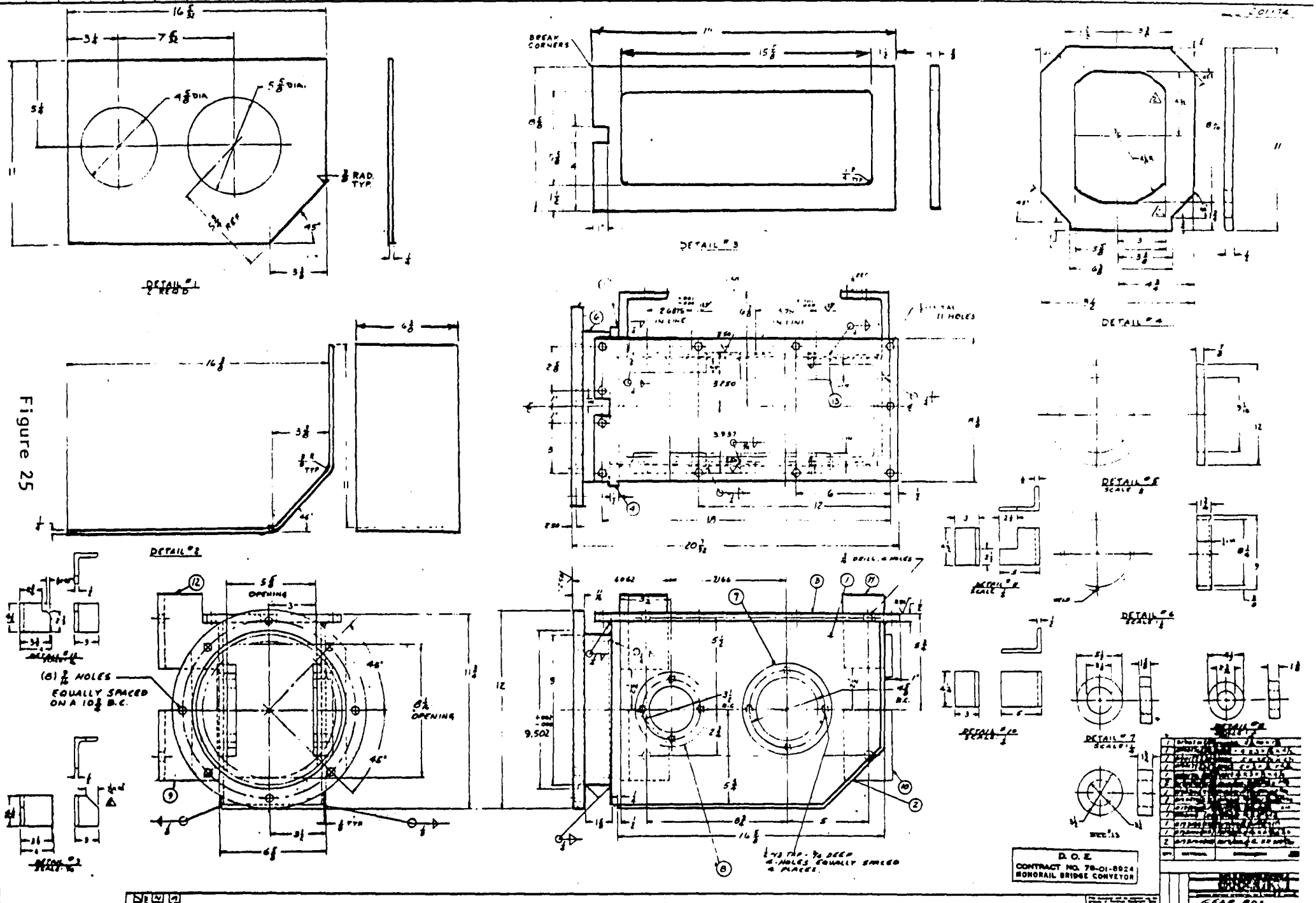
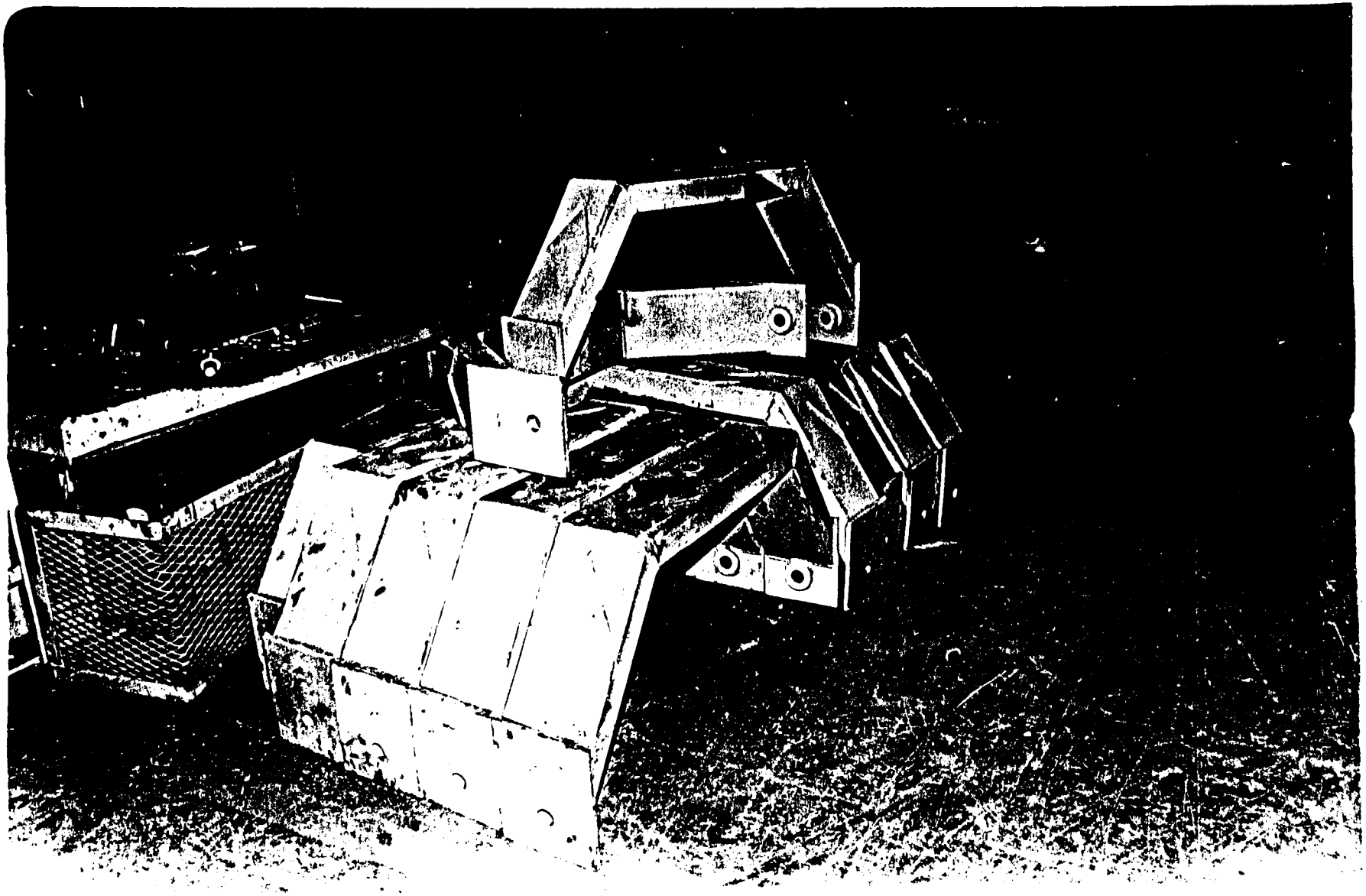

DETAIL "1
DETAIL "3
DETAIL "4
DETAIL "2
DETAIL "5
DETAIL "6
DETAIL "7
D. O. E.
CONTRACT NO. 78-01-8824
MONORAIL BRIDGE CONVEYOR
GEAR BOX

Figure 25

2.3 Suspension System

The eleven suspension frames (Fig. 26) were fabricated at Goodman Conveyor Corporation in Murfreesboro, Tennessee. The weldment consists of 8"x3"x3/16 wall rectangular tubing. In order to gain additional strength in jointing areas of details, additional 1/4 scalloped plates were added. Upon completion of suspension frame per Drawing 306115, Fig. 27 and 27A, it will contain the provisions for mounting to the rail carrier as well as the pivot joint for conveyor frame support. The 306115 suspension frame is supported by Cleveland Crane carrier 2900856-000, Fig. 28. The final design of the suspension system is illustrated on Fig. 29 and Fig. 30, which cover the entire cross-section of all the details involved. The design allows the conveyor units to adequately move and flex through all the required motions and angles, whether in the horizontal or vertical plane.



SUSPENSION FRAMES
#306115

Figure 26

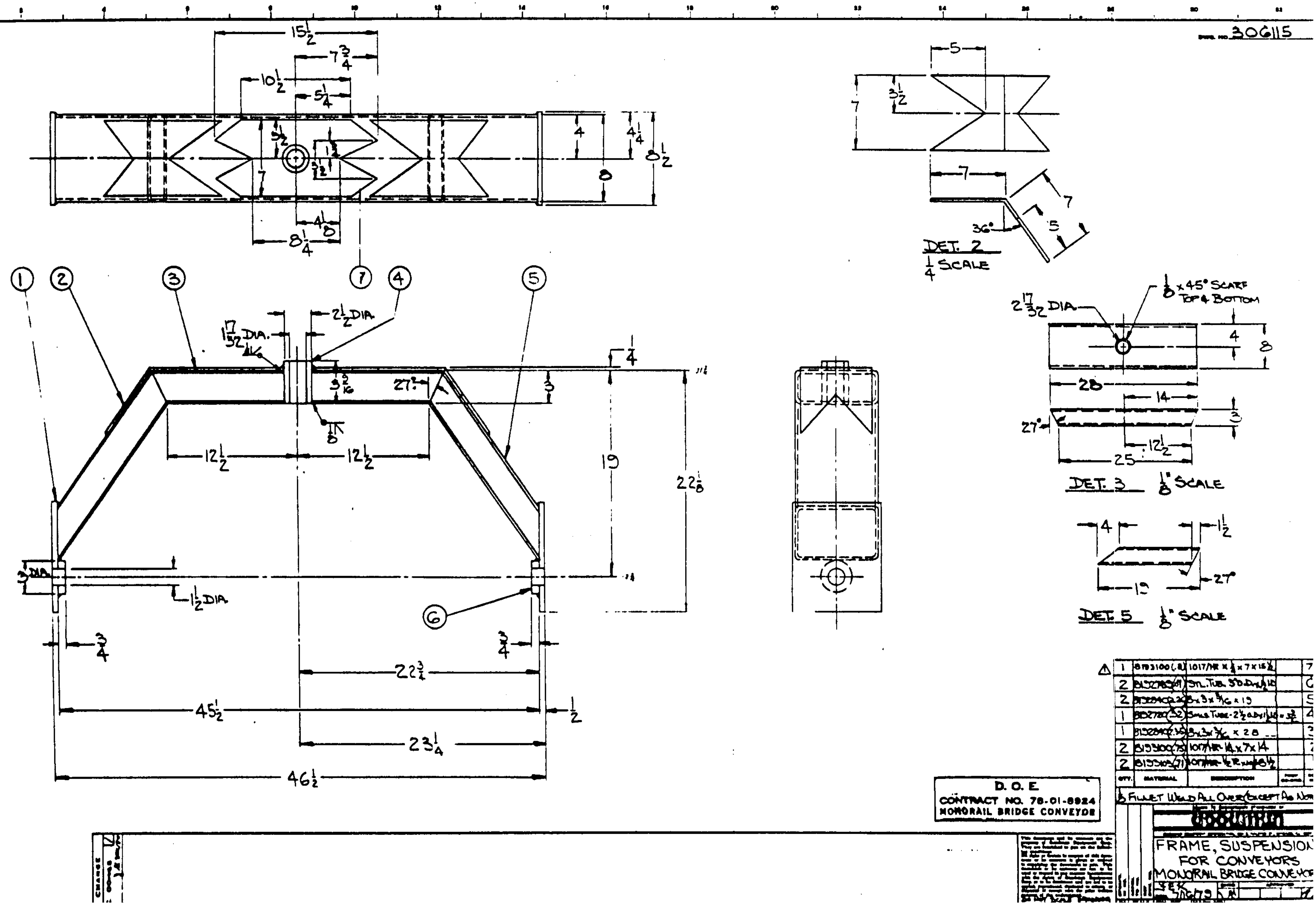

306115
DET. 2
1/4 SCALE
1/8 x 45° SCARF TOP & BOTTOM
2 17/32 DIA.
DET. 3 1/8" SCALE
DET. 5 1/8" SCALE
1 17/32 DIA.
2 1/2 DIA.
3 DIA.
1 1/2 DIA.
D. O. E.
CONTRACT NO. 78-01-8924
MONORAIL BRIDGE CONVEYOR
FILLET WELD ALL OVER (EXCEPT AS NOTED)
FRAME, SUSPENSION
FOR CONVEYORS
MONORAIL BRIDGE CONVEYOR

Figure 27

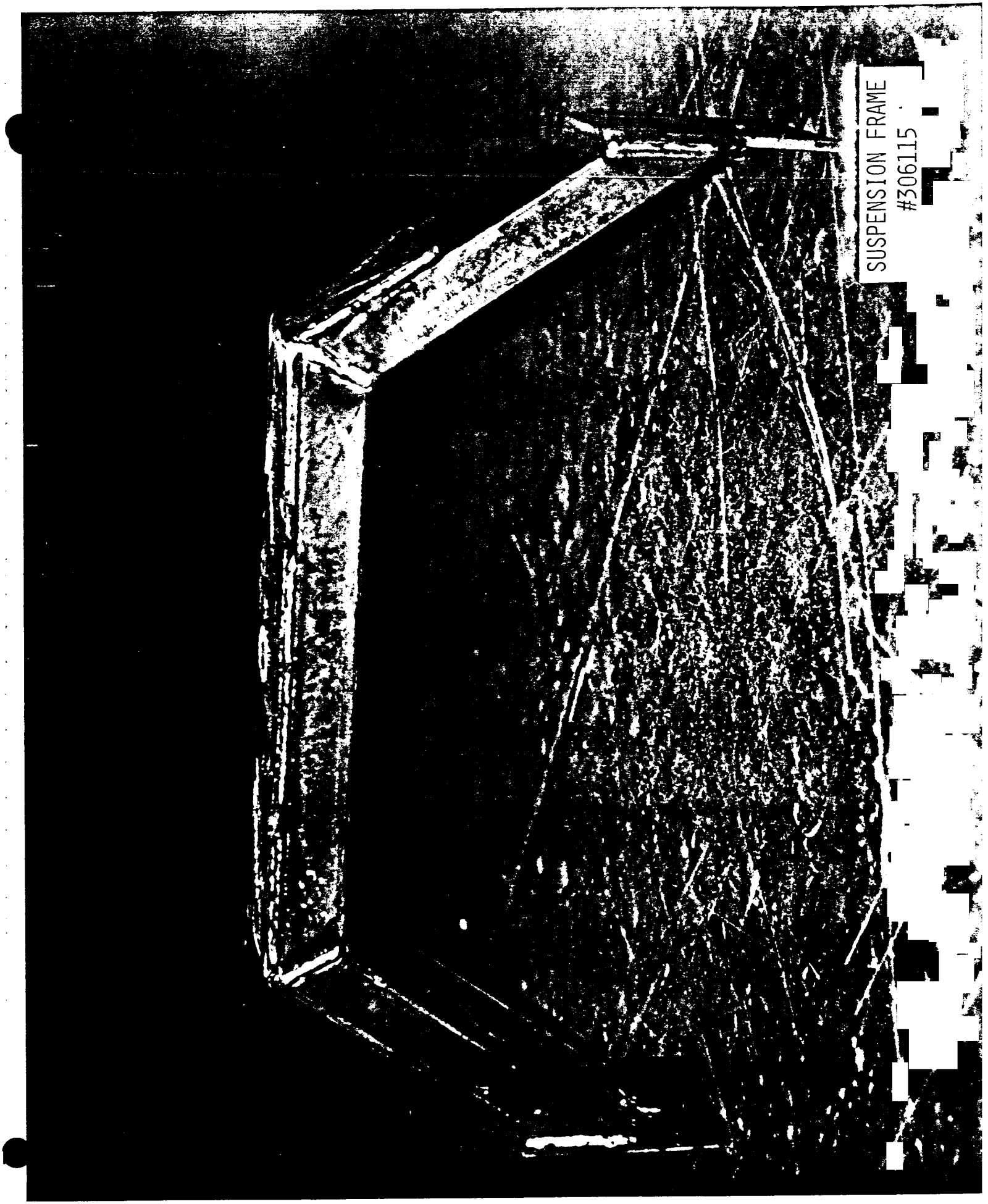


Figure 27A

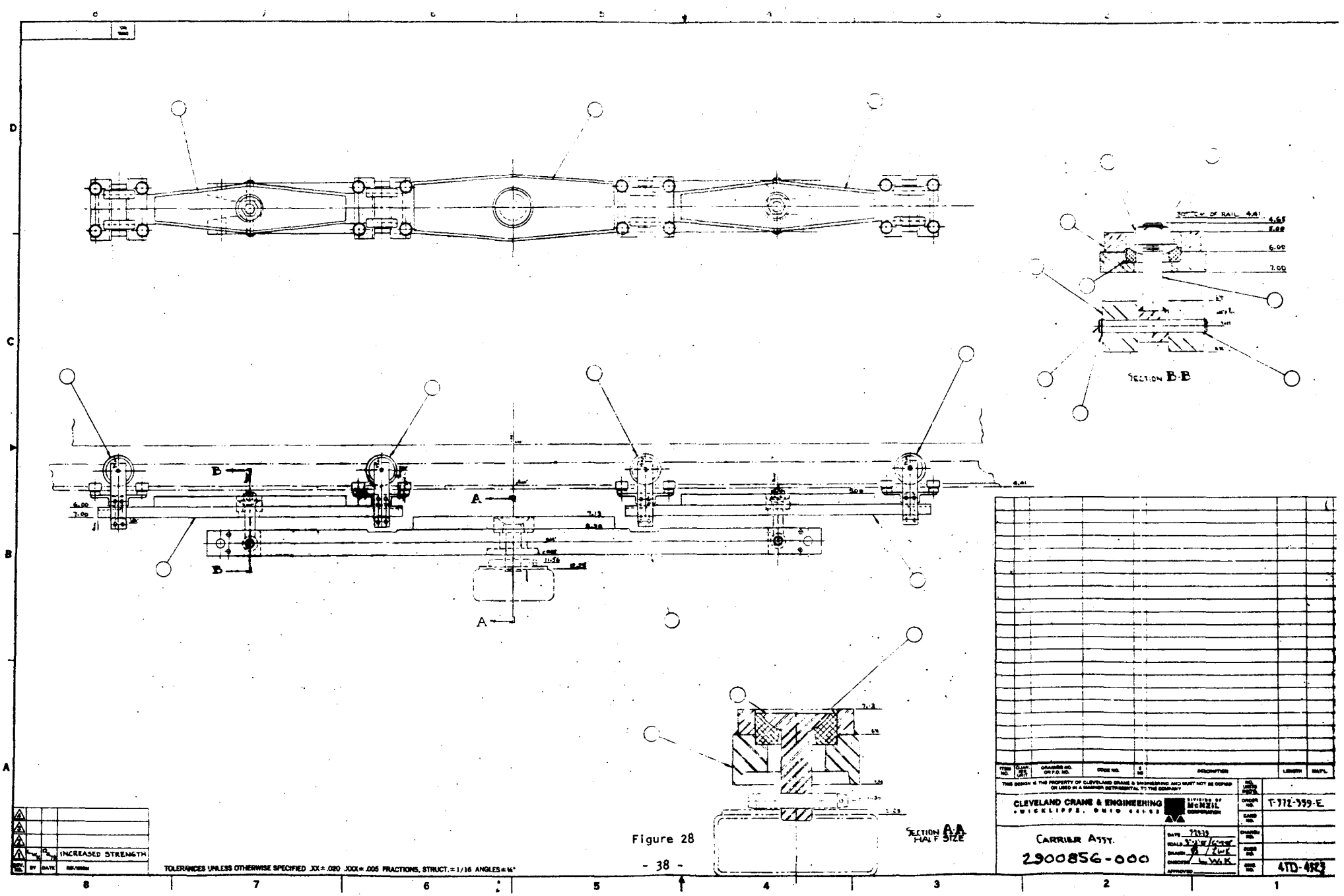

SECTION B-B
SECTION A-A
HALF SIZE
INCREASED STRENGTH
TOLERANCES UNLESS OTHERWISE SPECIFIED .XX ± .020 .XXX ± .005 FRACTIONS, STRUCT. ± 1/16 ANGLES ± ½°
CLEVELAND CRANE & ENGINEERING
WICKLIFFE, OHIO 44092
CARRIER ASSY.
2900856-000
T-772-399-E
4TD-4123

Figure 28

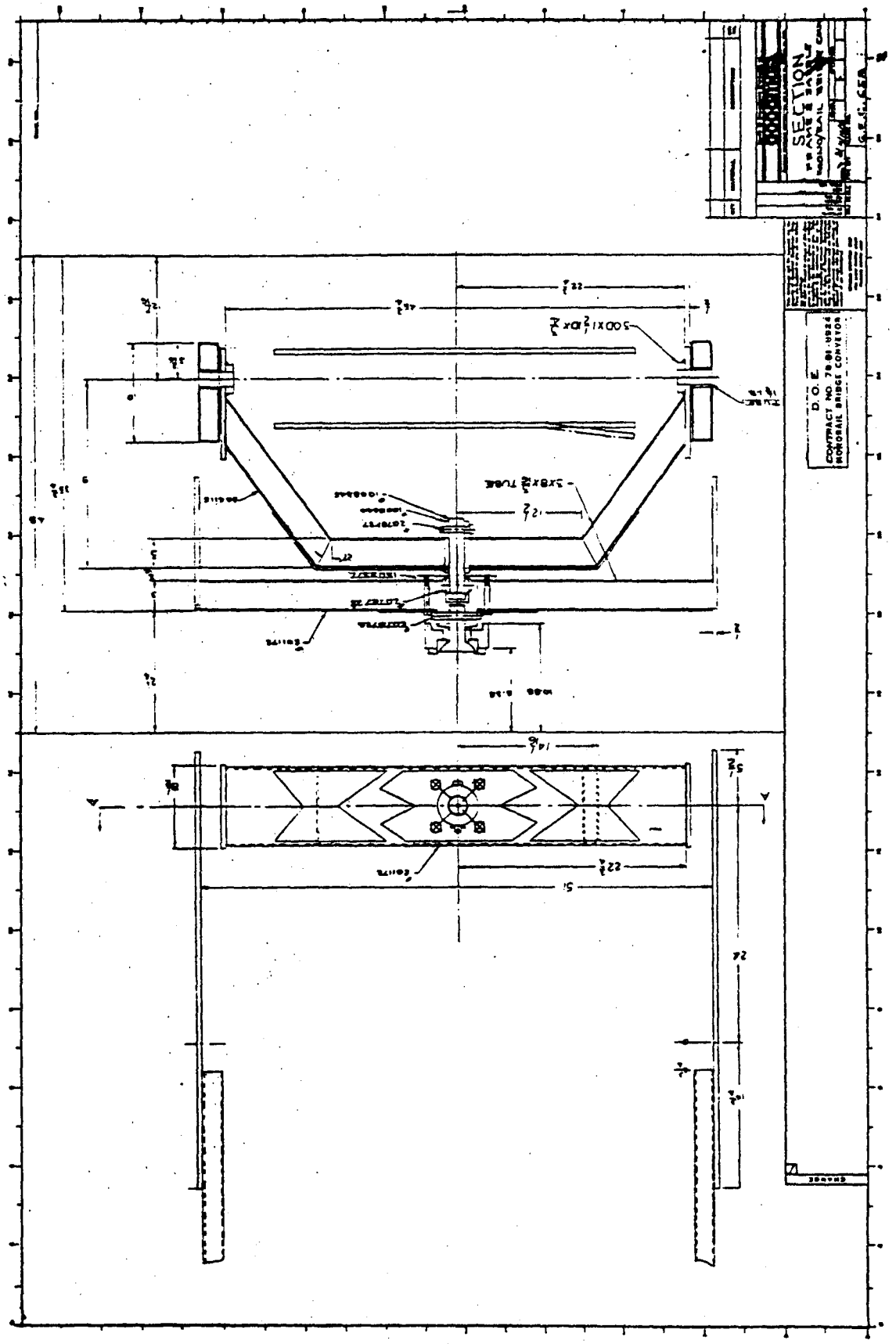
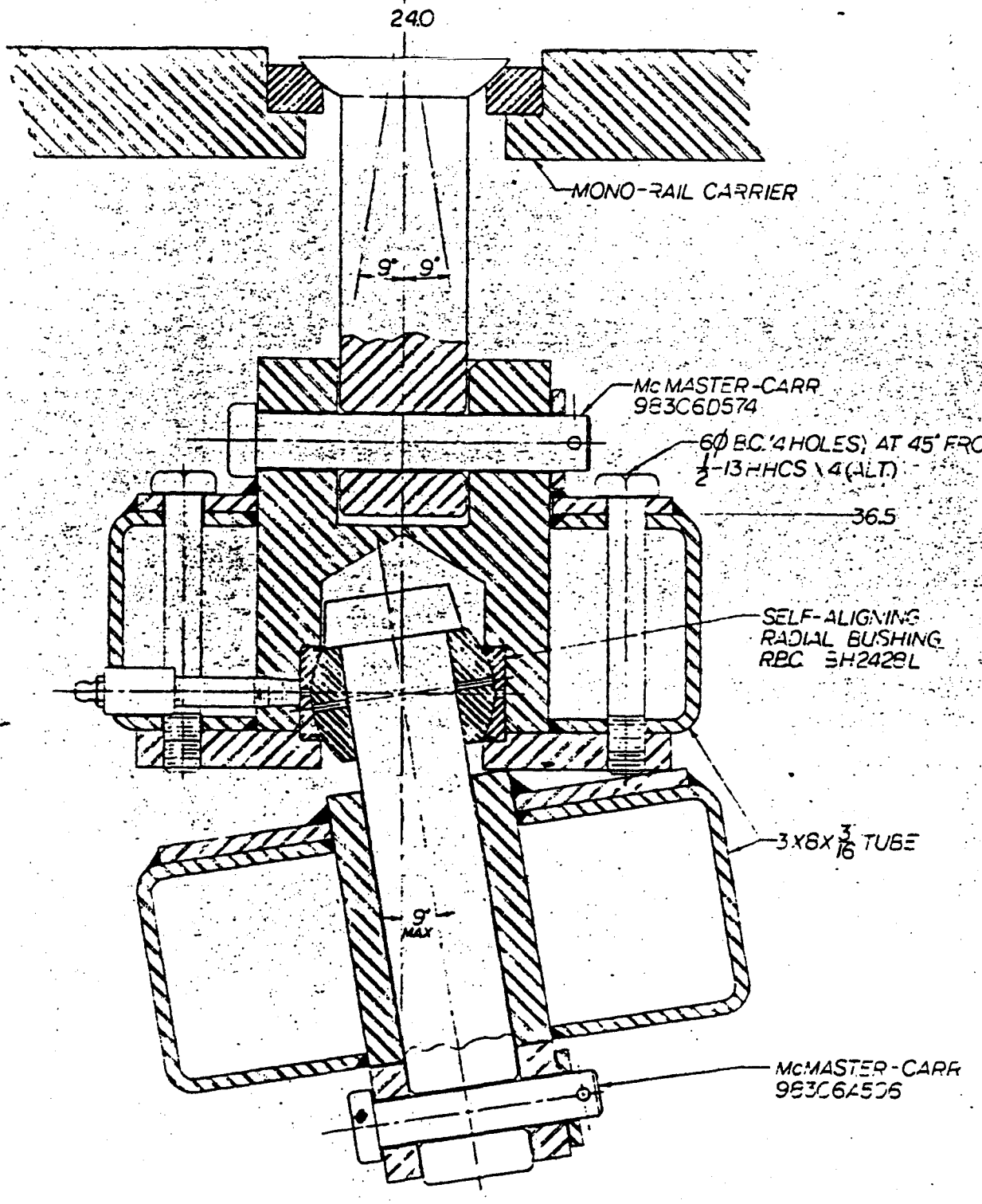


Figure 29

GOODMAN EQUIPMENT CORP
MONO-RAIL
BRIDGE CONVEYOR



SECTION B-B

NES 7/C3/79 A
SCALE : FULL
LAYOUT

Figure 30

2.4 Steering Mechanism

The fork type steering system lent itself best to fet into the system from the standpoint of powering the wheels as well as steering. The two major details of the mechanism are the Wheel Support 306402-000, Fig. 31, and the motor/reducer Bracket 1510248-000, Fig. 32. When the Wheel Support is completed it will contain the mounting holes for motor/reducer, the swivel pin, and the mounting for the pillow block which supports the ball screw and nut.

