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DEVELOPMENT OF TIRES
FOR
THE FAMILY OF MEDIUM TACTICAL TRUCKS

United States Rubber Tire Company
Detroit 32, Michigan

R. A. Reichert/E. D. Rogers-ATAC

FINAL REPORT
PHASE I AND II
FEBRUARY 1965

DETROIT PROCUREMENT DISTRICT U. S. ARMY

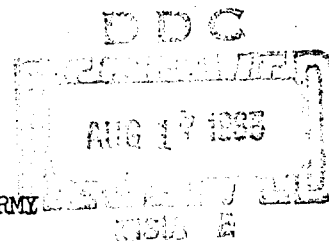
CONTRACT NO. DA 20-018-AMC 0585T

Technical Supervision by Research and Engineering Directorate

Army Tank Automotive Center

Detroit Arsenal, Center Line, Michigan

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Pursuant to Contract No. DA 20-018-AMC-0585T
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The findings in this report are not to be construed as an official Department of the Army position.

January 27, 1965

FINAL REPORT ON DEVELOPMENT OF TIRES
FOR THE NEW FAMILY OF MEDIUM TACTICAL TRUCKS

R. A. Reichert
United States Rubber Tire Company

The overall objectives of this contract were -

1. To supply thirty (30) 11.00-20 size radial ply tires, 6 ply nylon carcass with 2 ply wire belted treads, designed to provide increased performance over tires previously produced on Contract No. DA 20-018-ORD-20440.
2. Conduct a radial ply tire design investigation into the larger tire size (16-20) with low profile construction.
3. Perform a feasibility study of the replaceable tread tire concept.

Work was directed toward -

1. Increasing resistance to breaker separation, liner splitting and circumferential splice opening.
2. Increasing durability and improving general off-the-road performance of the tires.

Field testing of the 11.00-20 tires, under the direction of the Army Tank Automotive Center showed that the tires were much improved over previous radial tires tested. However, a few tires still failed from sidewall cracking.

The contract was revised to emphasize improvement in sidewall cracking resistance. This was accomplished by changing from a synthetic stock compound in the sidewall to a natural rubber compound with a neoprene veneer. Indoor sidewall cracking test results of tires with the natural rubber/neoprene veneer sidewalls indicate a vast improvement in cracking resistance over tires with previous sidewall construction.

Excellent test results were obtained with 16-20 low profile tire on all types of indoor tests. Due to the performance level of these tires on indoor testing, we feel that this tire is more than adequate for field endurance tests.

The experimental test results of the replaceable tread tire were very favorable and we feel that this concept should be broadened to include the highway-type tire.

ACKNOWLEDGMENT

The author wishes to acknowledge assistance received in this endeavor from Messrs. J. M. Almand, L. R. Gill, W. G. Hill, W. K. Klamp, W. C. Macklem, J. G. Manchetti and M. Ramos of the United States Rubber Tire Company.

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1. CONTRACT OBJECTIVES

1.1 Phase I

To supply thirty (30) nylon radial carcass, belted tread design 11.00-20 tires designed to provide increased performance over tires previously supplied on Contract DA 20-018-ORD-20440. The breaker and carcass ply stocks are of a natural rubber composition and the tread of synthetic rubber.

1.2 Phase II

Conduct a radial ply tire design investigation into the larger tire size (16-20) with low profile construction and to perform a feasibility study of the replaceable tread tire concept in the 11.00-20 size tire.

2. SUMMARY

2.1 Phase I - 11.00-20 Integral Tires

Field test results of the 11.00-20 integral tires indicated an improvement in performance over tires previously tested. However, with the increased mileage a sidewall cracking deficiency was noted. We believe that we have a method of correcting this problem as evidenced by the indoor sidewall cracking test results on the 16-20 size tires.

All experimental tires tested prior to shipment passed endurance test requirements.

2.2 Phase II - 16-20 Low Profile Tires

With the information obtained from the test results on Phase I tires, we were prompted to revise the construction features of the 16-20 low profile and 11.00-20 replaceable tread tires.

We proposed and received a contract modification to change from synthetic tread and sidewall stock to a natural rubber compound with a neoprene veneer on the sidewall. This revised construction showed a vast improvement on indoor sidewall cracking test over results obtained with the previous construction.