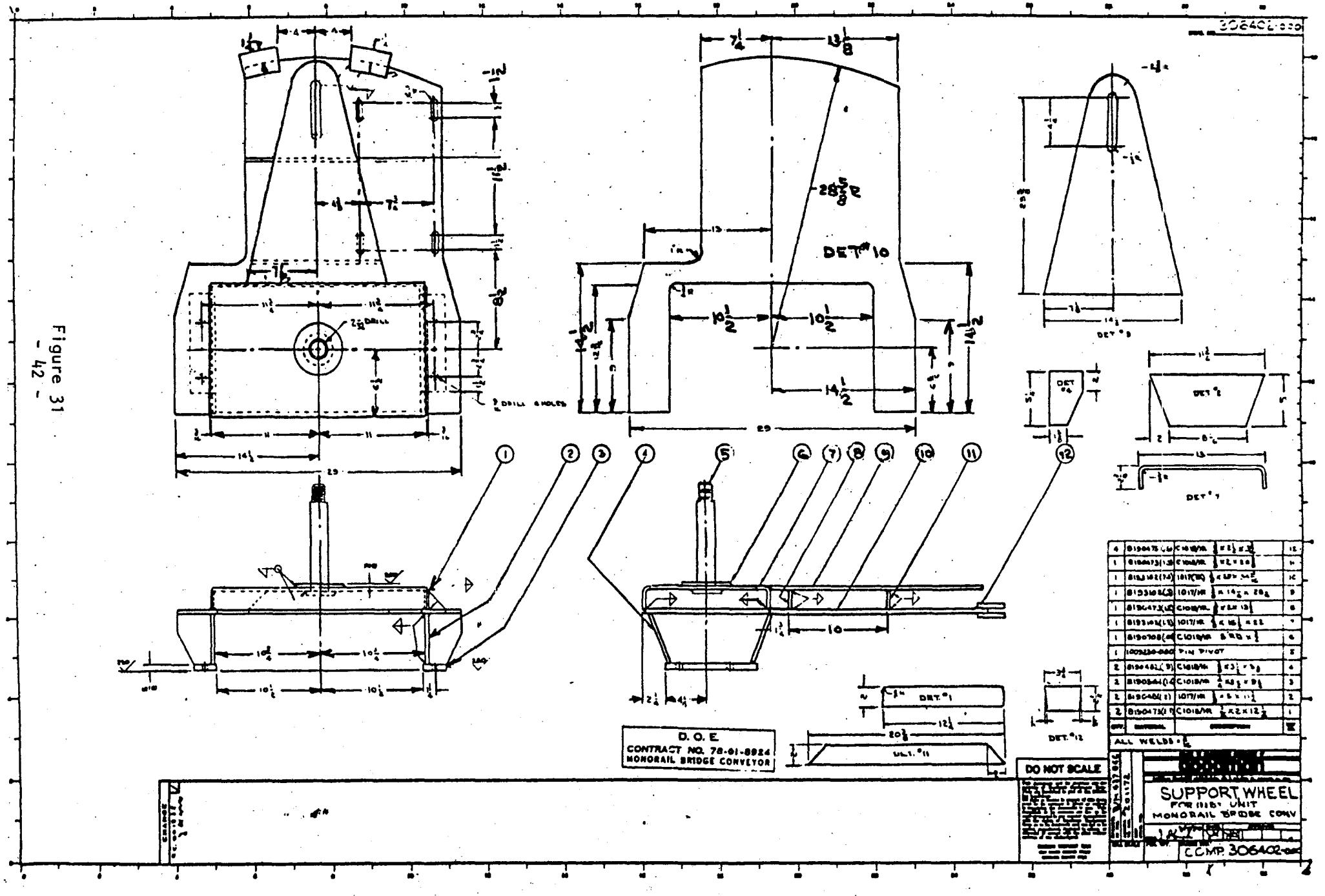
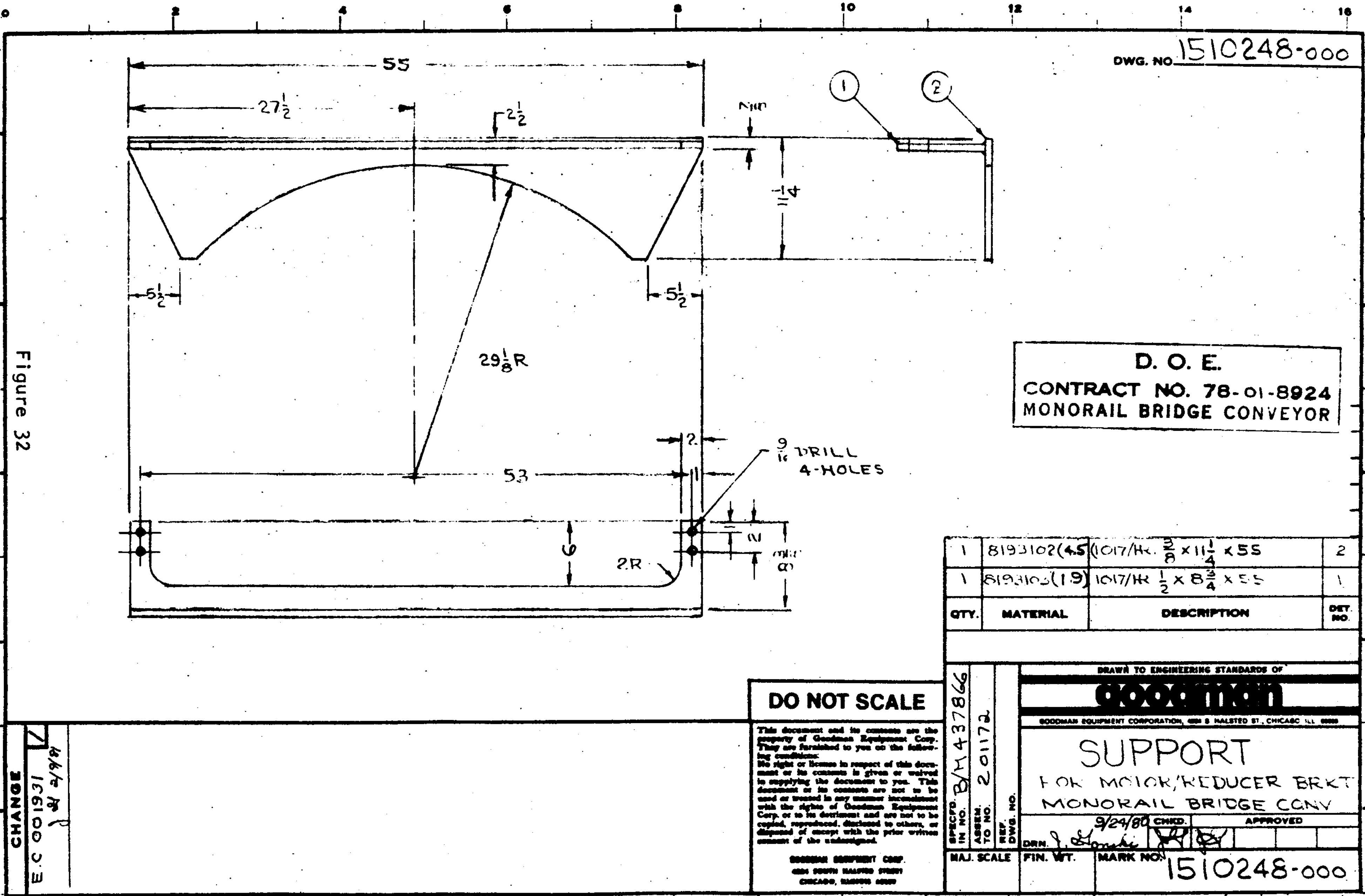

DET. 10
D. O. E.
CONTRACT NO. 78-01-8824
MONORAIL BRIDGE CONVEYOR
DO NOT SCALE
SUPPORT WHEEL
FOR IIIBY UNIT
MONORAIL BRIDGE CONV
COMP 306402

Figure 31
- 42 -



QTY.	MATERIAL	DESCRIPTION	DET. NO.
1	8193102(4.5)	1017/HR. 3/8 x 11 1/4 x 55	2
1	8193103(1.9)	1017/HR 1/2 x 8 3/4 x 55	1

Figure 32

2.5 Electrical Enclosures

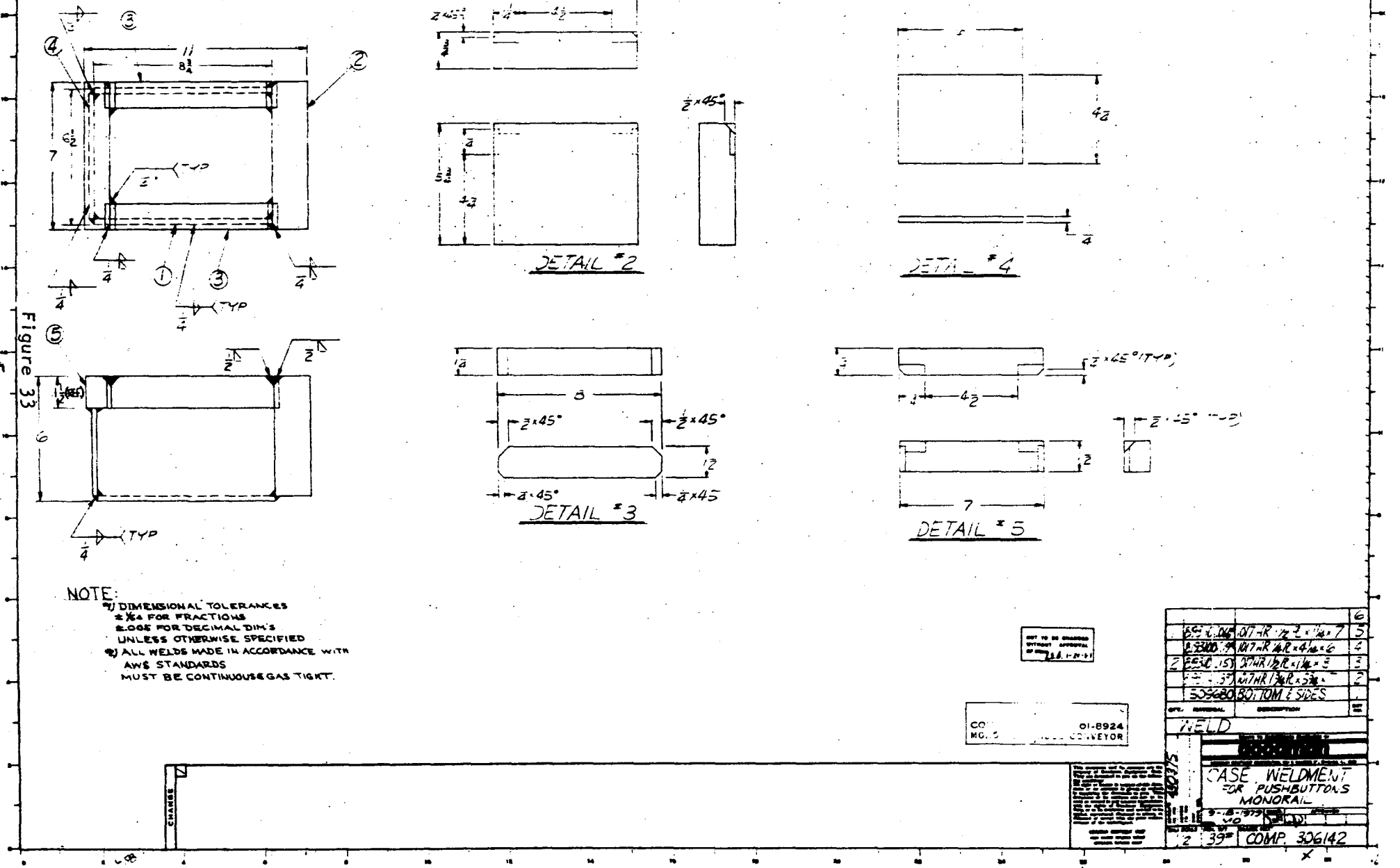
The Monorail Bridge Conveyor system necessitates four electrical enclosures which must be fabricated with the utmost care. Therefore, the fact that Goodman Equipment Corporation has had the experience of manufacturing this type of equipment resulted in the decision that it be built here.

The following enclosures are required and built in Chicago.

1 -	306142 Pushbutton Case (Weldment)	Fig. 33
1 -	306175 Headlight Switch Case (Weldment)	Fig. 34
12 -	201216 Motor Control Case (Weldment)	Fig. 35
1 -	201219 Master Control Case (Weldment)	Fig. 36

When fabrication was completed on each case, it was sent to welding inspection to be magnafluxed, to check for cracks and continuous weld penetration. The fact that the conveyors will be operating at the face with a ripper or borer necessitates completely explosion proof enclosures.

Figure 33


DWG. NO. 306142
DETAIL #2
DETAIL #4
DETAIL #3
DETAIL #5
TYP
NOTE:
1) DIMENSIONAL TOLERANCES
±1/64 FOR FRACTIONS
±.005 FOR DECIMAL DIM'S
UNLESS OTHERWISE SPECIFIED
2) ALL WELDS MADE IN ACCORDANCE WITH
AWS STANDARDS
MUST BE CONTINUOUS&GAS TIGHT.
WELD
CASE WELDMENT
FOR PUSHBUTTONS
MONORAIL
COMP. 306142
CHARGE

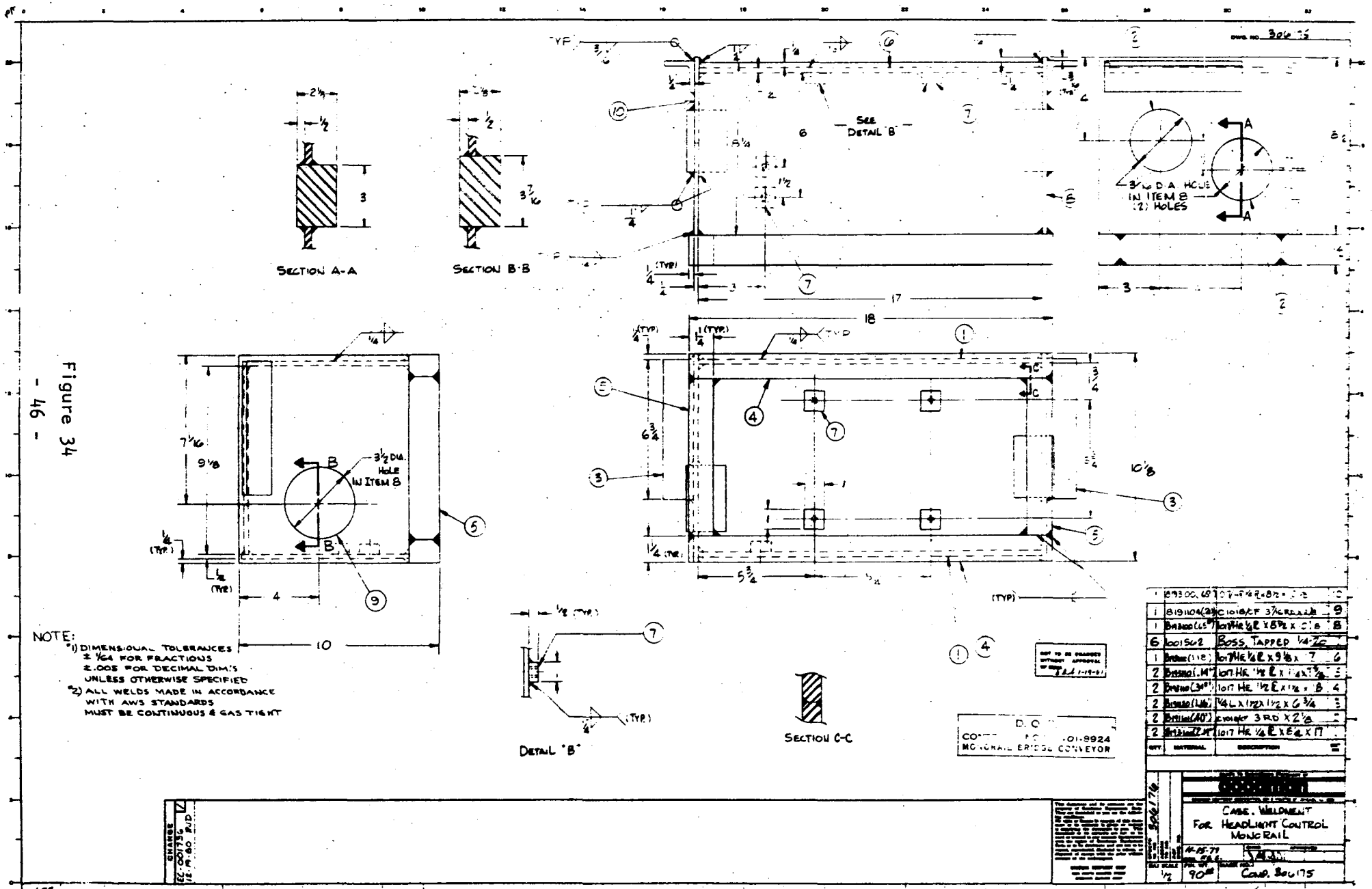

SECTION A-A
SECTION B-B
SEE DETAIL 'B'
3/16 DIA HOLE IN ITEM 8 (2) HOLES
3½ DIA. HOLE IN ITEM 8
DETAIL "B"
SECTION C-C
NOTE:
*1) DIMENSIONAL TOLERANCES
± 1/64 FOR FRACTIOUS
±.005 FOR DECIMAL DIM'S
UNLESS OTHERWISE SPECIFIED
*2) ALL WELDS MADE IN ACCORDANCE WITH AWS STANDARDS
MUST BE CONTINUOUS & GAS TIGHT
CASE, WELDMENT
FOR HEADLIGHT CONTROL
MONORAIL
Cond. 300175

Figure 34

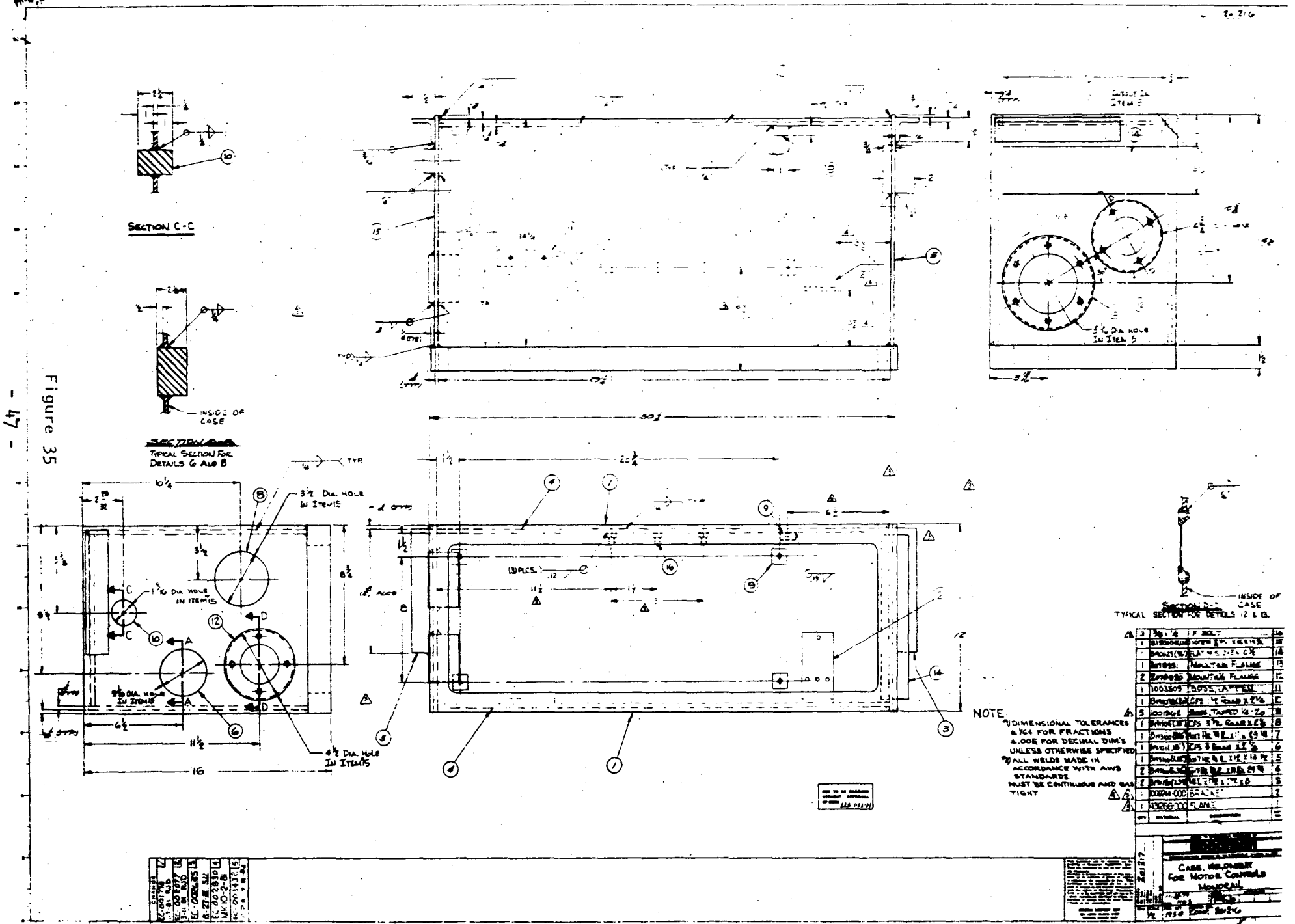

SECTION C-C
INSIDE OF CASE
TYPICAL SECTION FOR DETAILS 6 AND 8
3½ DIA HOLE IN ITEM 5
INSIDE OF CASE
TYPICAL SECTION FOR DETAILS 12 & 13
NOTE
1) DIMENSIONAL TOLERANCES ±1/64 FOR FRACTIONS ±.005 FOR DECIMAL DIM'S UNLESS OTHERWISE SPECIFIED
2) ALL WELDS MADE IN ACCORDANCE WITH AWS STANDARDS MUST BE CONTINUOUS AND GAS TIGHT
CASE, WELDMENT FOR MOTOR CONTROLS MONORAIL

Figure 35

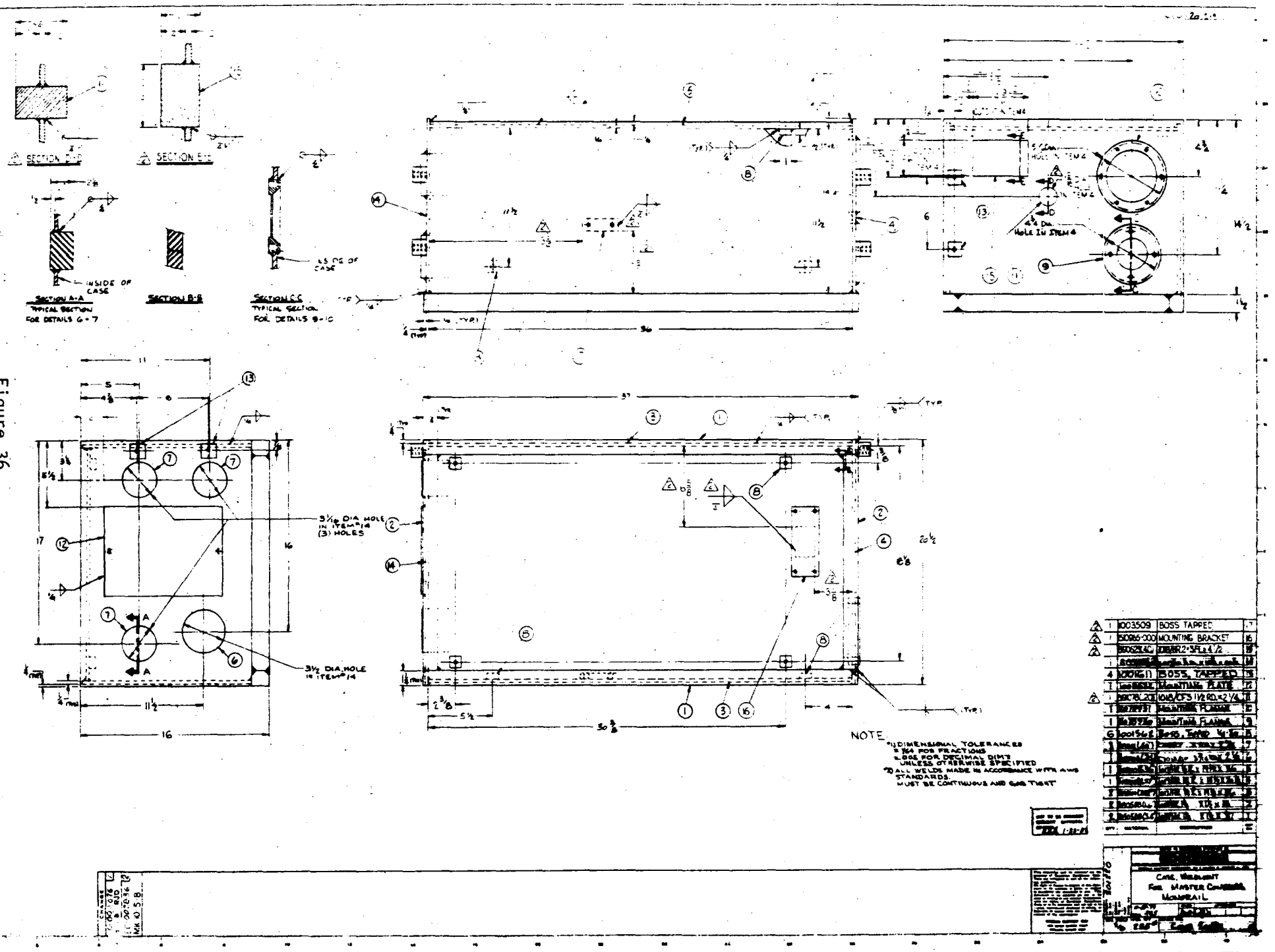

SECTION A-A
TYPICAL SECTION
FOR DETAILS 6-7
SECTION B-B
SECTION C-C
TYPICAL SECTION
FOR DETAILS 9-10
INSIDE OF CASE
NOTE
1. DIMENSIONAL TOLERANCES
± 1/64 FOR FRACTIONS
.005 FOR DECIMAL DIM'S
UNLESS OTHERWISE SPECIFIED
2. ALL WELDS MADE IN ACCORDANCE WITH AWS STANDARDS.
MUST BE CONTINUOUS AND GAS TIGHT

Figure 36

2.6 Conveyor Carrier and Supporting M.B.C. Structure

Cleveland Crane and Engineering, a subcontractor to Goodman Equipment Corporation, has completed the fabrication and assembly of all the contracted equipment.