The initial fourteen (14) 16-20 field evaluation tires were fluoroscoped and some irregular spacing of the cords in the breakers at the splice was found. The quality of these tires was questionable for penetration resistance and tread wear.

It was necessary to rebuild the fourteen (14) field evaluation tires in order to obtain tires with the desired quality level, as determined by visual and fluoroscopic examination, for field testing at Camp Bullis.

To establish the performance level of the tires with irregular spacing in the breaker cords, an agreement was reached with Messrs. Heinrich,

2. SUMMARY (cont'd)

2.2 Phase II - 16-20 Low Profile Tire (cont'd)

Jackson, and Rovers at the Detroit Arsenal to field test seven (7) of the first group of tires.

The 16-20 low profile tactical tire performed exceptionally well on all types of indoor testing. Based on these test results, we feel that this tire is more than adequate to meet the requirements for application to the new family of medium tactical trucks.

2.3 Phase II - 11.00-20 Replaceable Tread Tires

The indoor test results on this tire were very favorable. Although the testing of this tire was limited, there was no displacement of the tread band on the carcass during the test.

2.4 Testing

2.4.1 Indoor Tests

To establish the laboratory performance level of the experimental tires, the following test programs were conducted:

Phase I

Two tests were used - the stepped down inflation test and the 30 mph smooth wheel endurance test.

Phase II - 16-20/10 P.R. Tire

Four tests were used, the 30 mph smooth wheel endurance test, bead adequacy test, sidewall cracking test, and the average breaking energy plunger rupture test.

In addition to the above tests the 16-20/10 P.R. tire was subjected to a hydroburst test to establish the burst strength of the tire.

Phase II - 11.00-20 Replaceable Tread Tire

Testing of this tire was limited to the 30 mph smooth wheel endurance test.

2.4.2 Indoor Endurance Test

The 30 mph smooth wheel stepped up load endurance test was used to evaluate the separation resistance of the 11.00-20 and the 16-20 radial ply tires.

2. SUMMARY (cont'd)

2.4 Testing (cont'd)

2.4.2 Indoor Endurance Test (cont'd)

Loads and inflations for this test were as follows:

	<u>11.00-20</u>	<u>16-20</u>
Test Inflation	50 psi	50 psi
Initial Load	3850#	4125#
Load increment increase at 65 hours and every 24 hours thereafter	350#	375#

The results of the tests which are listed in Table I indicate a vast improvement in the 16-20 low profile tire for breaker and ply separation resistance as compared to 11.00-20 integral tire.

Table I

	<u>Total Hours</u>	<u>Failure</u>	<u>Load at Failure</u>
11.00-20 Integral Tire Radial Ply	201.0	Fabric Fatigue	5450#
16-20 Radial Ply Tire	280.9 263.7	Removed complete " "	7500# 7500#
11.00-20 Replaceable Tread Tire Radial Ply	136.3 106.3	Removed complete " "	4900# 4550#

2.4.3 Sidewall Cracking Tests

The sidewall cracking test for the 16-20 low profile tire was conducted on a smooth wheel. The tire was run at slow speed (25 mph), low inflation (20 psi) and loaded to 3750# (rated tire load).

Two groups of tires were evaluated for sidewall cracking. Group I tires featured a natural rubber sidewall and Group II tires a natural rubber sidewall with a neoprene veneer. The results listed in the following Table II indicate a definite improvement in sidewall cracking resistance with the natural rubber/neoprene veneer combination.

2. SUMMARY (cont'd)

2.4 Testing (cont'd)

2.4.3 Sidewall Cracking Tests (cont'd)

Table II

<u>Group I</u>	<u>Total Hours</u>	<u>Failure</u>
16-20 Radial Tire	(*) 220.0	Sidewall cracking
	(*) 220.0	" "
<u>Group II</u>		
16-20 Radial Tire	272.00	Removed - complete
	272.0	" "

(*) Sidewall cracking was initiated at 110.0 hours. The tires were kept running to study rate of crack growth.

2.4.4 Bead Adequacy Test

To establish the performance level of the 16-20 low profile tires for bead adequacy, two tires were tested on a flat belt machine. The tires were inflated to 35 psi and mounted diametrically opposite on a vertical flat belt. The tires were then over-loaded to 6675# and run at speed of 23 mph. These conditions were designed to produce a flex strain in the bead area of the tire without generating excessive heat in tread.