The following Figures will identify the fabrication completed or being completed in the Cleveland Crane factory.

Figure 37	Carrier Frame
Figure 38	Load Bar Carrier
Figure 39	Curved Track
Figure 40	Straight Track
Figure 41	Roof Plate
Figure 42	Switch Frame

Figure 37

CLEVELAND CRANE
LOAD BAR CARRIER

Figure 38

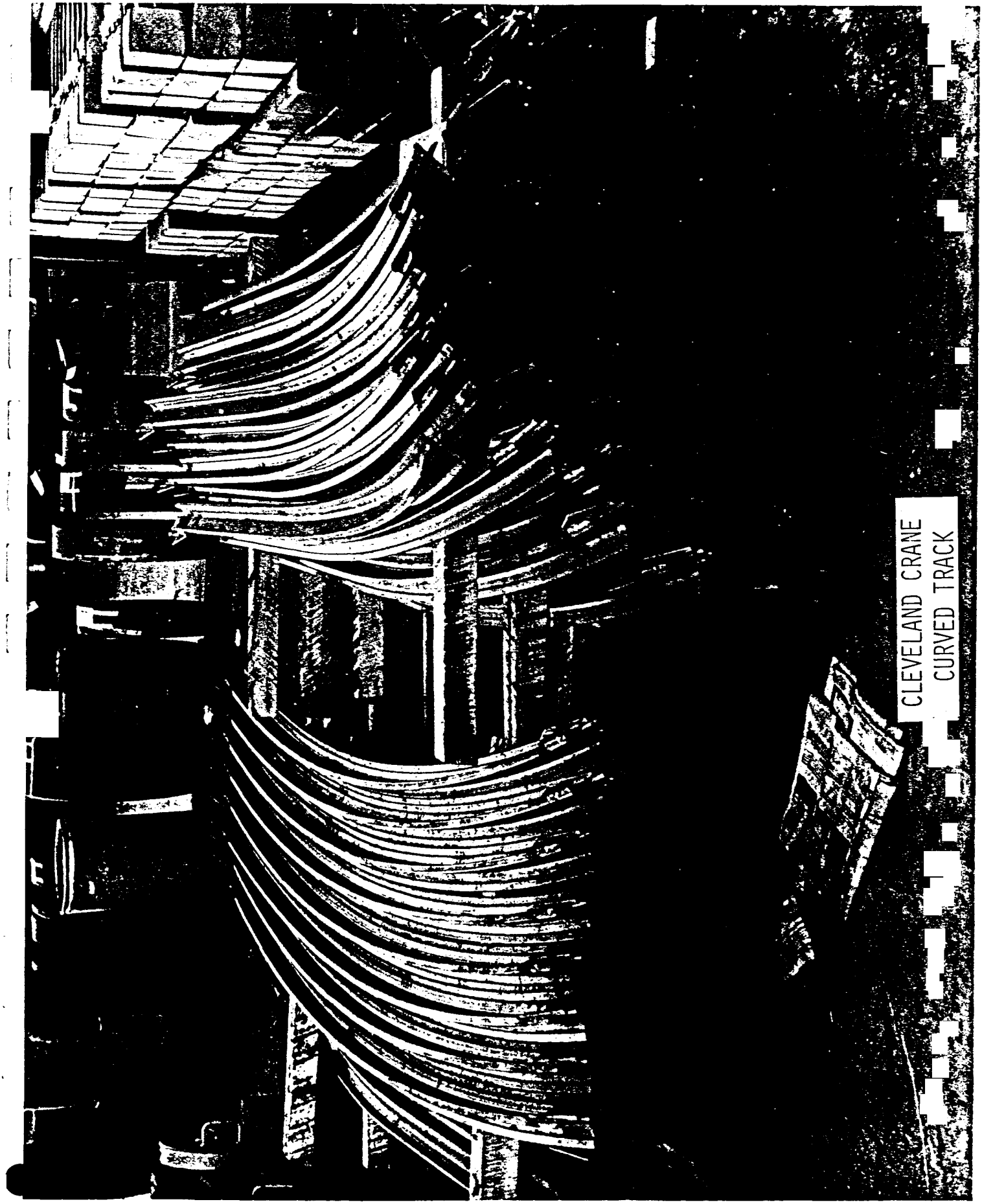


Figure 39

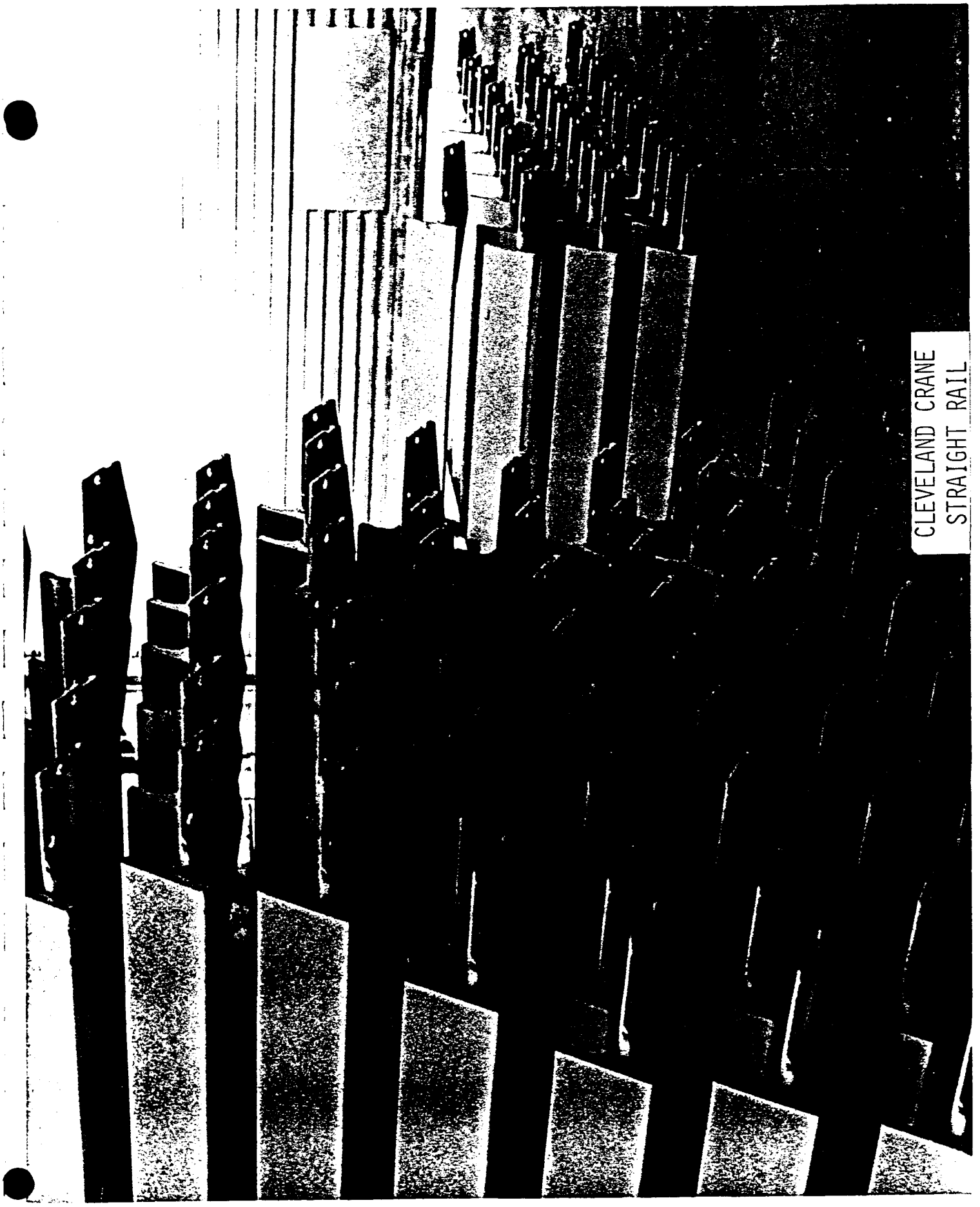


Figure 40

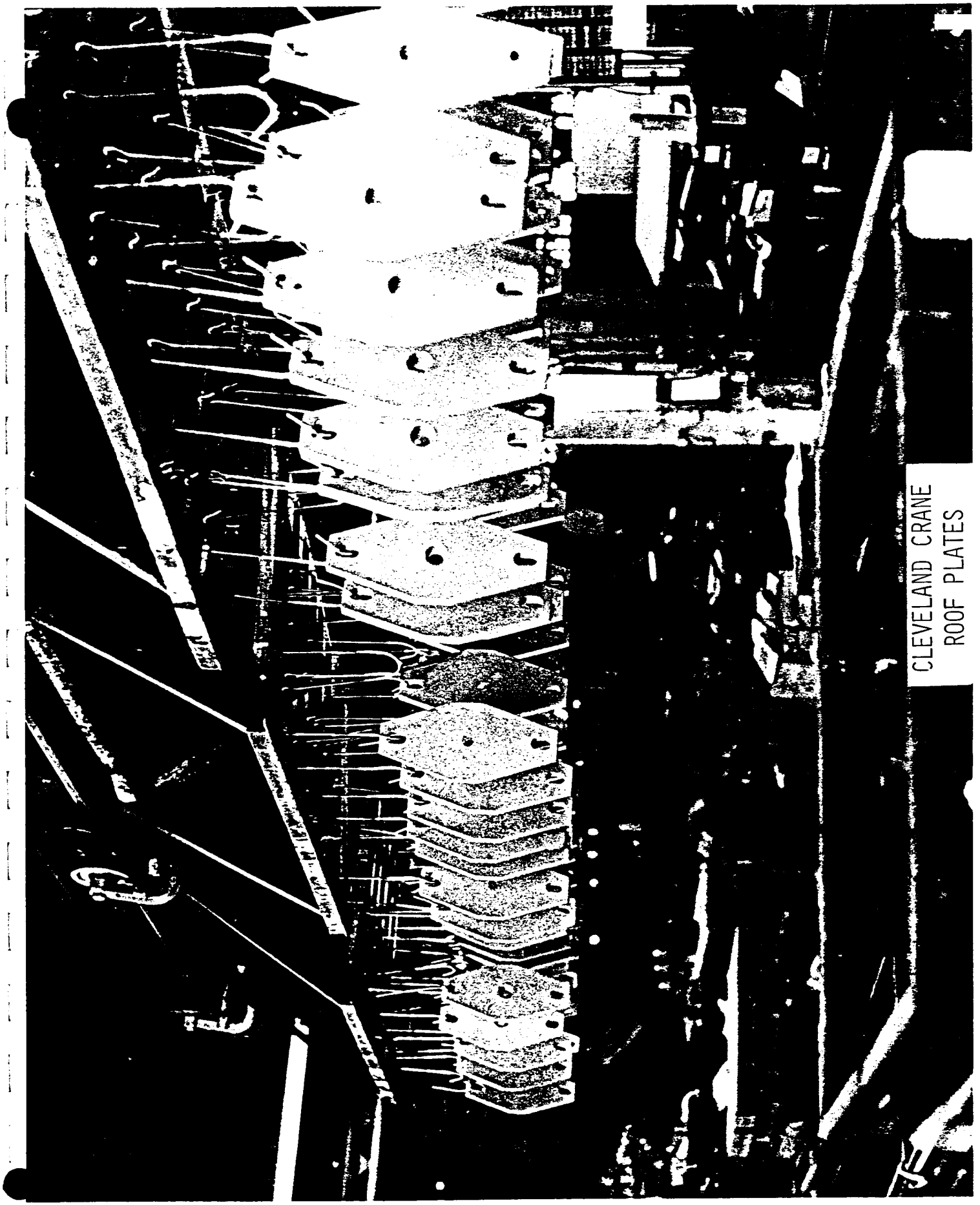


Figure 41

Figure 42

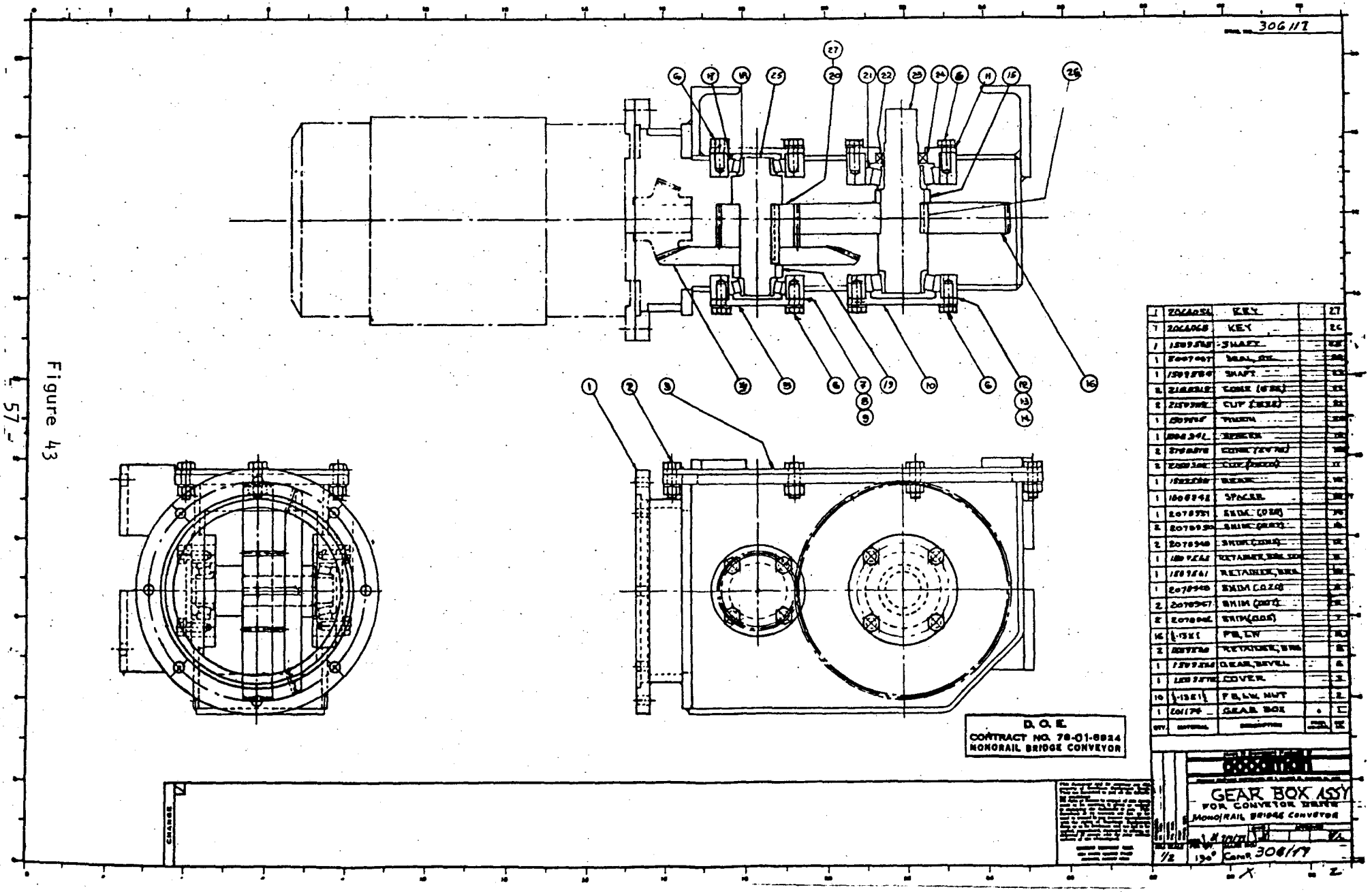
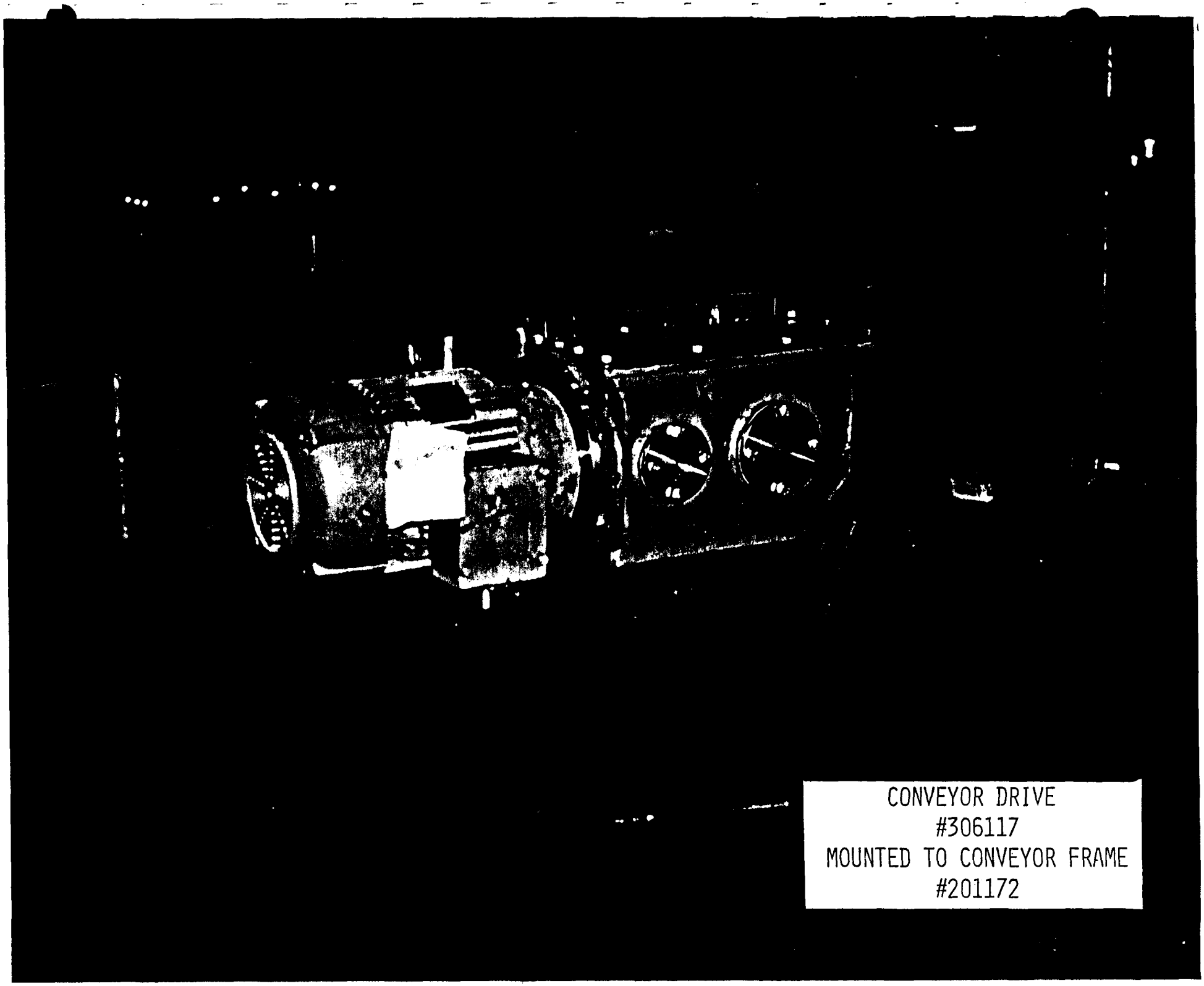

306117
D. O. E.
CONTRACT NO. 78-01-6924
MONORAIL BRIDGE CONVEYOR
GEAR BOX ASSY
FOR CONVEYOR DRIVE
MONORAIL BRIDGE CONVEYOR
1/2
130°
306117

Figure 43



CONVEYOR DRIVE
#306117
MOUNTED TO CONVEYOR FRAME
#201172

Figure 43A

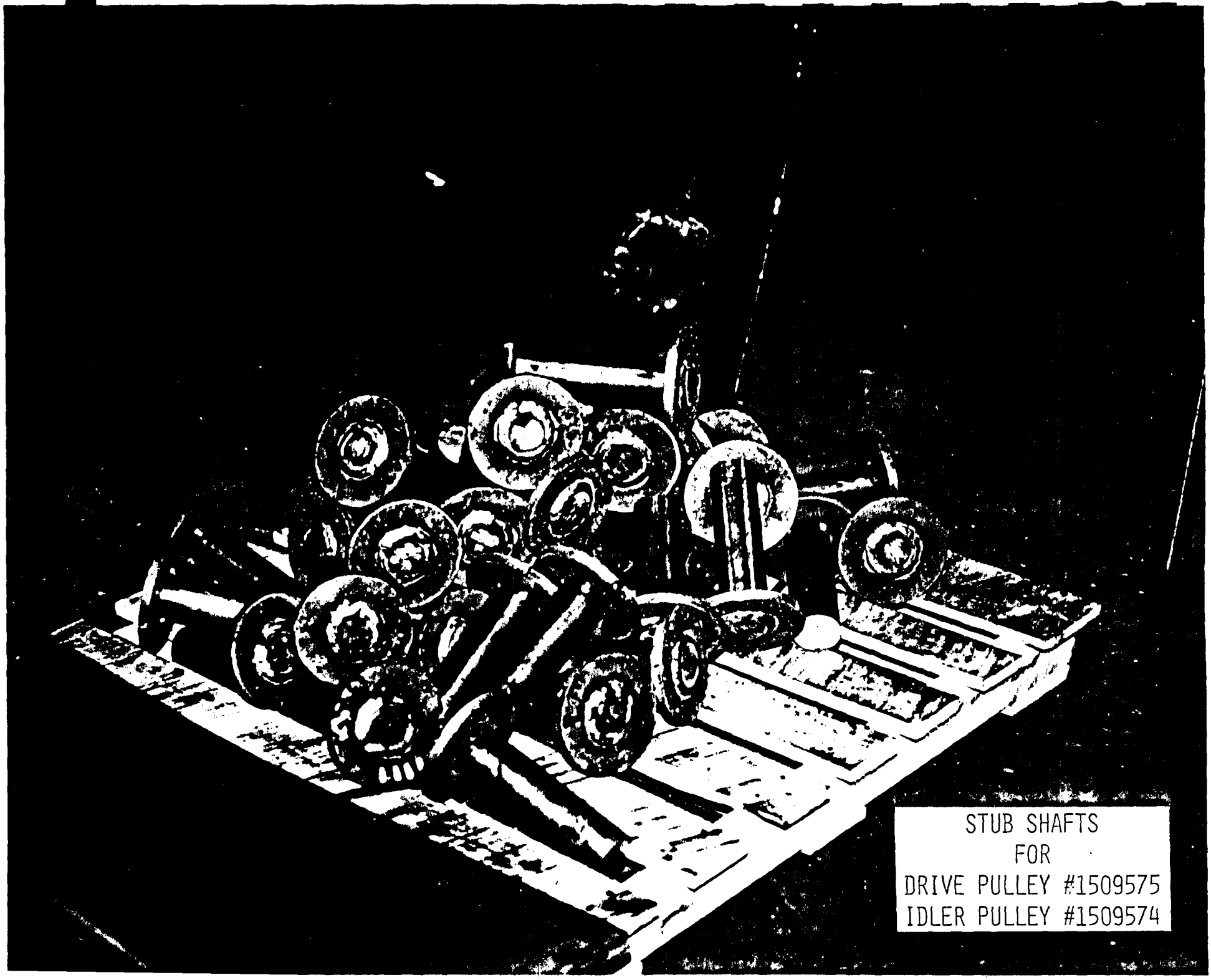


Figure 44

Figure 45

3.2 Electrical Components

The electrical system is modular in design and consists of the following:

12 - 201218	Motor Control Cases	Fig. 47
1 - 201221	Master Control Case	Fig. 48 - 48A
1 - 306143	Pushbutton Control Case	Fig. 49
1 - 306177	Headlight Control Switch	Fig. 50

The twelve motor control cases are identical and control power input. They also direct and control power to the following:

1. Tram drive motors and brakes for inby conveyor and carrier drives.
2. Conveyor drives/manual and sequential.
3. Headlight switch to inby lights.
4. Pendant switch is for starting and stopping conveyor tram drives.