Results listed in Table III indicate that the performance level of the beads is more than adequate since 200 hours on this test is considered very good.

Table III

	<u>Total Hours</u>	<u>Failure</u>
16-20 Radial Tire	264.7	Removed - complete
	264.7	Slight sidecover separation

2.4.5 Stepped Down Inflation Test

Test conditions for this test are as follows: load 3500#; speed 30 mph; inflation 50, 40, 30, 20, and 10 psi for 24 hours each on a smooth wheel.

One 11.00-20 integral tire was subjected to this test and failed from fabric fatigue one hour after entering the 10 psi phase.

2. SUMMARY (cont'd)

2.4 Testing (cont'd)

2.4.6 Hydroburst Test

A 16-20 tire was subjected to a hydrostatic burst test. The tire failed with a broken bead bundle at 415 psi. The actual burst value agrees with the calculated burst value for this tire.

2.4.7 Plunger Test

Plunger tests were conducted on the 16-20 low profile tire at 35 psi. The average breaking energy was 46,181.28 in.lbs. which is more than ample for rupture resistance for the tire.

3. DISCUSSION

3.1 Tire Design

3.1.1 11.00-20 Integral Tire

In order to meet the objective for Phase I a revised construction of the 11.00-20 radial ply, wire belted tire, as compared to that featured in previous Contract DA 20-018-ORD-20440, was designed. The revised construction featured 6 full plies of 1680/2 denier nylon cord and 2 low angle breakers of 5x7x.0059 flexible steel cable. The sidewall featured a layer of wire loaded stock with a cover of synthetic stock. Chloro-butyl (a stock which is highly resistant to liner cracking) was featured as the liner stock in this construction.

To increase the resistance of tire to rim chafing an SBR-CisBR stock with excellent elongation and flex cracking properties was used as a rim flange strip. An SBR-CisBR/NR cement was used at all tread and sidewall junctions to increase splice opening resistance of the tire.

The six nylon plies provided the required carcass strength and the two wire breakers provided the needed circumferential strength of the tire.

Load deflection curves, Figures 17 and 20, are shown on pages 27 and 30 and engineering data are shown in Table VI.

3.1.2 16-20 Low Profile Tires

From the knowledge gained with the Phase I tires tested at Camp Bullis, the 16-20 radial ply tire was designed to provide a tire with increased sidewall cracking resistance.

The construction of this tire featured 6 full plies of 1680/2 denier nylon cord and 2 low angle breakers of 5x7x.0059 flexible

3. DISCUSSION (cont'd)

3.1 Tire Design (cont'd)

3.1.2 16-20 Low Profile Tires (cont'd)

steel cable. The sidewall featured a layer of wire loaded stock covered by a natural rubber sidewall with a neoprene veneer. Six nylon plies and two wire breakers provided the required structural strength of the tire. A chlorobutyl liner was featured in this construction also. The neoprene veneer reduces checking and sidewall cracking (see Sidewall Cracking Test Results).

Since the 16-20 size tire was entirely new, experimental tires were required to verify constructions.

Load deflection curves, Figures 18 and 21, are shown on pages 28 and 31 and engineering data are shown in Table VI.

3.1.3 11.00-20 Replaceable Tread Tire

The carcass construction features of the 11.00-20 replaceable tread tire were identical to those of the 16-20 size tire. The tread band featured two circumferentially wound breakers of flexible steel cable to provide maximum restraint of movement of the breaker band on the carcass.

Experimental tires were required to verify the construction.

The initial construction check tire revealed a slight misfit of the tread band and carcass. The carcass rings were modified to provide a more uniform fit or mating of the carcass and tread band.

Load deflection curves, Figures 19 and 22, are shown on pages 29 and 32 and engineering data are shown in Table VI.

3.2 Mold Design

3.2.1 16-20 Low Profile Tire

The tire mold was designed to the low profile principle using a section height to section width ratio of .74. The mold has a 43.950 inch outside diameter, a 15.30 inch cross section and a 15.30 inch crown radius. The tread pattern was similar to the tread designed for the 11.00-20 integral tire, a tactical design with the tread pattern ending at the tread shoulder.

Prints of the mold and letter drawings are included with this report.

3. DISCUSSION (cont'd)

3.2 Mold Design (cont'd)

3.2.2 11.00-20 Replaceable Tread Tire

The 11.00-20 replaceable tread tire mold was designed to produce a carcass and tread band which when assembled would yield a tire of the same dimensions as the 11.00-20 integral tire with an overall diameter of 42.540 inches and a 11.600 inch cross section.

3.3 Rim Design

The rim for the 16-20 size tire was designed for tubed type tires. The rim has a semi-drop center, 12" width, 20" nominal diameter with heel diameter .188" over nominal, 5° tapered bead seat and a modified safety hump to prevent slippage or bead displacement under emergency conditions.

3.4 Fabrication of Tires

3.4.1 Phase I - 11.00-20 Integral Tires

Existing equipment was utilized in the production of the thirty (30) 11.00-20 integral tires for this phase of the contract. No manufacturing difficulties were encountered.

3.4.2 Phase II - 16-20 Low Profile Tires

The only special equipment required to produce the 16-20 size tire was a tire mold. Curing bags and toe rings available from a previous government contract were used in the manufacturing of these tires.

Building procedures, shaping bagging and curing of the 16-20 low profile tires were similar to those for radial ply tires previously produced for highway service.

3.4.3 Phase II - 11.00-20 Replaceable Tread Tires

Equipment needed to manufacture the 11.00-20 replaceable tread tires comprised a tire mold, carcass rings, drum building core, segmented tread rim and one bottom toe ring.

The breakers for this tire were circumferentially wound. No preshaping of the carcass was necessary prior to cure.

A slight recut of the carcass rings was necessary to provide a tighter fit of the carcass to the tread band (see mold profile attached to this report which shows recut).

3 DISCUSSION (Cont'd)

3.5 Tubes

16-20 size tubes were supplied in compliance with applicable requirements of Government Specification ZZI-550. Tube weight was 15 lbs.

Although flaps were supplied, the design of the 16-20 tire beads and the rim seat permitted tubed tire operation without the use of flaps.

3.6 Tire Mounting

In Phase II mounting checks were made on the 16-20 tire on the rim designed for this vehicle by Ford Motor Company. Mounting and dismounting were satisfactory.

As a safety precaution 40 psi should not be exceeded during tire mounting.

3.7 Measurements

The measurements taken in conjunction with the test program were load deflection curves, vertical spring rates, tread pressures, footprints, weight, cross section, outside diameter, loaded radius, rolling radius and gross and net contact areas.

Table IV lists all measurements taken on the specified tires. The pages which follow contain Figures 8 through 22 which are the load deflection curves, footprints, tread pressures and closed loop load deflection or spring rate curves.

Table IV

<u>Measurement</u>	<u>11.00-20</u> <u>Integral</u>	<u>16-20</u>	<u>11.00-20</u> <u>Rep.Trd.</u>
Gross Section	13.79	16.92	13.84
Outer Diameter	42.50	43.85	42.59
Loaded Radius	19.25	20.19	19.39
Tread Width	8.09	10.41	8.39
Deflection at 3750# load and 35 psi inflation	2.004	1.788	1.902

3. PHYSICAL PROPERTIES

3.7 Measurements (cont'd)

Table V

<u>Measurement</u>	<u>11.00-20 Integral</u>	<u>16-20</u>	<u>11.00-20 Rep.Trd.</u>
Vertical Spring Rate at 3750# load and 35 psi inflation	2315#/in.	2604#/in.	2399#/in.
Weight	201# 2 oz.(1)	241# 10 oz.(1)	210# 2 oz.(1)
Rim	8.00	12.00	8.00

(1) Includes weight of tire, rim, tube and flap.

Table VI

Engineering data of the 11.00-20 integral 16-20 low profile, and the 11.00-20 replaceable tread tires.

	<u>11.00-20 Integral</u>	<u>16-20</u>	<u>11.00-20 Rep.Trd.</u>
Load (lbs.)	3500	3750	3500
Inflation (psi)	30	35	30
Rim Dimensions (Diameter and Width)	20x8.0	20x12.0	20x8.0
Max. Cross Section (in.)	12.17	15.84	12.27
Overall Diameter (in.)	42.50	43.85	42.59
Mold Antiskid (in.)	.65	.67	.65
Loaded Radius (in.)	19.25	20.19	19.39

3.8 Weight Data

Tire and rim assembly weights were as follows:

	<u>11.00-20 Integral</u>	<u>16-20</u>	<u>11.00-20 Rep.Trd.</u>
Tire	117#	158#	119#
Tube	10# 10 oz.	14# 6 oz.	10# 10 oz.
Flap	6# 0 oz.	8# 4 oz.	6# 0 oz.
Rim	73# 8 oz.	61# 0 oz.	73# 8 oz.