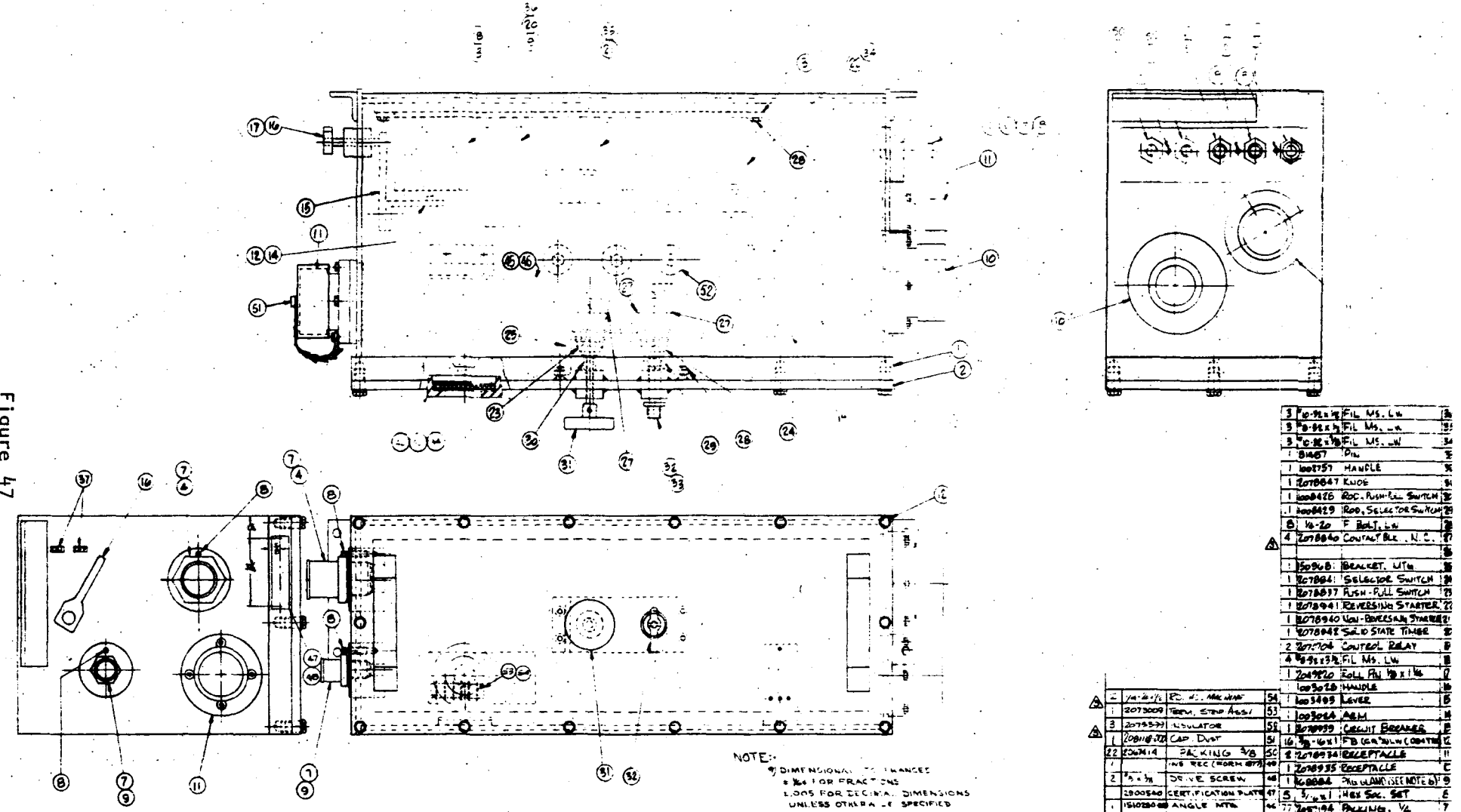


Figure 47

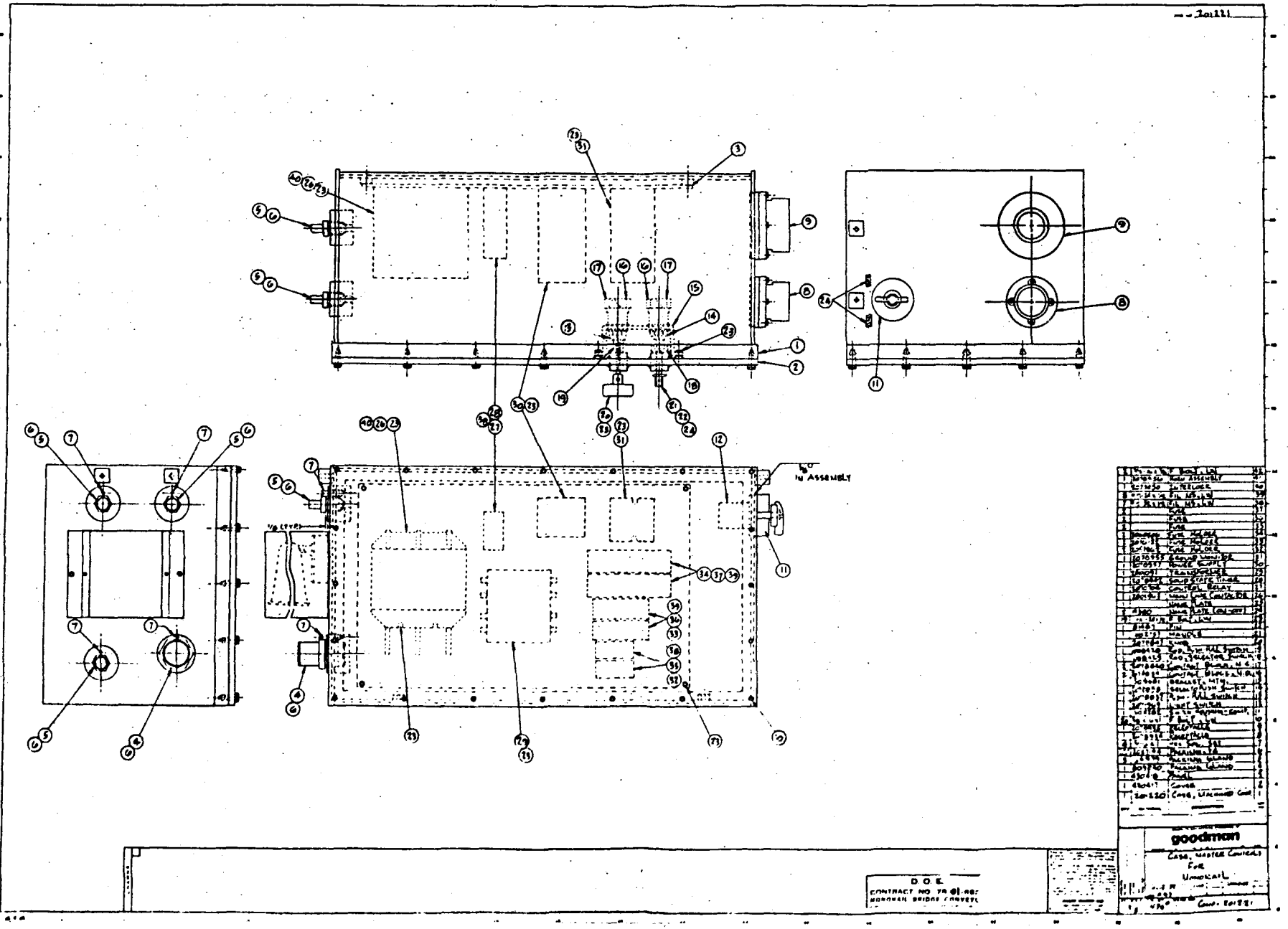
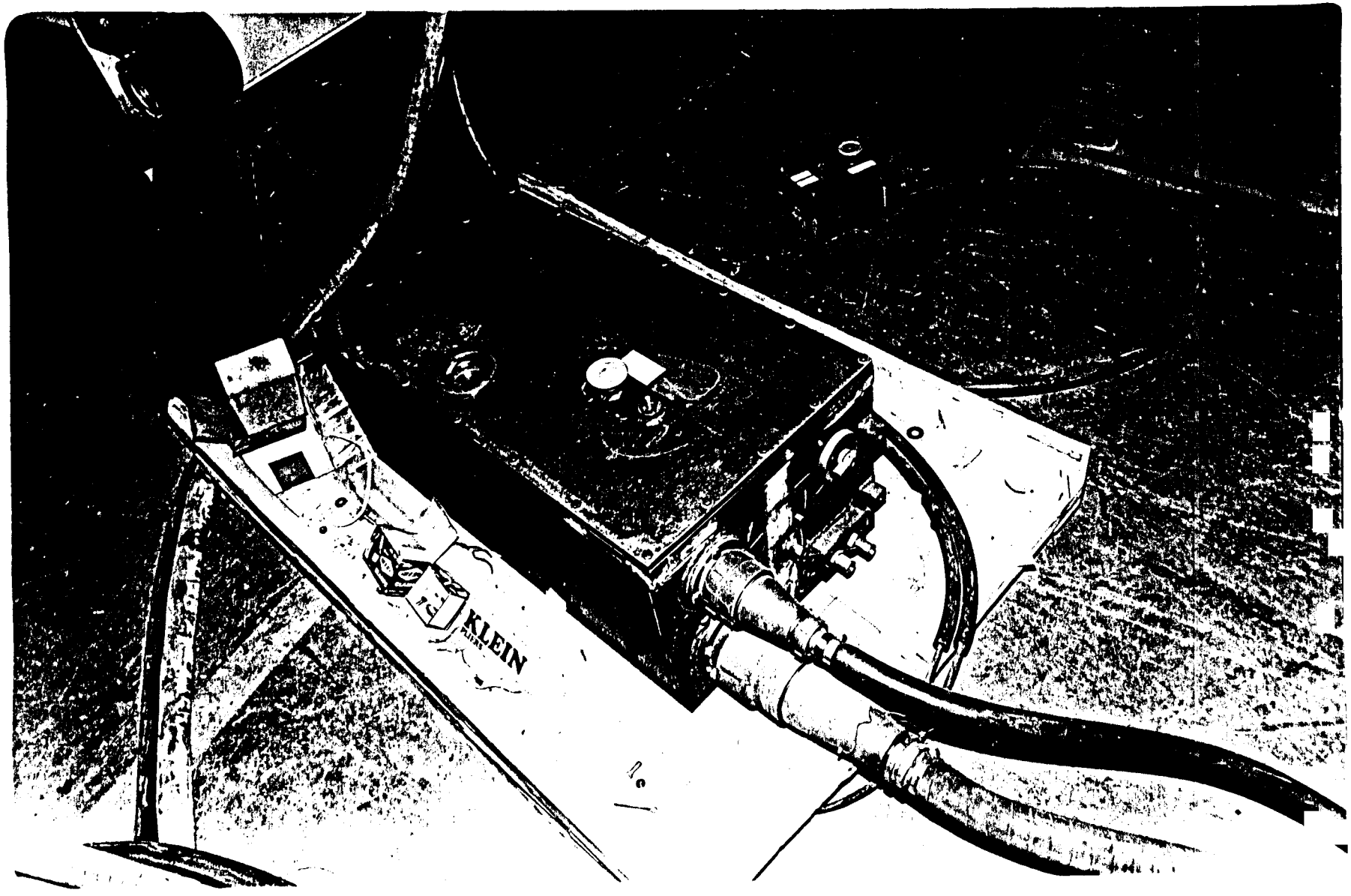
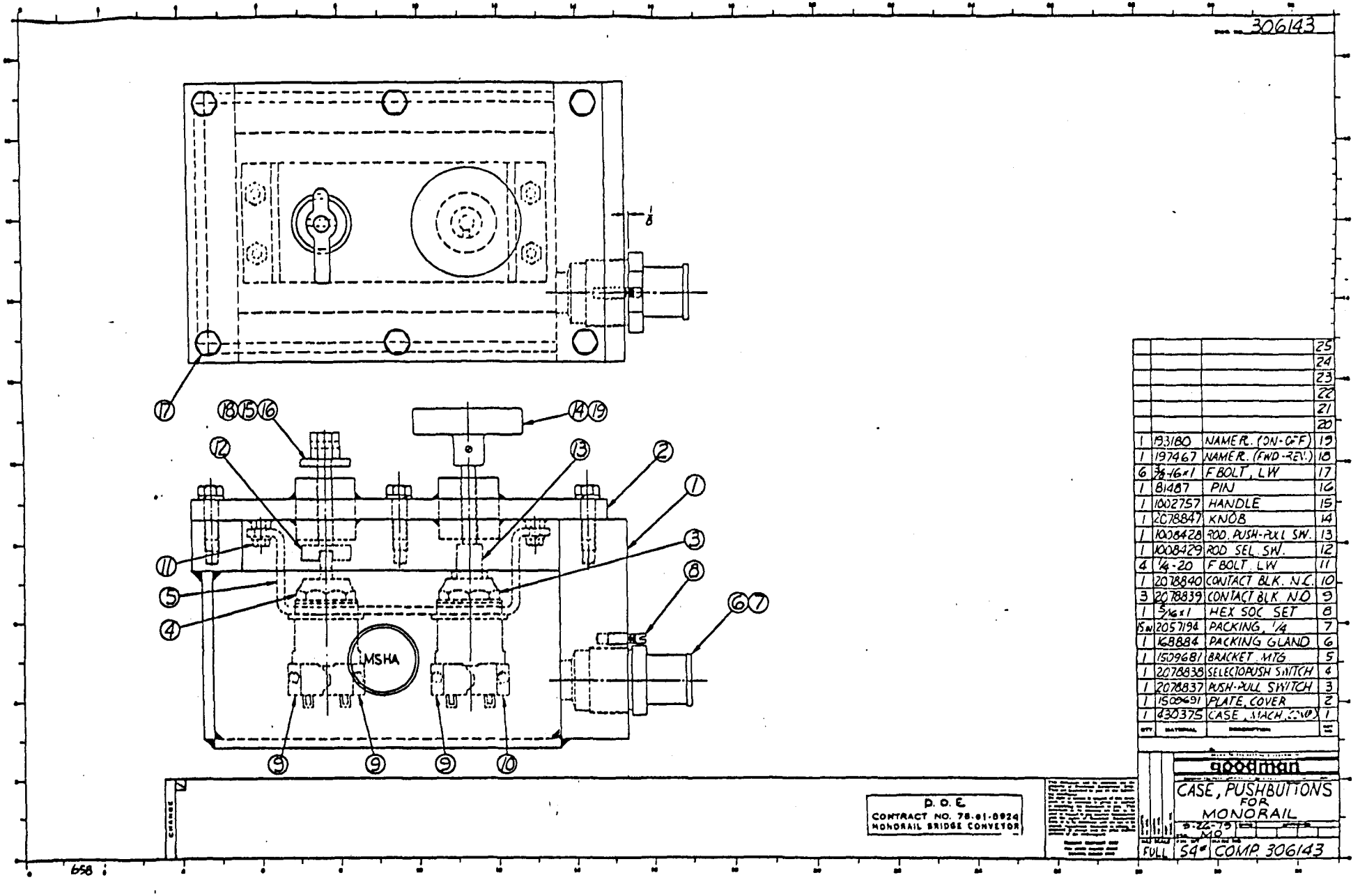


Figure 48



MASTER CONTROL CASE
#201221

Figure 48A



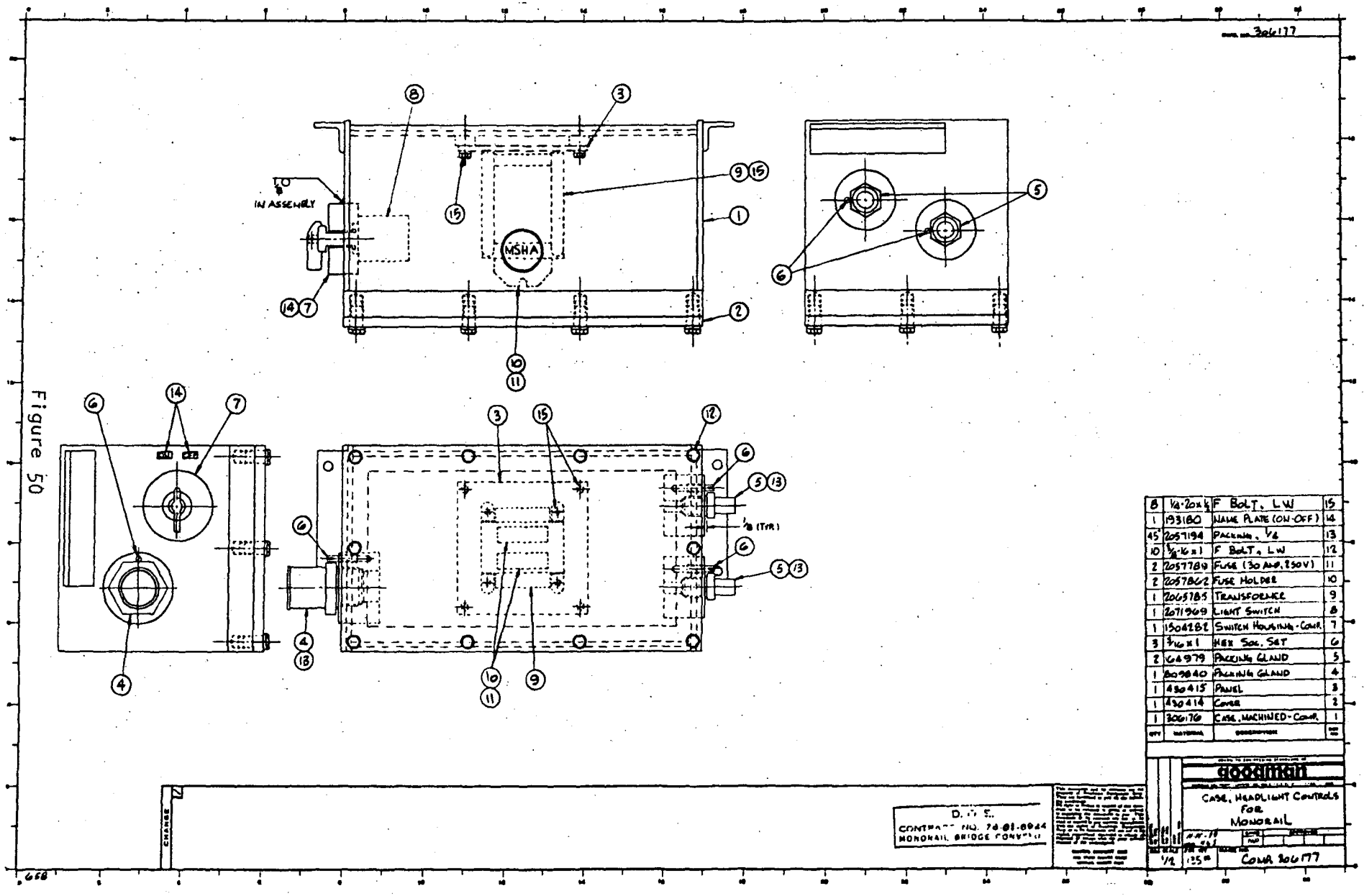
			25
			24
			23
			22
			21
			20
1	193180	NAMER. (ON-OFF)	19
1	197467	NAMER. (FWD-REV.)	18
6	3/8-16x1	F BOLT, LW	17
1	81487	PIN	16
1	1002757	HANDLE	15
1	2078847	KNOB	14
1	1008428	ROD, PUSH-PULL SW.	13
1	1008429	ROD SEL. SW.	12
4	1/4-20	F BOLT, LW	11
1	2078840	CONTACT BLK. N.C.	10
3	2078839	CONTACT BLK. N.O.	9
1	5/16x1	HEX SOC. SET	8
5IN	2057194	PACKING, 1/4	7
1	168884	PACKING GLAND	6
1	1509681	BRACKET, MTG.	5
1	2078838	SELECTOPUSH SWITCH	4
1	2078837	PUSH-PULL SWITCH	3
1	1500491	PLATE, COVER	2
1	430375	CASE, STACH. [illegible]	1
QTY	MATERIAL	DESCRIPTION	ITEM

goodman

9-24-79 MB

FULL 54" COMP 306143

Figure 49



8	1/4-20x1/2	F BOLT, LW	15
1	193180	NAME PLATE (ON-OFF)	14
45	2057194	PACKING, 1/8	13
10	1/4-16x1	F BOLT, LW	12
2	2057784	FUSE (30 AMP, 250V)	11
2	2057862	FUSE HOLDER	10
1	2065785	TRANSFORMER	9
1	2071969	LIGHT SWITCH	8
1	150428E	SWITCH HOUSING-COVR.	7
3	3/16x1	HEX SOC. SET	6
2	64979	PACKING GLAND	5
1	809840	PACKING GLAND	4
1	430415	PANEL	3
1	430416	COVER	2
1	306176	CASE, MACHINED-COVR.	1
QTY	MATERIAL	DESCRIPTION	ITEM

Figure 50

3.3 Carrier and Tram Drive

Cleveland Crane and Engineering is supplying the following:

11 - 2900856-000 Carriers - Figure 51

These units contain eight rollers which ride the rail. They also contain the suspension structure to which the saddle frame attaches and in turn supports the conveyor frame.

13 - 2900857-000 Tractor Assemblies - Figure 52

These drives provide the tractive effort for the inby conveyor as well as the track carriers. These assemblies are made up of 1½ HP single speed reversing, across the line Reliance motors, a reducer which is a standard Cleveland Crane unit and a Dings electric brake which sets when conveyor is stationary and released upon activating tram control.

The braking system was designed to hold on grades of 6½% and automatically set when drive is shut off. The brake is mounted on the rear of the tractor motor and is electrically released, and it does fulfill all the MSHA requirements.

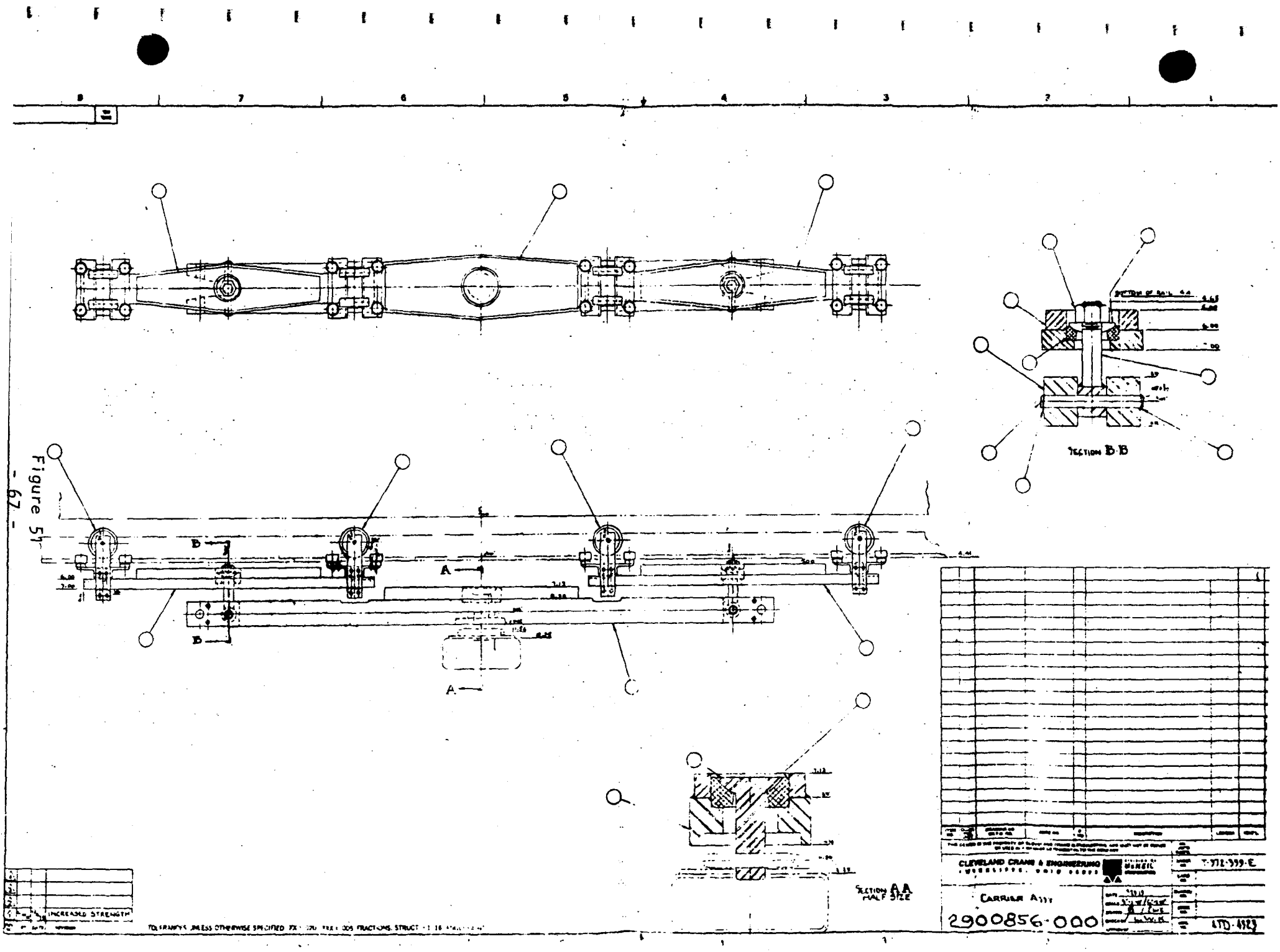

SECTION B-B
SECTION A-A
HALF SIZE
CLEVELAND CRANE & ENGINEERING
CARRIER ASSY
2900856-000

Figure 51

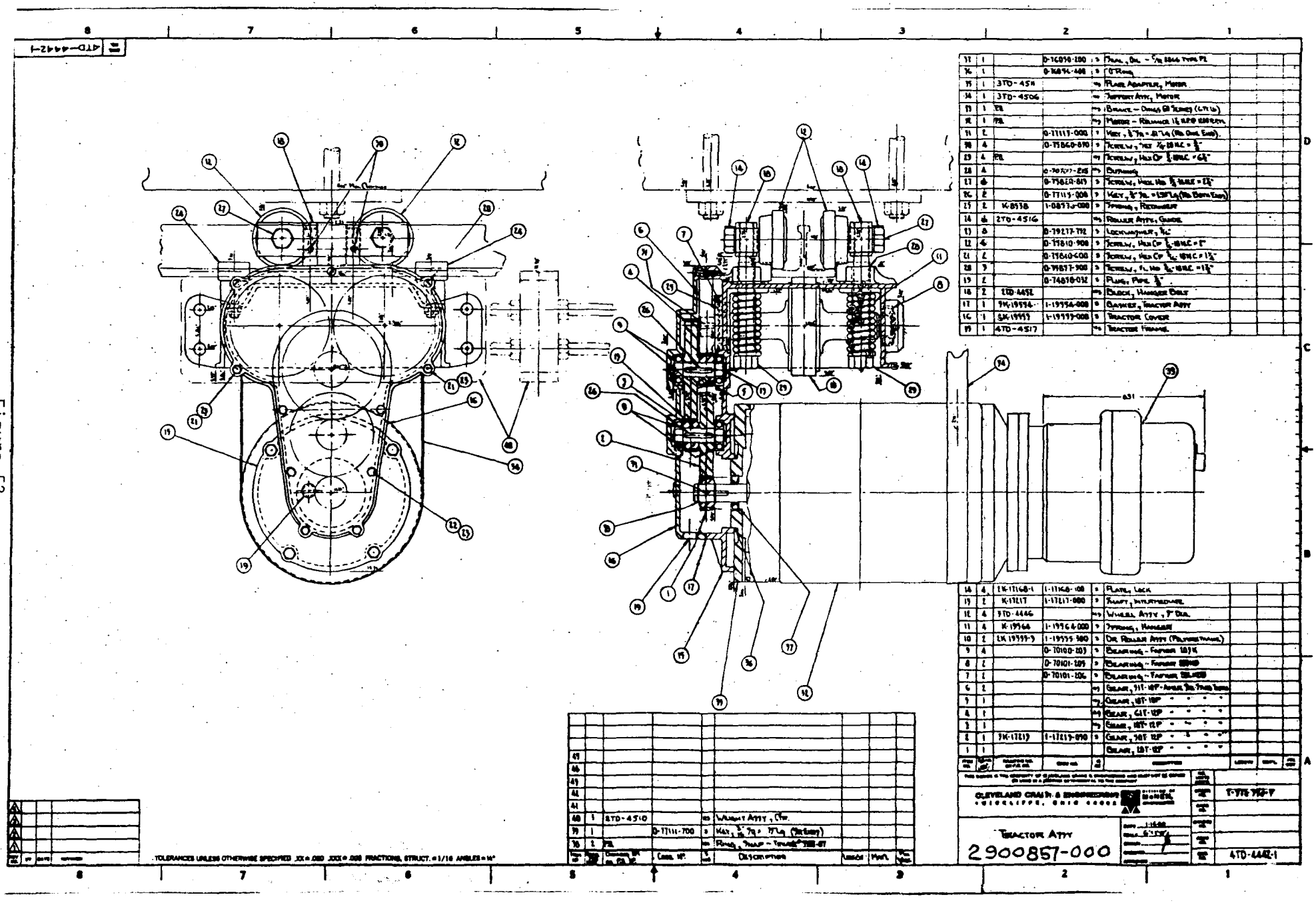


Figure 52

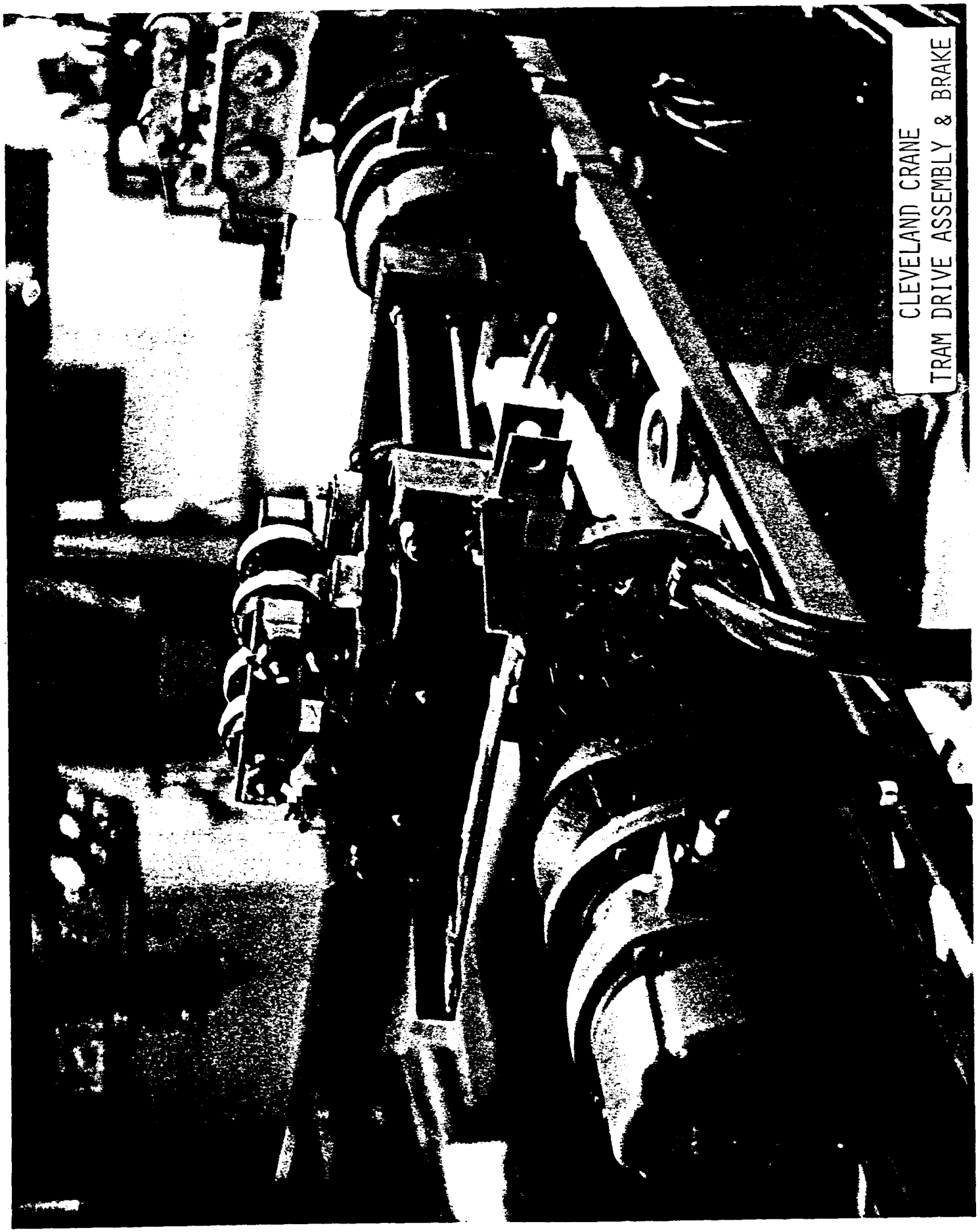


Figure 52A

4.0 FINAL ASSEMBLY

4.1 Conveyor Drives to Conveyor Frames

The conveyor drive is mounted at the discharge end of the conveyor frame, The gear case is held in place by four 1/2 x 1-1/2 bolts with lock washers.

At this particular point in assembly of the conveyor drive and conveyor frame, the drive consists of the following:

Gear Box	#306117	Contains 7.7 right angle reduction
Adapter	#1509559	Mounts to gear box and contains pilot and mounting holes for motor
Motor	#2078789	10 HP 1750 RPM 60 cycle Westinghouse Electric

The output shaft of the speed reducer drives the conveyor belt pulley through a flexible coupling at a speed of 225 RPM or 400-450 FPM.

4.2 Motor Control Cases to Conveyor Frames

Each of the motor control cases #201218 is mounted to the conveyor frame by four 1/2 bolts and in such a position that it counter-balances the gear box drive.

There are 12 identical cases, one on each conveyor and mounted in identical areas. Each case contains the following outlets:

1 - Centrifugal switch
1 - Centrifugal switch
1 - Tram motor
1 - Tram bracket
1 - Headlight
1 - Power input

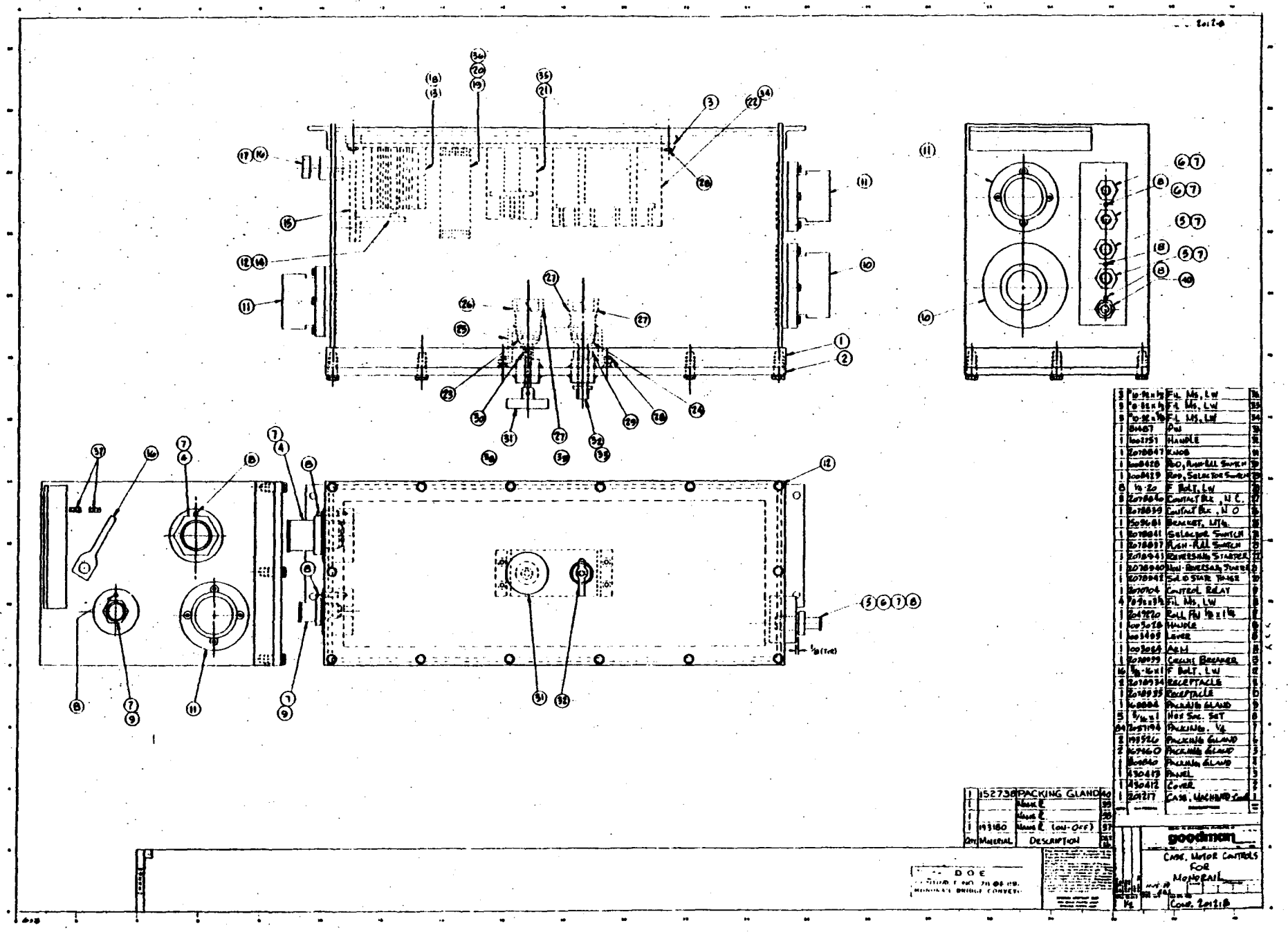

goodman
CASE, MAJOR CONTROLS FOR MONORAIL
DOE
PACKING GLAND
DESCRIPTION
MATERIAL

Figure 53

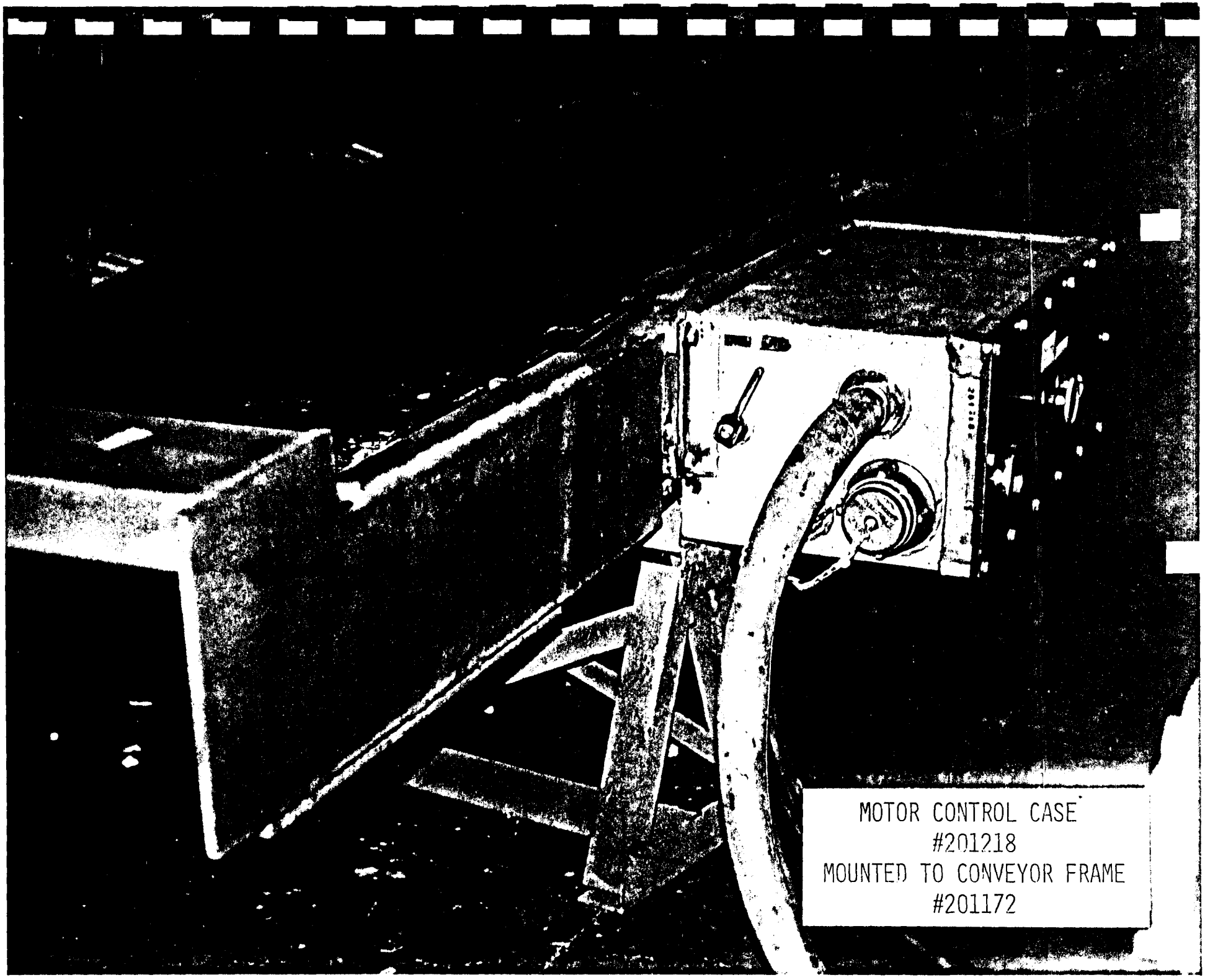
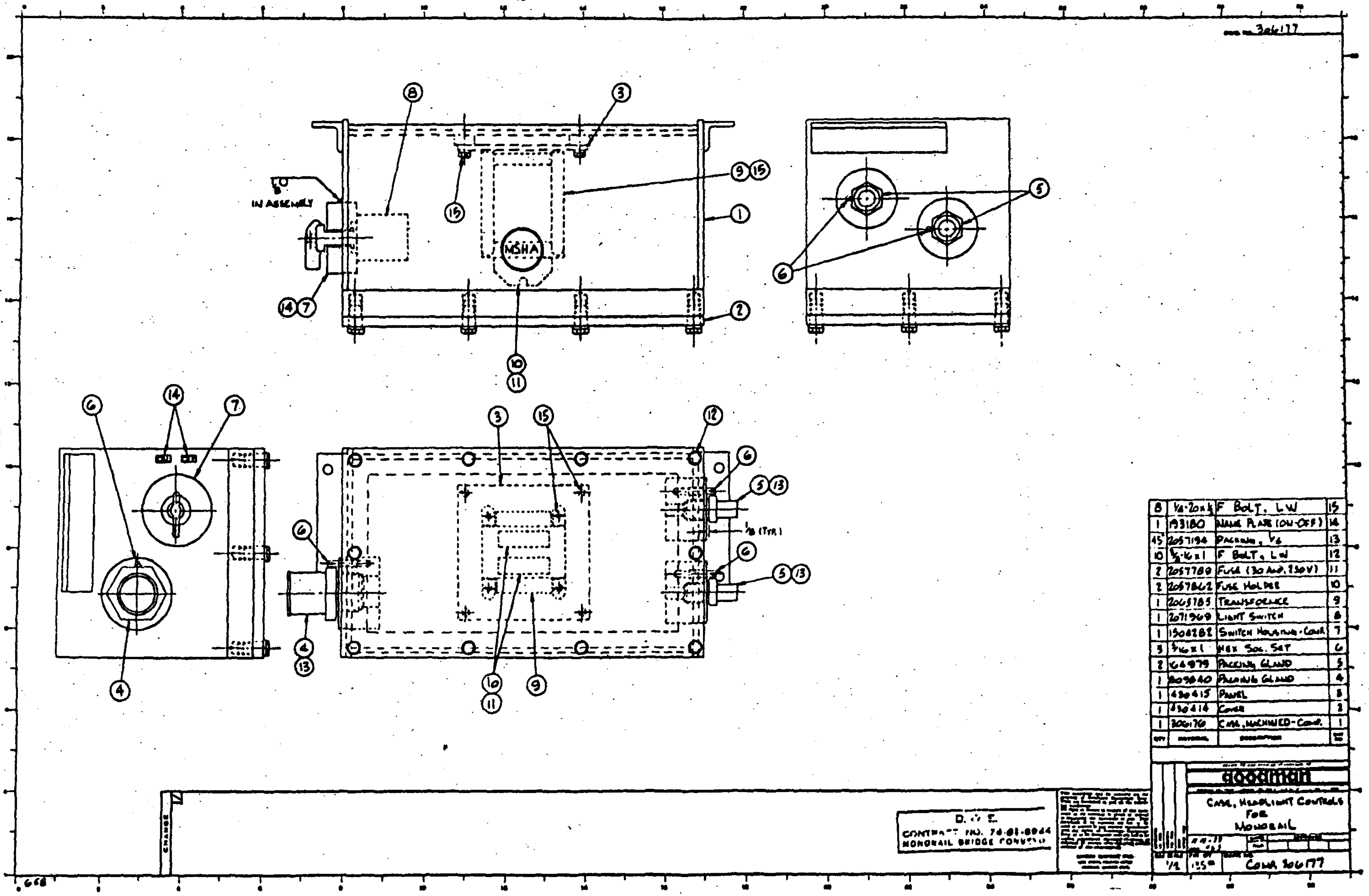

MOTOR CONTROL CASE
#201218
MOUNTED TO CONVEYOR FRAME
#201172

Figure 54

4.3 Headlight Switch Case to Inby Conveyor Frame

The headlight switch #306177 is mounted on the right hand side of the inby conveyor, just in back of the dual steering wheels. It controls just the two headlights which are mounted on the front plate. Each light has its own protective guard. The switch is MSHA approved and is easily accessible to the front operator who guides the steering mechanism of the inby conveyor, which follows either a borer or ripper.



QTY	MATERIAL	DESCRIPTION	NO.
8	1/4-20x3/4	F BOLT, LW	15
1	193180	NAME PLATE (ON-OFF)	14
45"	2057194	PACKING, 1/4	13
10	3/8-16x1	F BOLT, LW	12
2	2057780	FUSE (30 AMP, 250V)	11
2	2057862	FUSE HOLDER	10
1	2065185	TRANSFORMER	9
1	2071969	LIGHT SWITCH	8
1	1504282	SWITCH HOUSING-COVER	7
3	5/16x1	HEX SOC. SET	6
2	64979	PACKING GLAND	5
1	809840	PACKING GLAND	4
1	430415	PANEL	3
1	430414	COVER	2
1	306176	CASE, MACHINED-COMP.	1

Figure 55

4.4 Steering Mechanism to Inby Conveyor Frame

The steering mechanism on the monorail bridge is mounted on the front end of the inby conveyor. The mechanism guides the inby conveyor into 60° crosscuts. A dual wheel connected by a threaded screw and nut provides right hand or left hand control.

In the beginning of the design we had a choice of three different thoughts to go with on steering:

1. Center pivot, coaster wagon steering
2. Automotive king pin steering
3. Center mounted tires with fork type steering

The fork type lent itself best to fit into the system from a standpoint of powering the wheels as well as steering.

The mechanism is made up of the following parts, shown in Fig. 56:

1 -	430832	- Front Plate
1 -	306402	- Wheel Support
2 -	2080614-000	- Bushing
2 -		Pillow Blocks
1 -	1510251	- Shaft
2 -	425072	- Wheels
2 -	2079948	- Pillow Block
1 -	1009229	- Threaded Screw
1 -		Threaded Nut

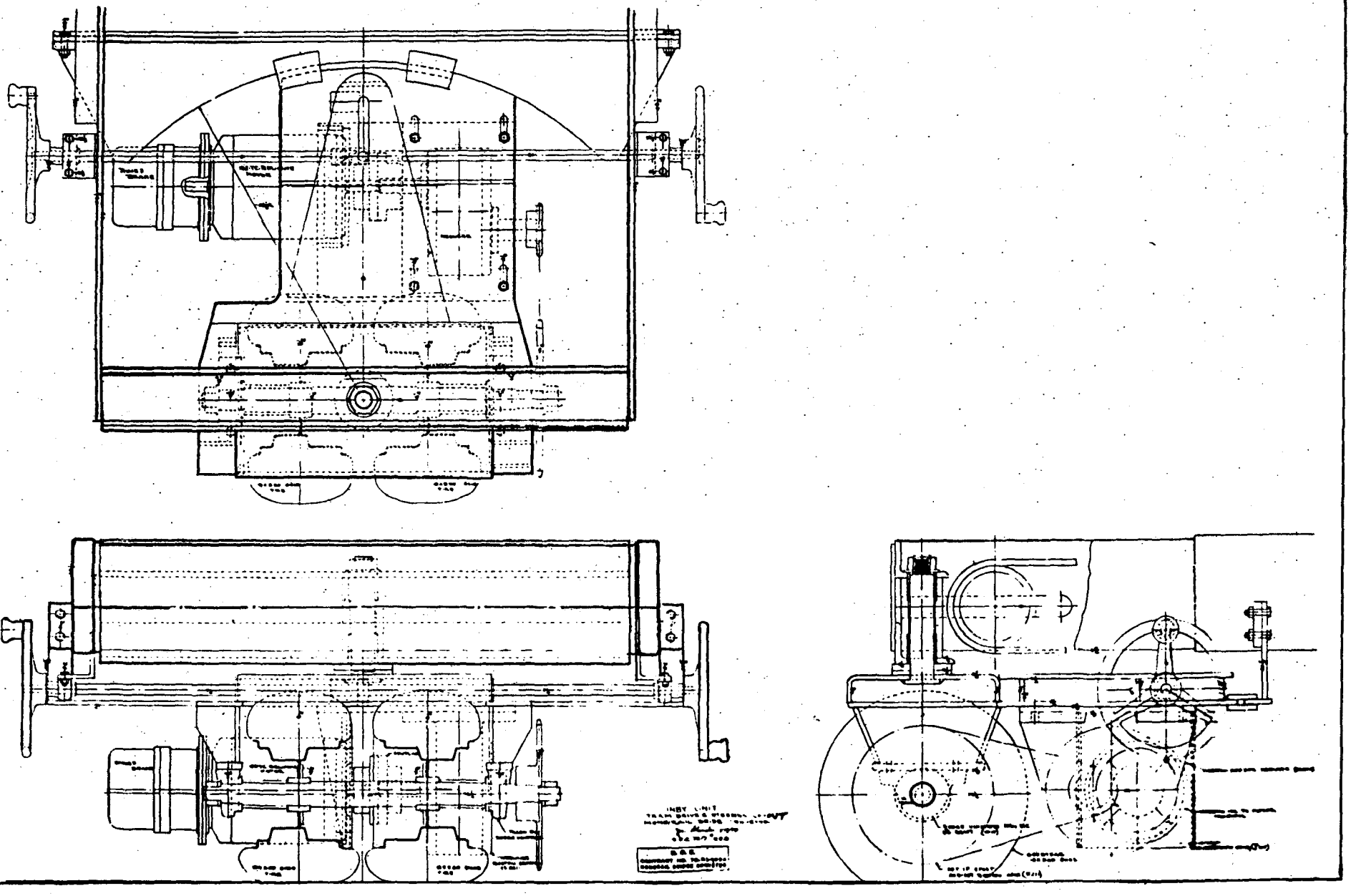
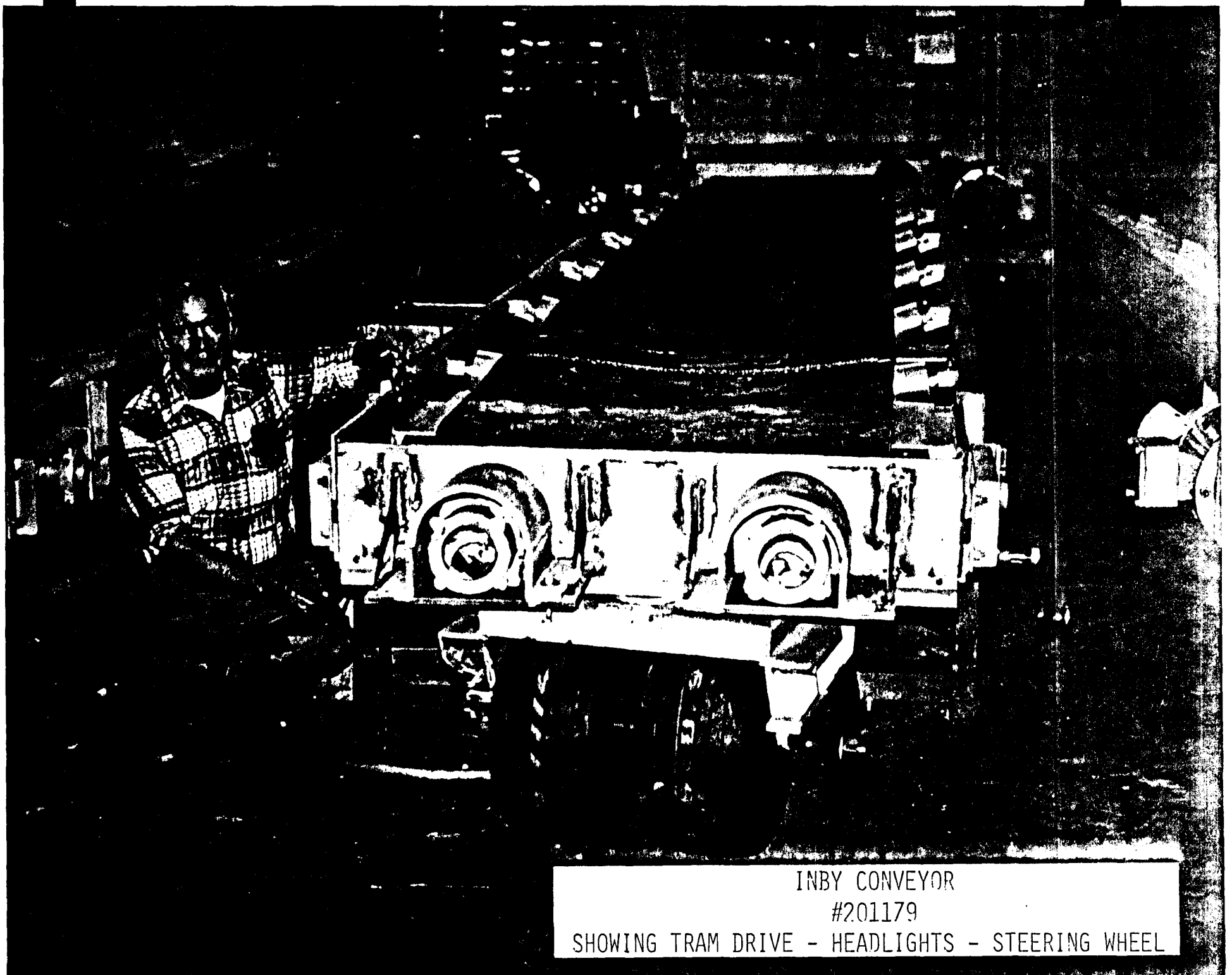


Figure 56



INBY CONVEYOR
#201179
SHOWING TRAM DRIVE - HEADLIGHTS - STEERING WHEEL

Figure 57

5.0 SURFACE TEST PLAN

5.1 Outline of Plan on Test Site

The outline plan of test site will be made per Figure 58. This shows the location of test facility at the Goodman Murfreesboro plant.

The test facility will be such as to simulate the underground demonstration and will strictly adhere to the plans and designs approved by the Bureau. The only difference between surface test and underground test will be that three conveyors will be involved rather than twelve.

This test will provide the means of traveling up and down a 6½% grade, going through a switch and traveling through a straightaway.

The facility will be constructed under the direct supervision of Goodman Equipment Corporation personnel.

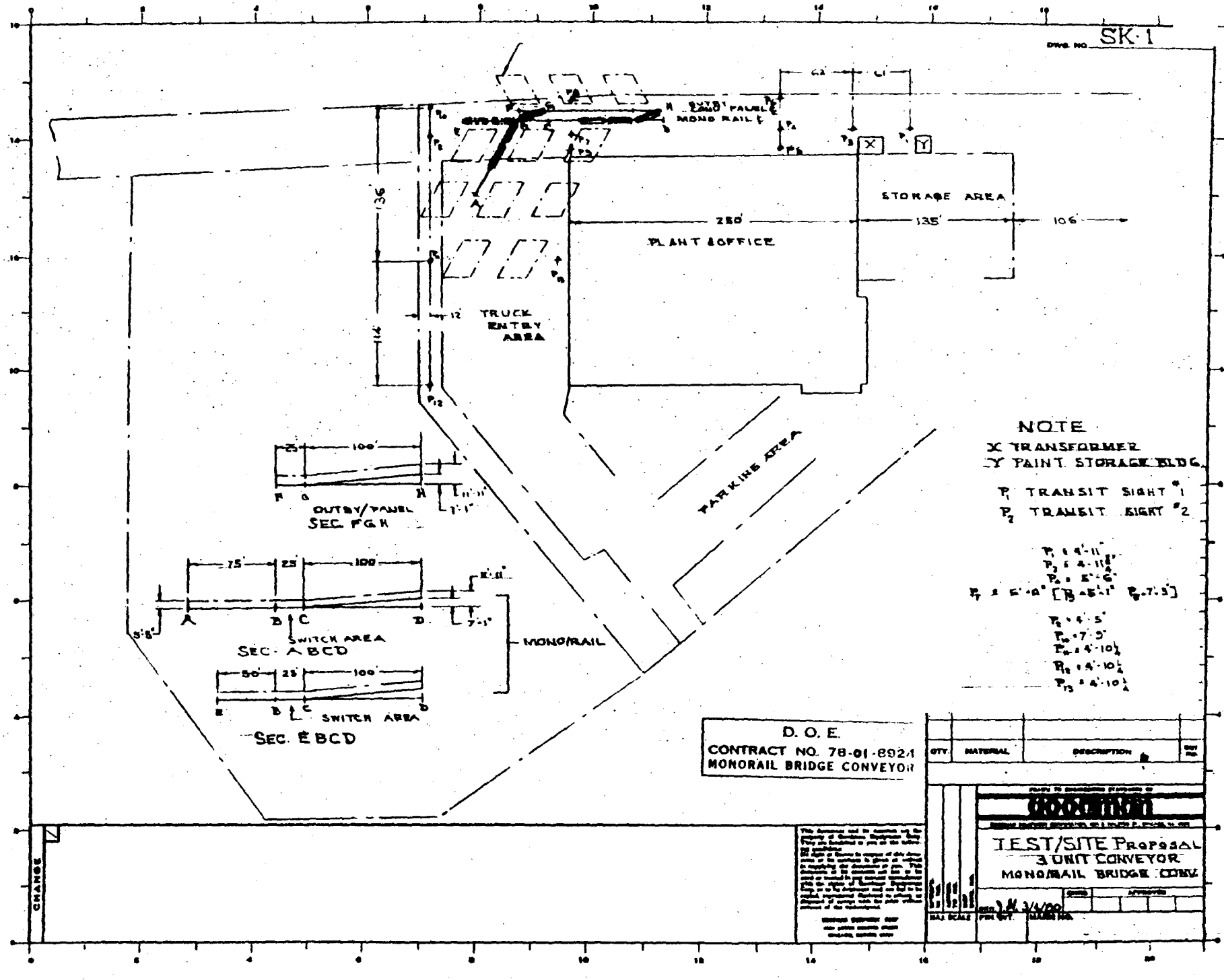

SK-1
STORAGE AREA
250'
135'
106'
PLANT & OFFICE
136'
12'
TRUCK ENTRY AREA
PARKING AREA
OUTBY/PANEL
SEC. FGH
SWITCH AREA
SEC. ABCD
MONORAIL
SWITCH AREA
SEC. EBCD
NOTE
X TRANSFORMER
Y PAINT STORAGE BLDG.
P1 TRANSIT SIGHT #1
P2 TRANSIT SIGHT #2
D. O. E.
CONTRACT NO. 78-01-8921
MONORAIL BRIDGE CONVEYOR
TEST/SITE Proposal
3 UNIT CONVEYOR
MONORAIL BRIDGE CONV.

Figure 58

5.2 SURFACE TESTING

Construct Surface Facility

A surface testing facility will be constructed. As suggested earlier, this will be done at our Murfreesboro facility. The facility will be such as to simulate the underground demonstration and will strictly adhere to the plans and designs earlier approved by the Bureau.

The surface facility will be constructed under the direct supervision of Goodman personnel.

We will dynamically test the M.B.C. The M.B.C. System after installation will be tested to ensure smooth operation. The trials conducted will actually go through all the motions of conveying material and of moving the bridge sections along the monorail and across a switch. All the operations expected of the system will be conducted.

We will modify the M.B.C. and/or the surface test facility. Although this is not actually expected during the program, allowance has been made in the schedule to make any minor alterations in the system that may improve its operation underground. The modification will be made by Goodman.

We will demonstrate the Monorail Bridge Conveyor after completing the modifications and again testing the M.B.C. system. It will be demonstrated to the TPO, Bureau Staff, the Contracting Officer and/or his designated representative(s). At least two (2) weeks notice will be given to the TPO prior to this test. All the motions and activities expected of the system will be thoroughly tried during these runs.

5.3 Layout/Details of Surface Test Structure

Layout - Figure 59

Details - Figures 60-72

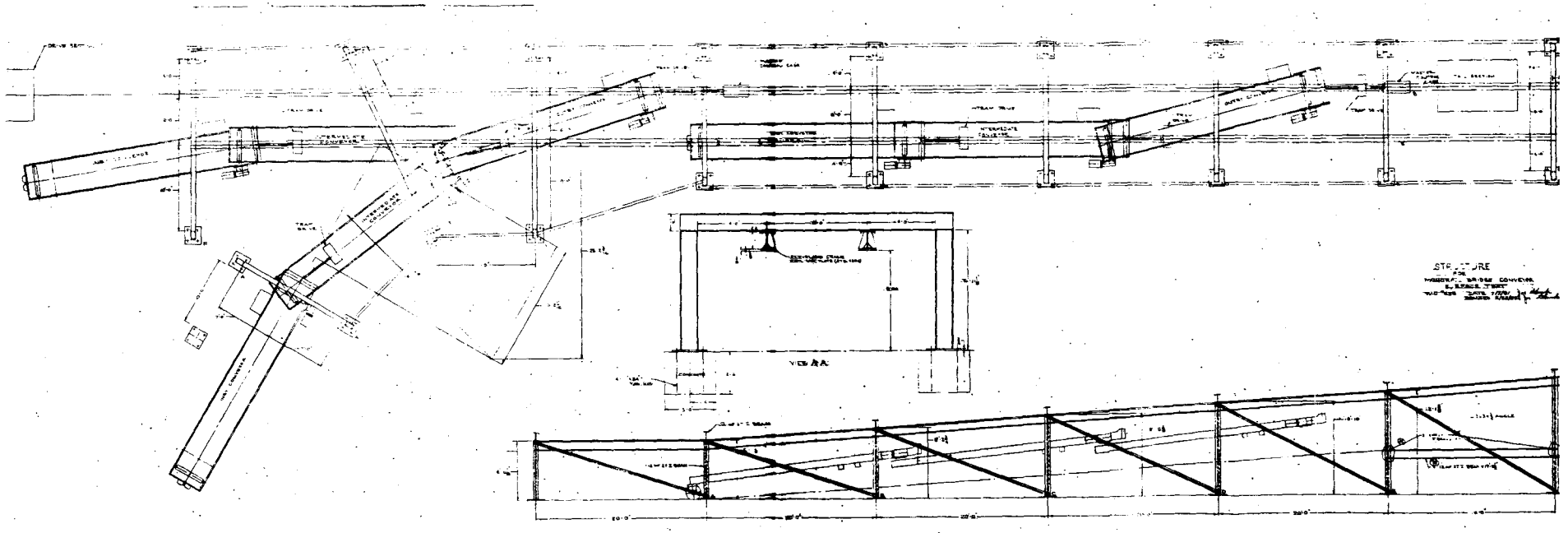
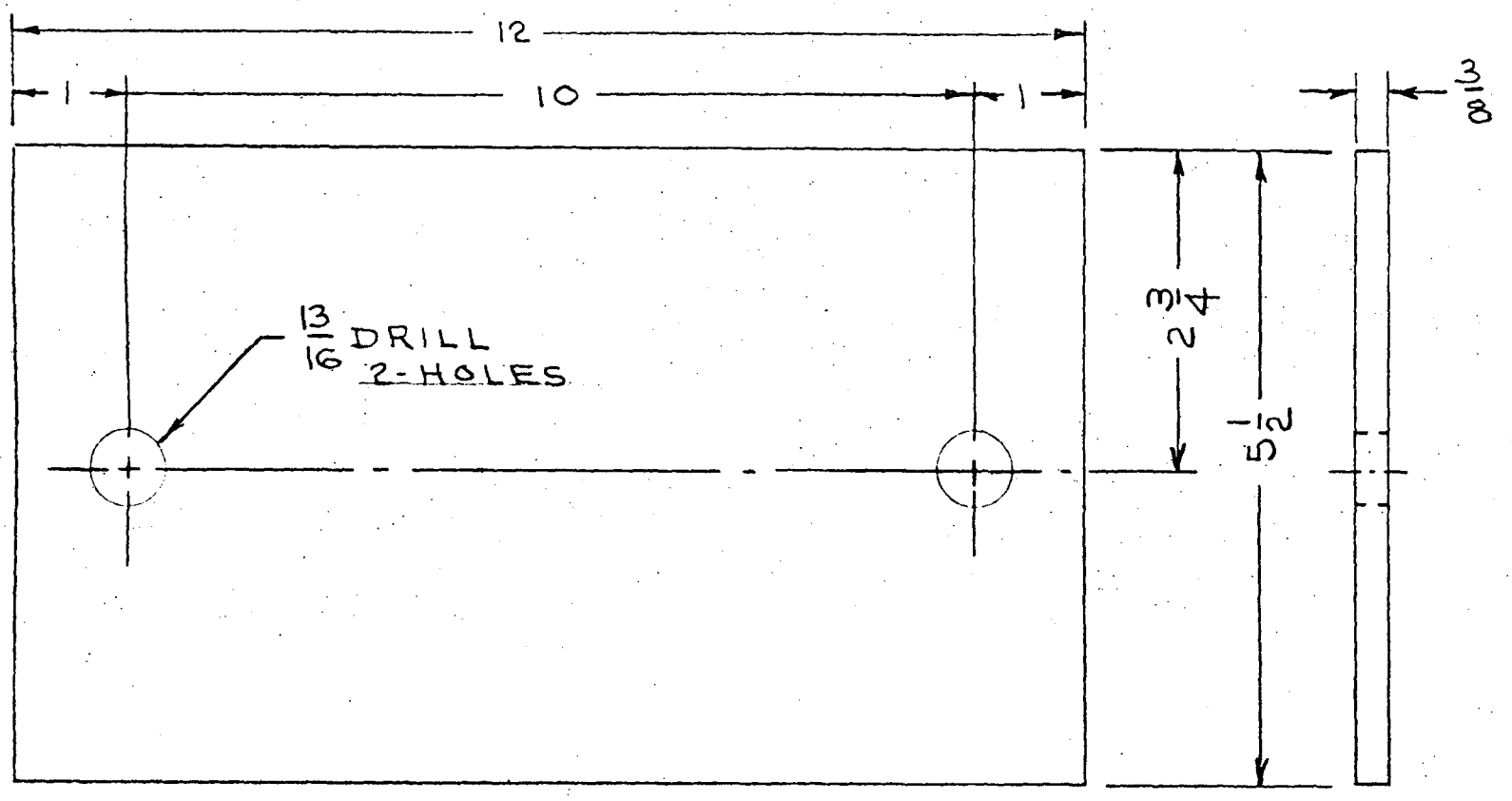


Figure 59



MAKE-72

MATERIAL - 8193102 - 1017/HR $\frac{3}{8} \times 5\frac{1}{2} \times 12$

PLATE, MTG.
FOR RAIL
MONORAIL BRIDGE CONV.
SK.-#1 J. Honaker 7/24/81

Figure 60

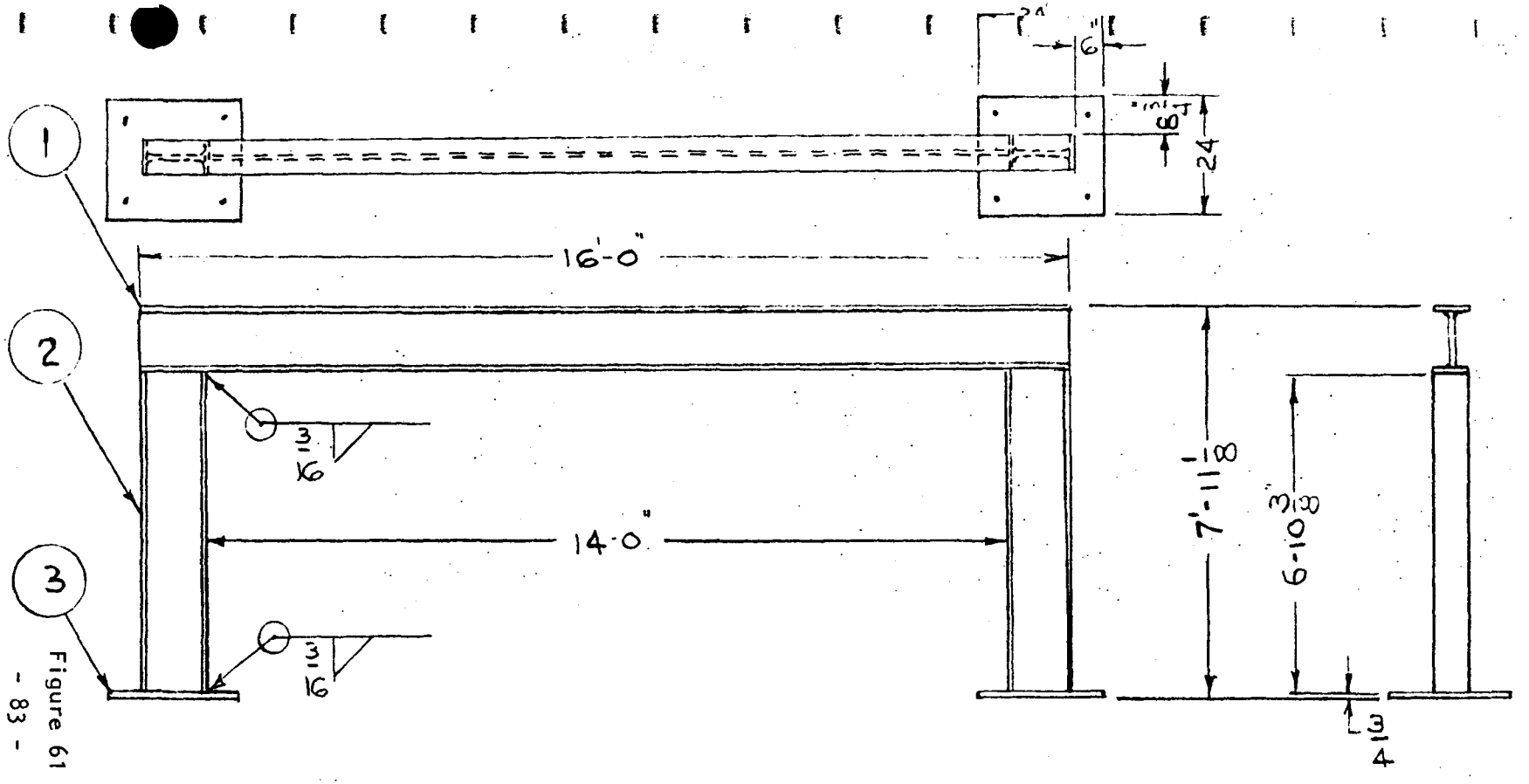
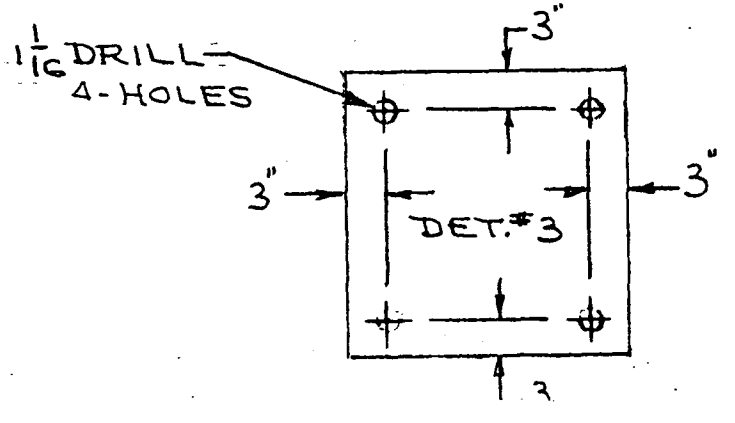


Figure 61

MATERIAL LIST		
DET.	QUAN	MATERIAL
1	1	12 WF 27 (I BEAM) x 16'-0" LG. — MAKE-2
2	2	12 WF 27 (I BEAM) x 6'-10 3/8 LG.
3	2	24" X 24" X 3/4 PLATE (1017 HR.)



FRAME SECTION "A-A"

FOR SURFACE TEST

MONORAIL BRIDGE CONVEYOR

J. Hornby 7/8/81

W.O. #658

SK. #2

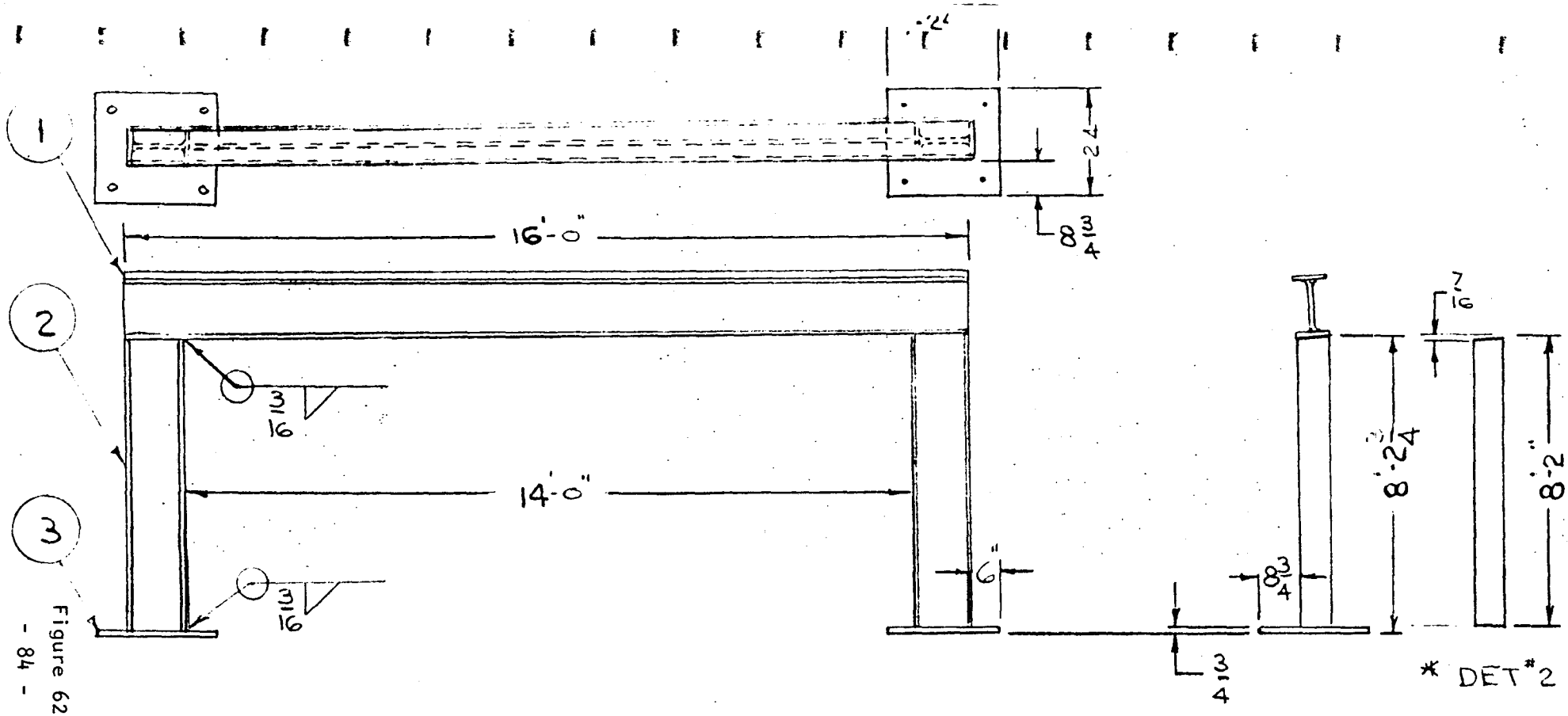
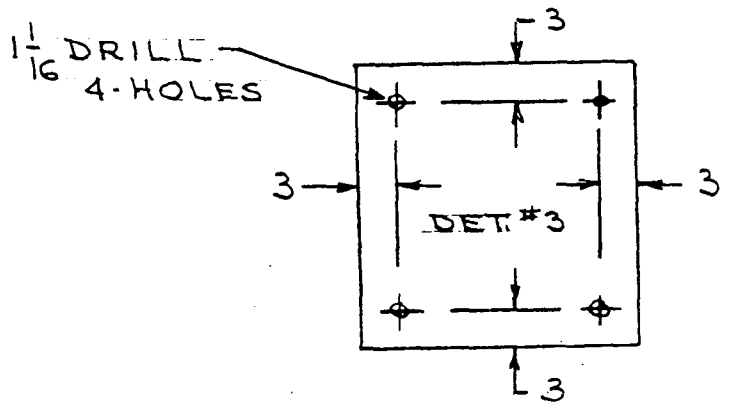


Figure 62

MATERIAL LIST		
DET.	QUAN	MATERIAL
1	1	12 WF 27 (I BEAM) X 16'-0" LG. — MAKE-1
* 2	2	12 WF 27 (I BEAM) X 8'-2" LG
3	2	24" X 24" X 3/4 PLATE (1017 HR)



FRAME SECTION "B-B"

FOR SURFACE TEST

MONORAIL BRIDGE CONVEYOR

J. Horsin 7/13/81

W.O. # 658

SK. # 3

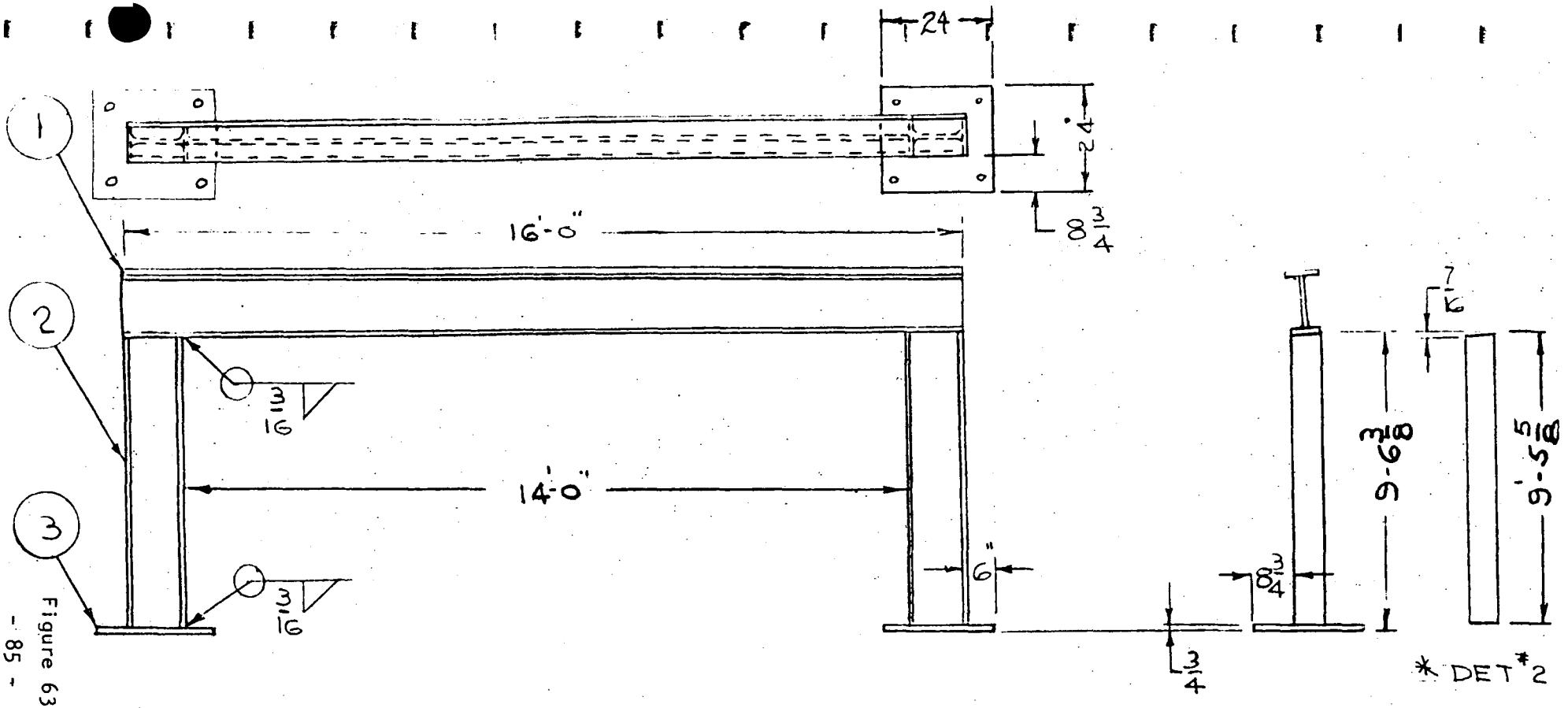
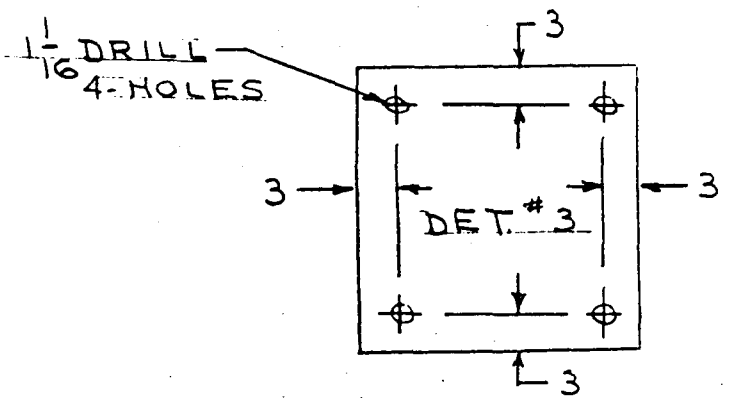


Figure 63

MATERIAL LIST		
DET.	QUAN	MATERIAL
1	1	12WF 27 (I BEAM) X 16'-0" LG.
2	2	12WF 27 (I BEAM) X 9-5 5/8 LG.
3	2	24"X 24" X 3/4 PLATE (1017 HR)

MAKE-1



FRAME SECTION "C-C"

FOR SURFACE TEST

MONORAIL BRIDGE CONVEYOR

J. Honsik 7/13/81

W.O. # 658

SK. # 4

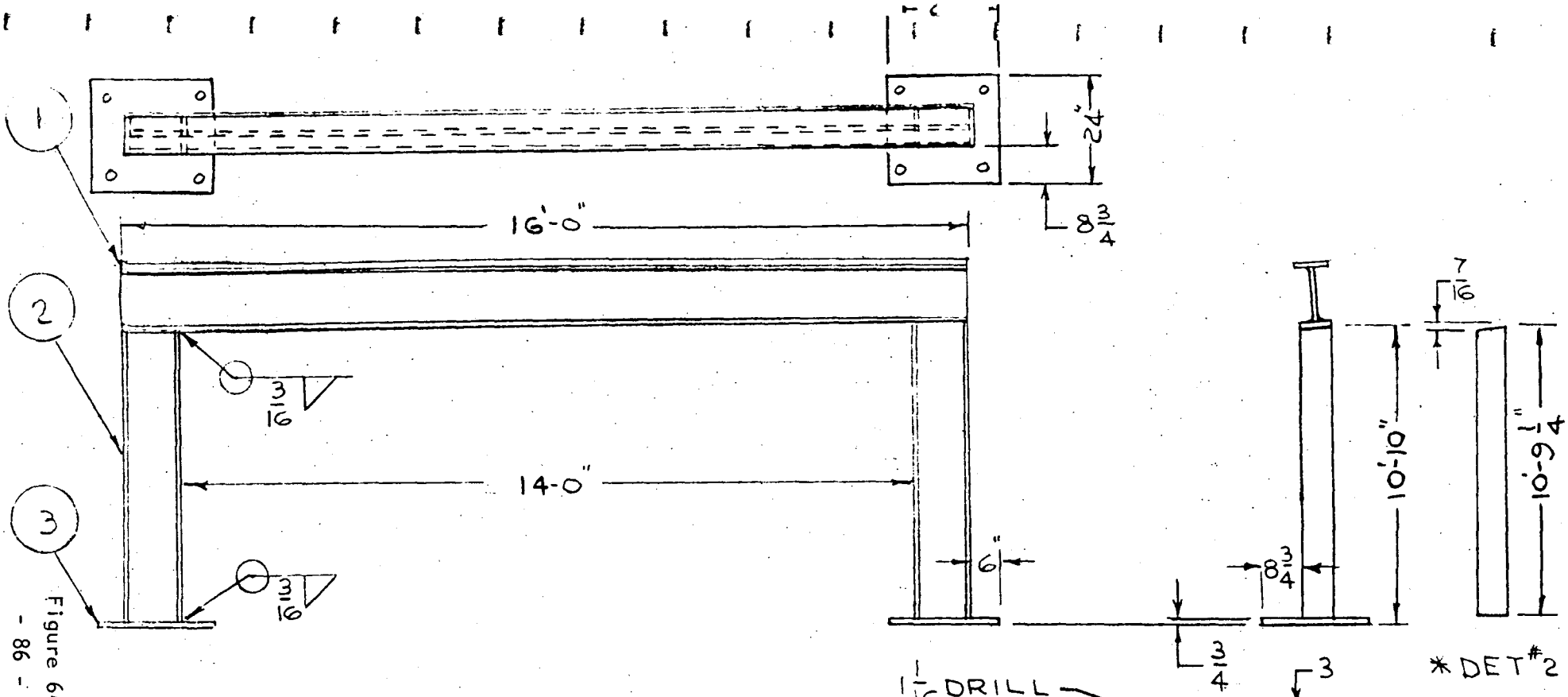


Figure 64

MATERIAL LIST		
DET.	QUAN	MATERIAL
1	1	12WF 27 (I BEAM) X 16-0" LG.
2	2	12WF 27 (I BEAM) X 10-9 1/4" LG
3	2	24" X 24" X 3/4 PLATE (1017HR)

FRAME SECTION D-D

FOR SURFACE TEST

MONORAIL BRIDGE CONVEYOR

J. Slonski 7/17/81

W.O. # 658

SK. # 5

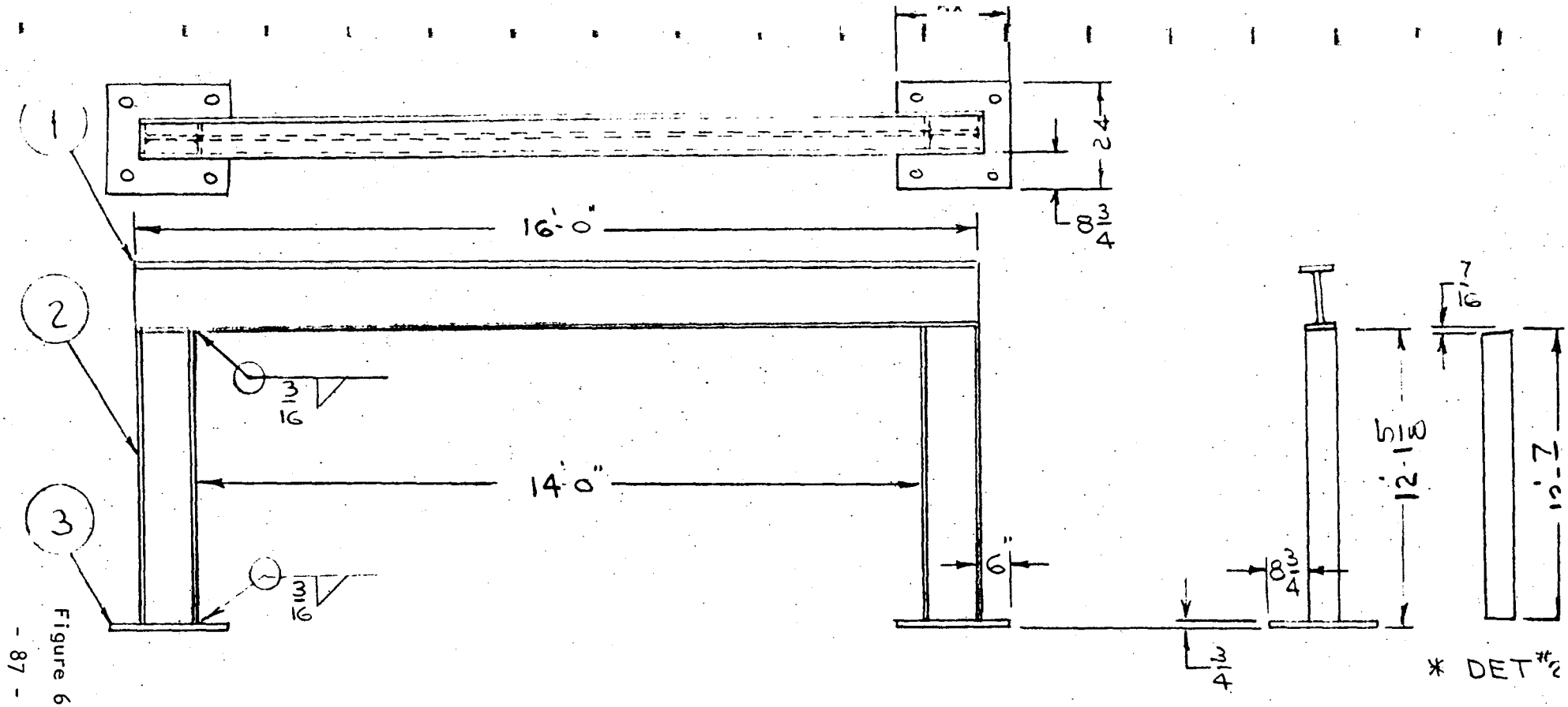
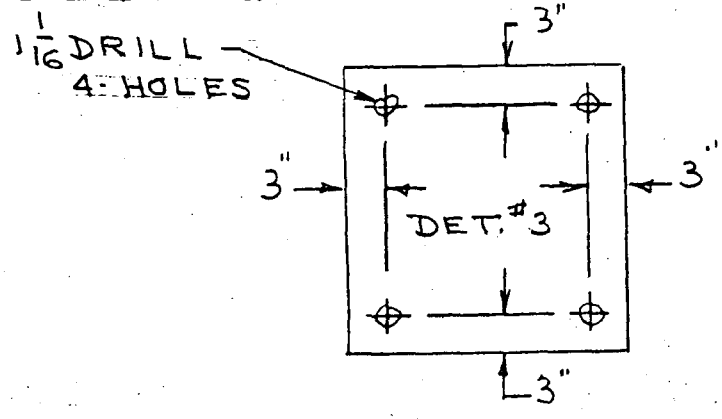


Figure 65

MATERIAL LIST		
DET.	QUAN.	MATERIAL
1	1	12 WF 27 (I BEAM) X 16'-0" LG
2	2	12 WF 27 (I BEAM) X 12'-7/8" LG.
3	2	24" X 24" X 3/4" PLATE (1017 HP)

MAKE-1



FRAME SECTION "E-E"

FOR SURFACE TEST

MONORAIL BRIDGE CONVEYOR

J. Blanke 7/14/81

W.O. #658

SK. #6

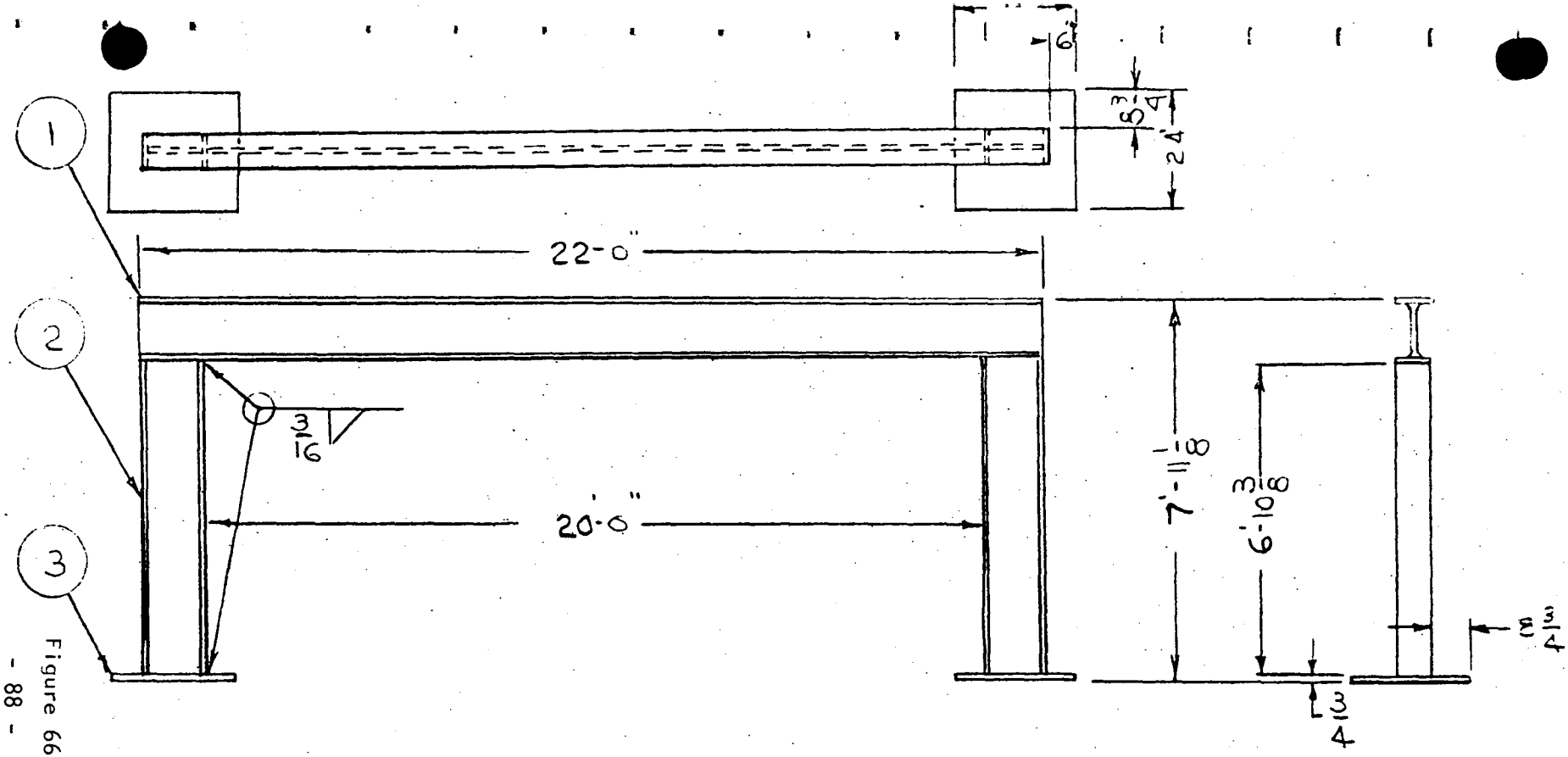
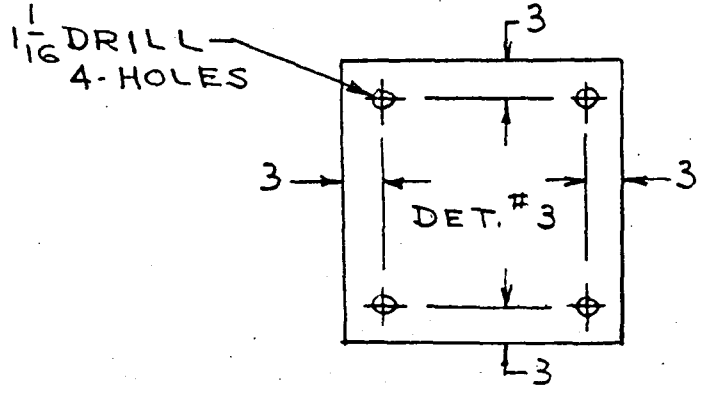


Figure 66

MATERIAL LIST		
DET.	QUAN.	MATERIAL
1	1	12 WF 27 (I BEAM) X 22'-0" LG
2	2	12 WF 27 (I BEAM) X 6'-10 3/8 LG.
3	2	24" X 24" X 3/4 PLATE (1017 HP)

— MAKE-2



FRAME SECTION F-F
FOR SURFACE TEST
MONORAIL BRIDGE CONVEYOR

J. Stanski 7/24/81

W.O. #655

SK.-#7

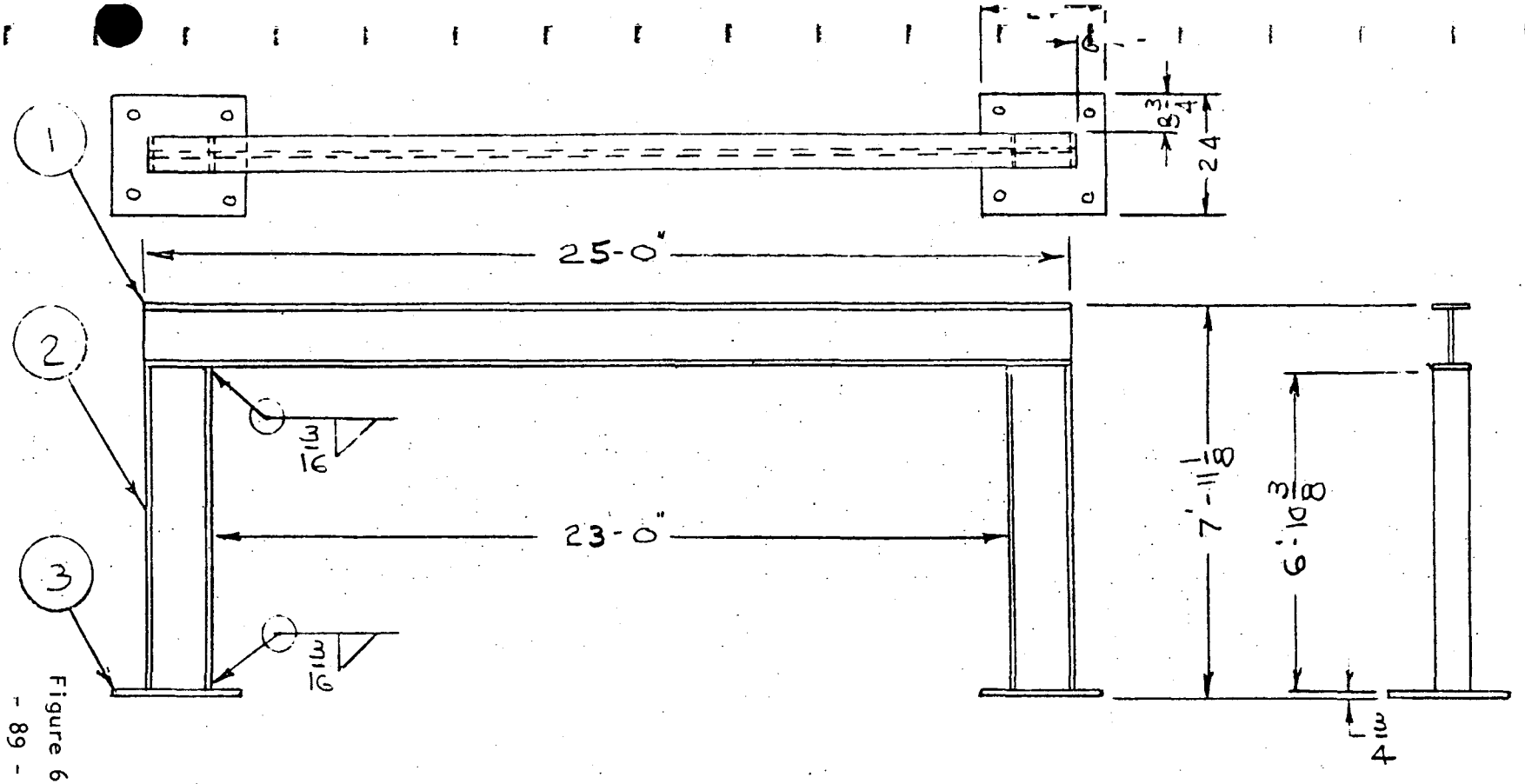
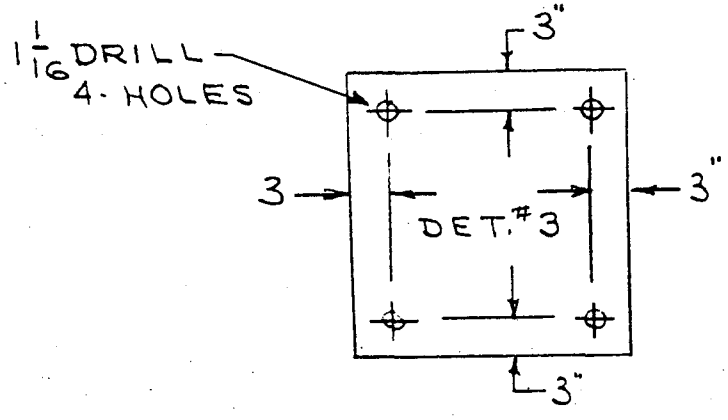


Figure 67

MATERIAL LIST		
DET.	QUAN	MATERIAL
1	1	12 WF 27 (I BEAM) X 25-0" LG
2	2	12 WF 27 (I BEAM) X 6'-10 3/8 LG
3	2	24" X 24" X 3/4 PLATE (1017 HR.)

MAKE-1



FRAME SECTION G-G

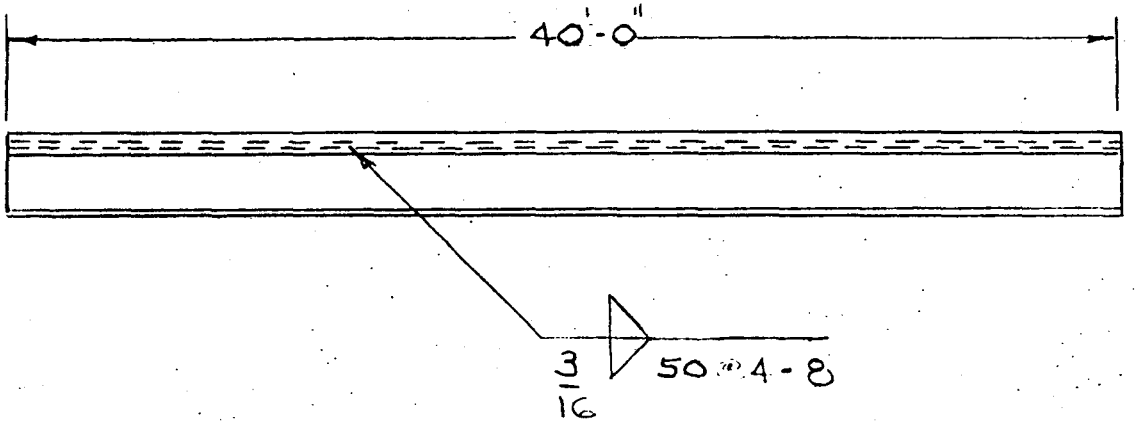
FOR SURFACE TEST

MONORAIL BRIDGE CONVEYOR

J. Hanshi 7/24/81

W.O. #658

SK.-#8



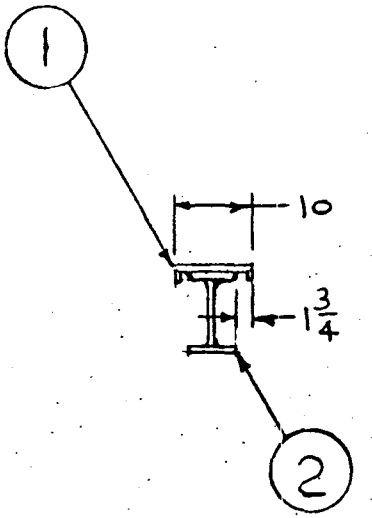


Figure 68

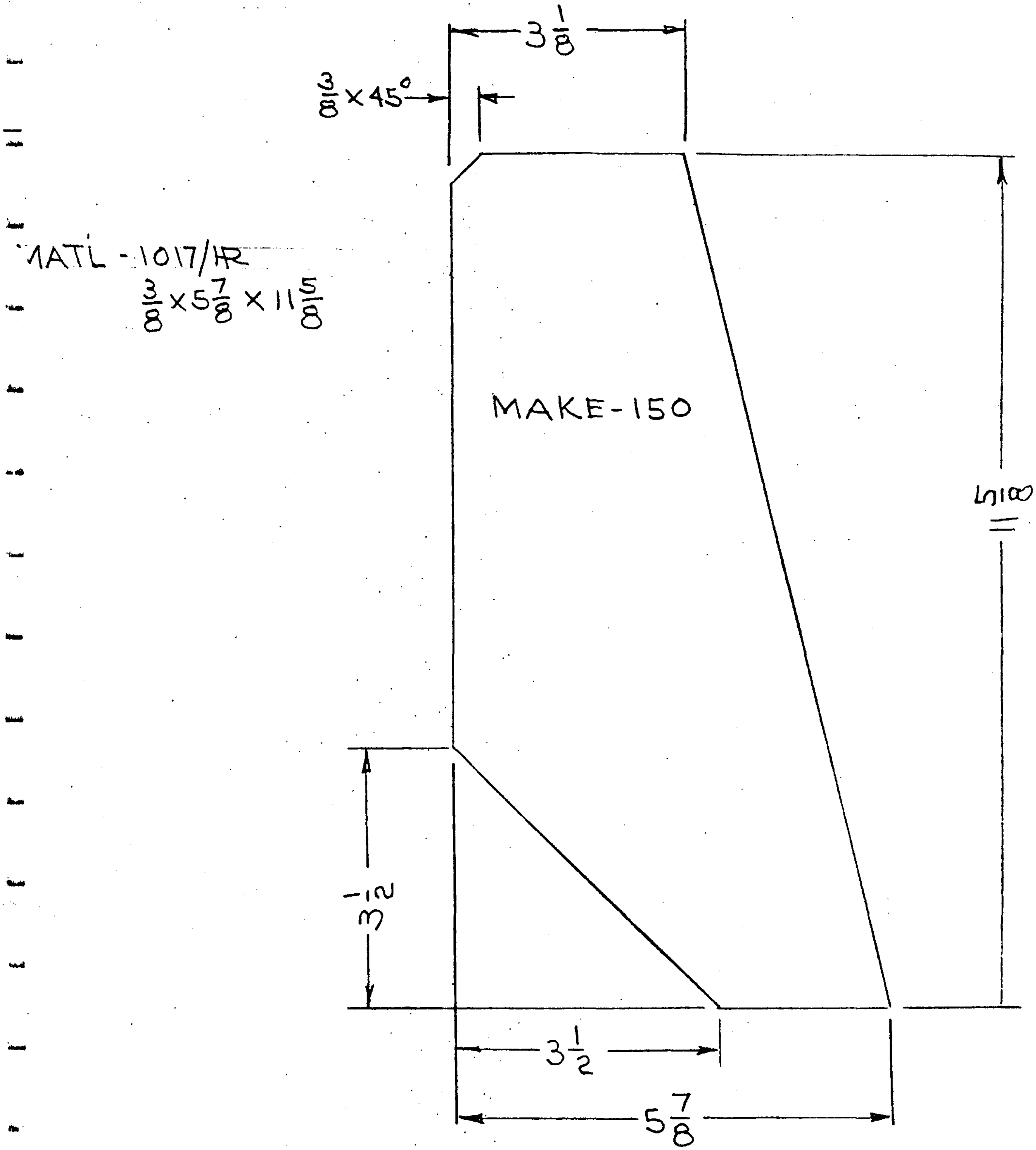
MATERIAL LIST		
DET.	QUAN.	MATERIAL
1	1	10 X 1½ X 8.4 (CHANNEL) X 43'-0"
2	1	12 WF 27 (I BEAM) X 40'-0" LG

— MAKE - 8

40' BEAM
FOR SURFACE TEST
MONORAIL BRIDGE CONVEYOR

J. Gonske 7/24/81
W.O. # 658

SK. - # 13



RIB
FOR MOUNTING PLAT
MONORAIL BRIDGE C

Figure 69

SK.-#14

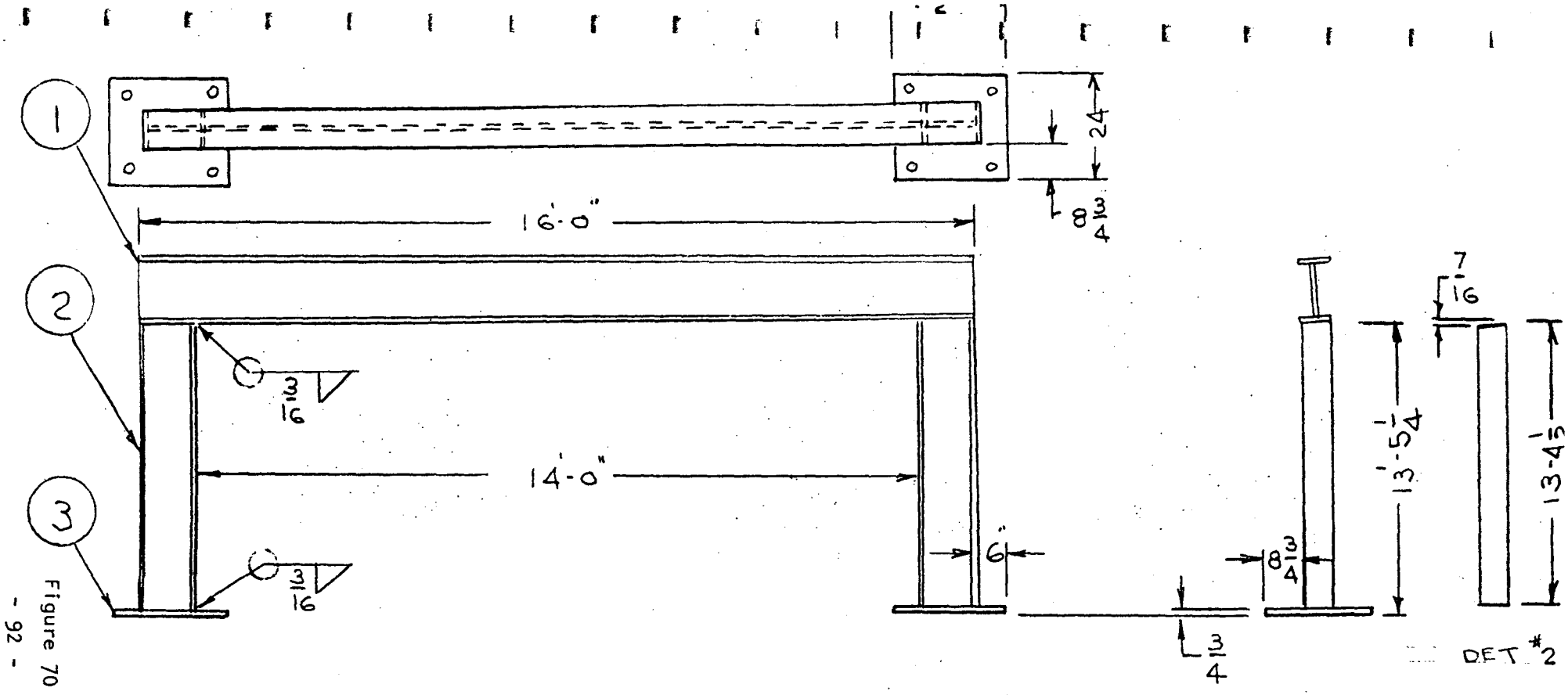
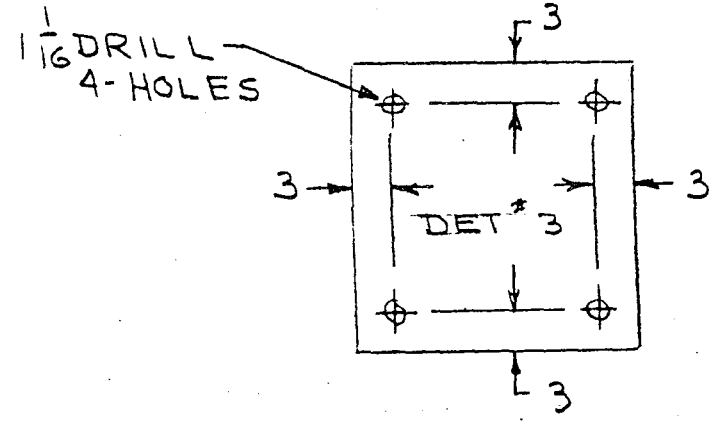


Figure 70

MATERIAL LIST		
DET.	QUAN.	MATERIAL
1	1	12 WF 27 (I BEAM) X 16'-0" LG.
2	2	12 WF 27 (I BEAM) X 13'-4 1/2 LG.
3	2	24" X 24" X 3/4 PLATE (1017 HR)

MAKE-1



FRAME SECTION "H-H"

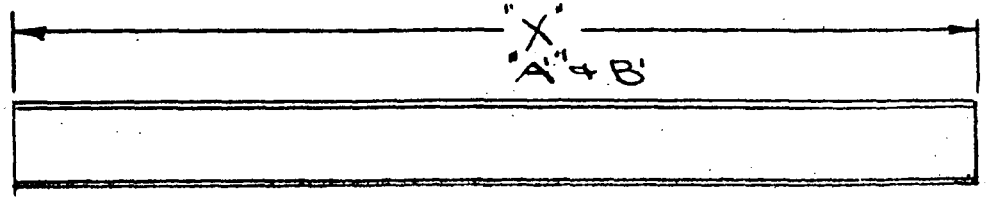
FOR SURFACE TEST

MONORAIL BRIDGE CONVEYOR

J. Hanke 3/25/82

W.O.# 658

SK # 15



MATERIAL LIST		
DET.	QUAN.	MATERIAL
A	2	12 WF 27 (I BEAM) X 14'-0" LG.
B	2	12 WF 27 (I BEAM) X 17'-11½ LG
C	20	3 X 3 X ½ ANGLE X 24'-0"

I BEAM & ANGLE
FOR SURFACE TEST
MONORAIL BRIDGE CONVEYO
J. Hamilton 3/1/
W.O.# 65
SK # 16

Figure 71

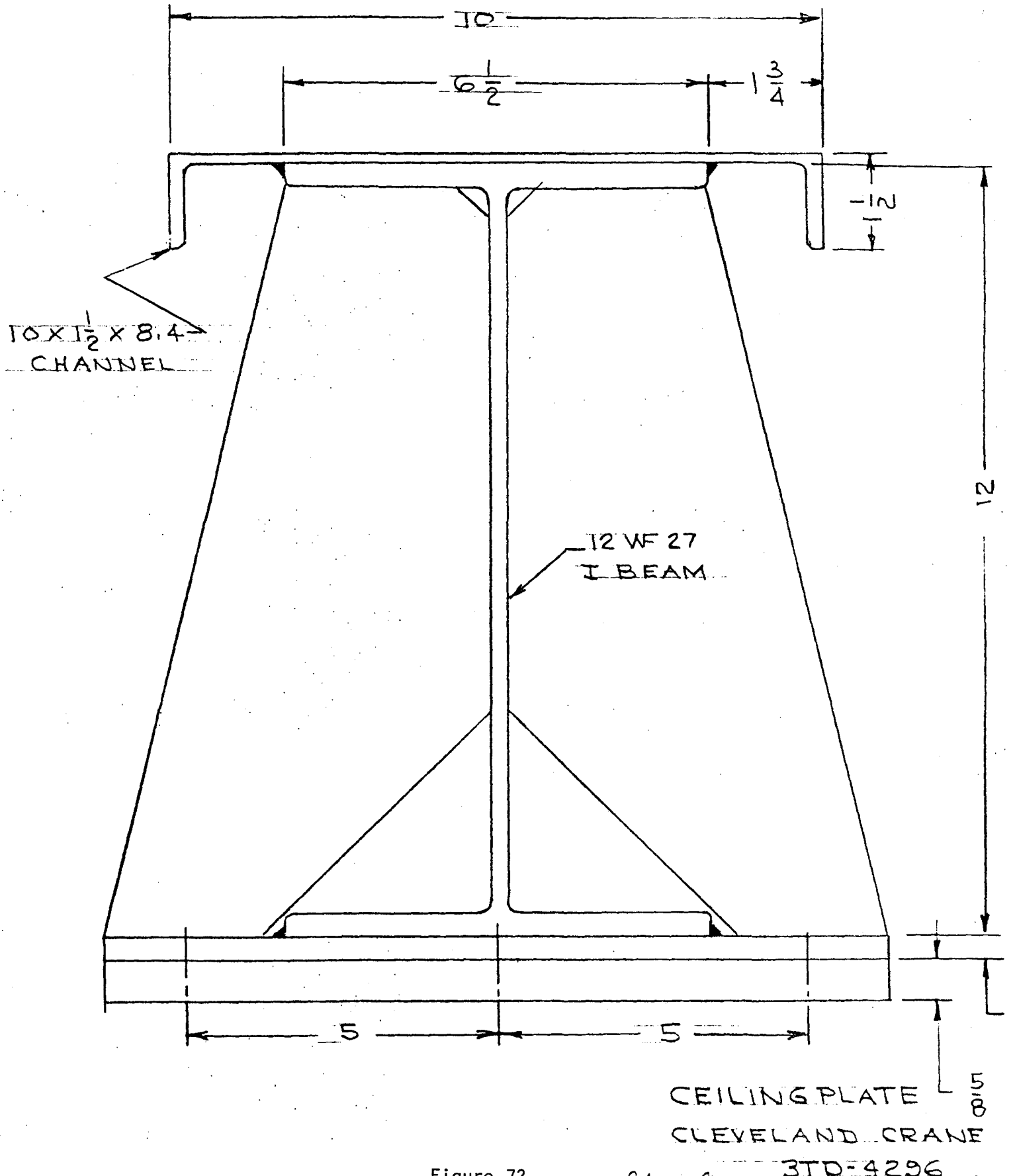


Figure 72

J. Gonsler 7/2/81

6.0 Final Summary

When Phase II was initiated it was divided into six (6) categories:

I. Fabrication
II. M.S.H.A. Approval
III. Update Design Drawings
IV. Design/Surface Test
V. I.O.M. Manual
VI. Phase II Report

In February, 1982, all the fabricated parts made at Goodman Equipment Corporation and Goodman Conveyor Corporation had been finished. All assemblies, both electrical and mechanical, were completed and shipped to Murfreesboro, Tennessee. Here, all the component parts were assembled to each of the twelve conveyor frames.

Upon completion of the assembly, all twelve conveyors were interconnected electrically. The first three conveyors contained the inby unit, intermediate and outby, each cascading one another similar to intended surface test arrangement. (Shown in Figure 74.)

The preliminary test proved that the electrical system could be controlled successfully, either manually or automatically. We also proved the capability of sequential starting and stopping, which is mandatory in this system of mining.

Earlier, in June of 1981, we visited the Cleveland Crane plant where we saw a successful operation of a carrier, tram drive and electric brake. The 8-wheel carrier had a 6,000 lb. weight (equal to weight of conveyor frame assembled with a load of coal on belt) driven on the straightaway track, through a switch, and up a 6½% grade (shown in Figure 73). Intermediate starting and stopping up and down grade created no problem. This demonstration, along with our pre-test at Murfreesboro of the electrical system, encourages our outlook of the project.

6.1 MSHA Approval Status

Upon conclusion of the preliminary test at Murfreesboro, we removed a motor control case #201218 from a conveyor not to be used in the surface test, and the headlight switch case #306177 from the inby unit #201179. These assemblies were shipped to Chicago for proper preparation prior to testing at MSHA. Both units are scheduled for testing the week of June 28. The other two remaining units, the pendant switch #306142 and the main control case #201220 must be used in the study of the surface test and thus will have to be sent to MSHA at a later date. The specifications required by MSHA of these electrical components brought about changes in our design, which prolonged our scheduled manufacturing time.

6.2 Public Exposure and Possible Change in Surface Test Area

A meeting was held in Bruceton, Pennsylvania on April 13, 1982

between the DOE and Goodman Equipment Corporation. The meeting demonstrated the joint DOE-Goodman development efforts. Mr. Claude Good, Acting Director, DOE, suggested that a portion of the MBC be shown to the public. To this, Goodman indicated to the DOE its desire to exhibit a full scale set up of the MBC at the American Mining Congress International Mining Show in Las Vegas, October, 1982.

It was also suggested at this meeting that we consider doing the surface test at the DOE Technology Center in Bruceton rather than our Murfreesboro, Tennessee facility, due to budget curtailment.

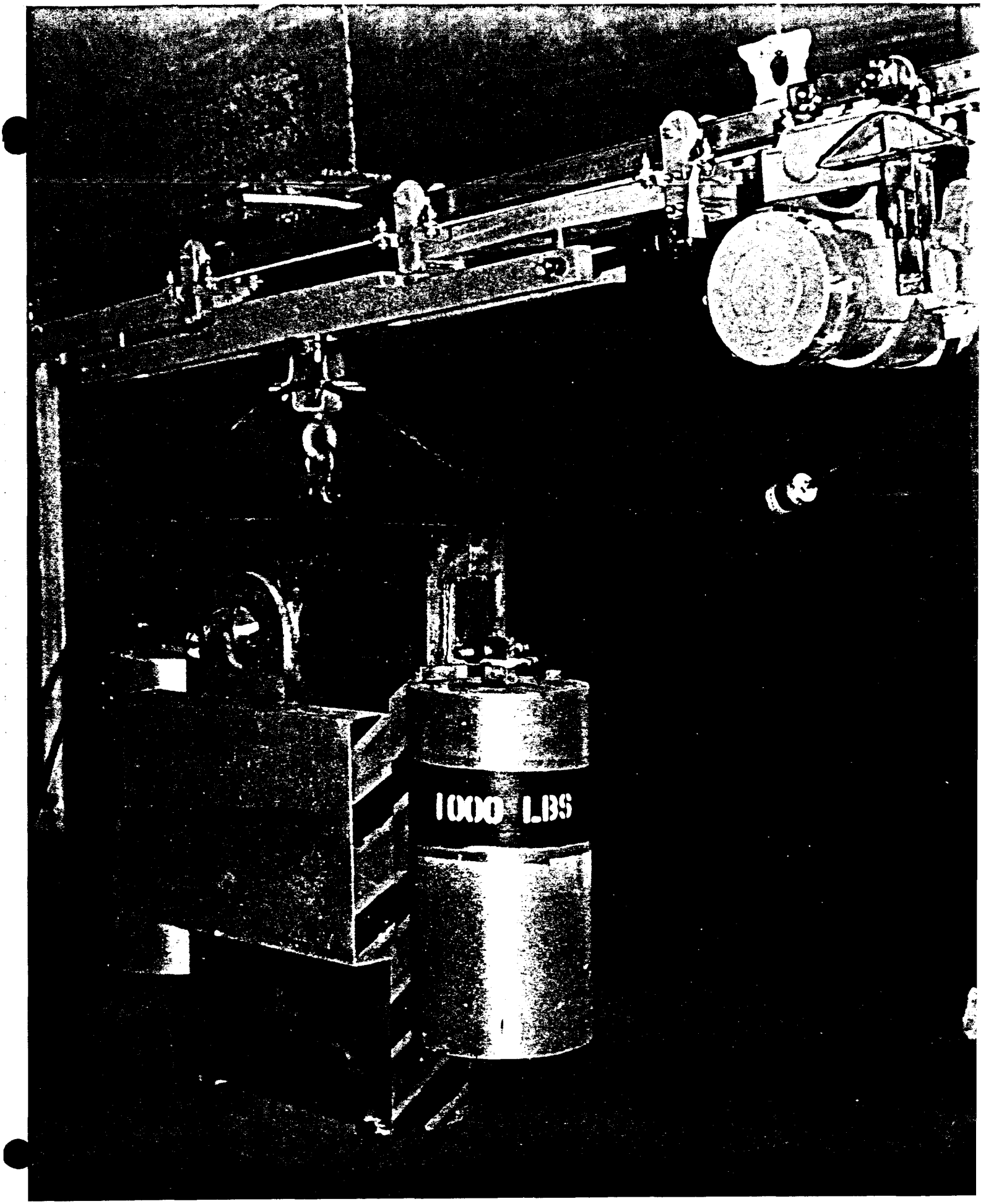
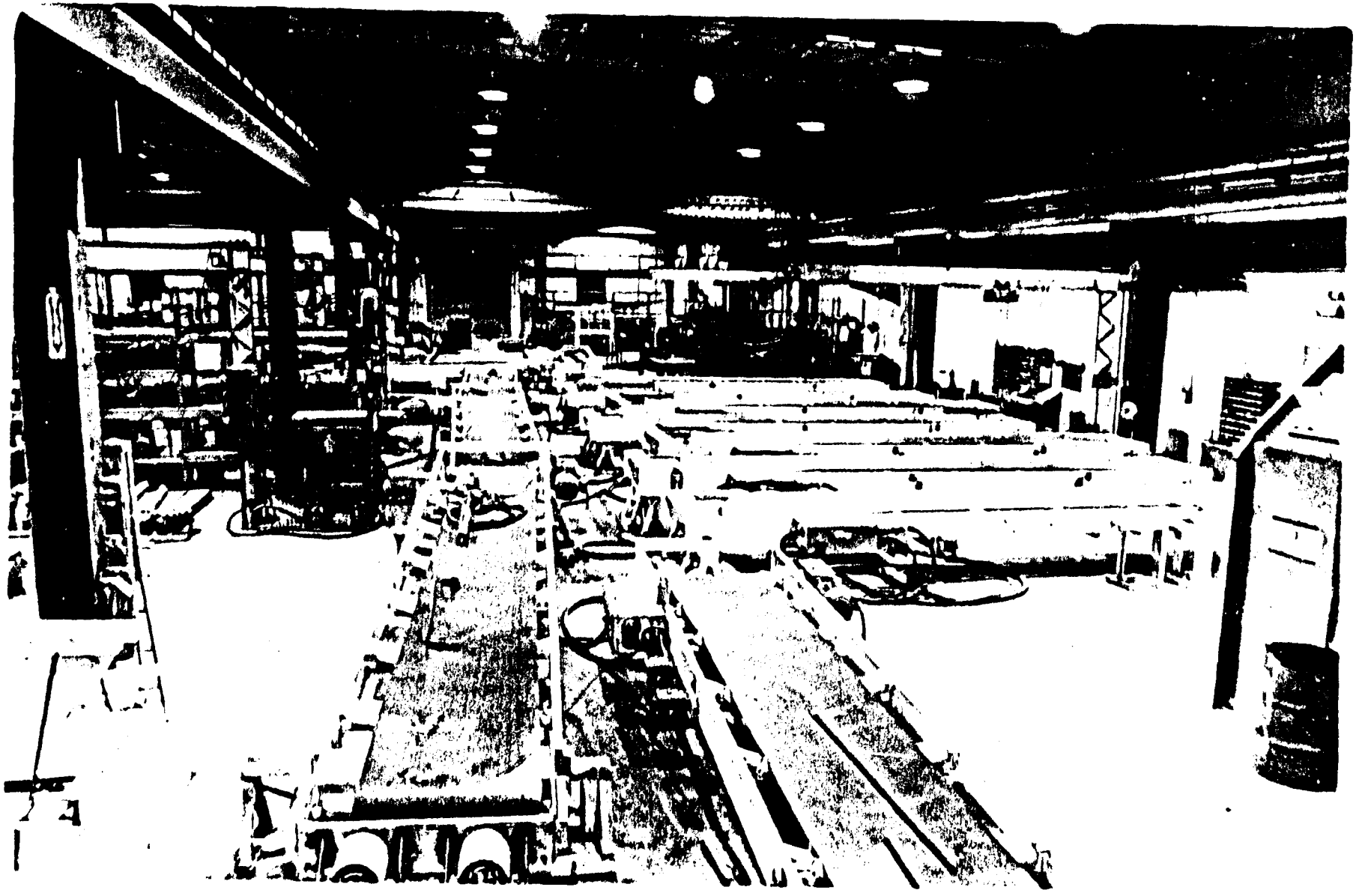


Figure 73



12 - CONVEYOR FRAMES
#201172

Figure 74