4. CONCLUSIONS AND RECOMMENDATIONS

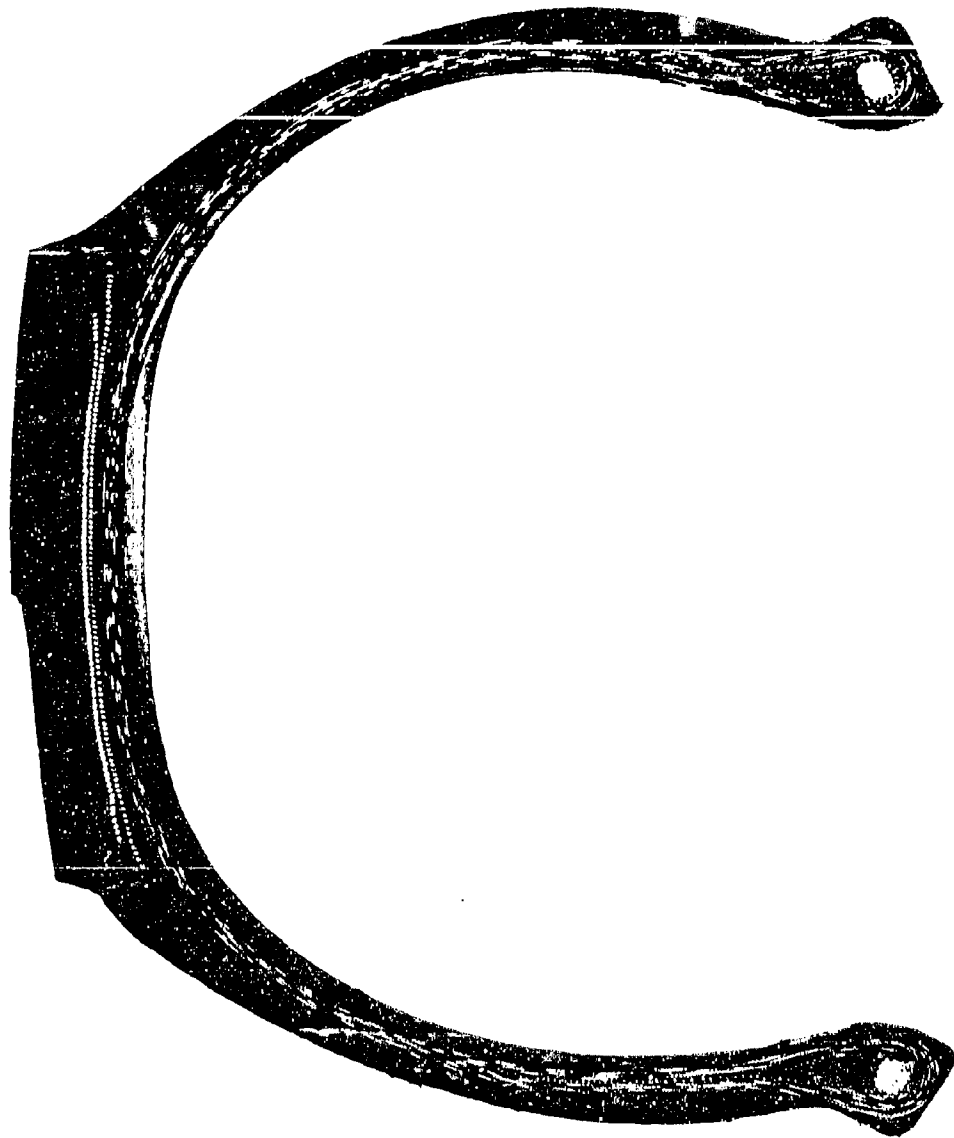
The following conclusions can be based on laboratory measurements, indoor testing and field testing information gained on this contract.

4.1 Phase I

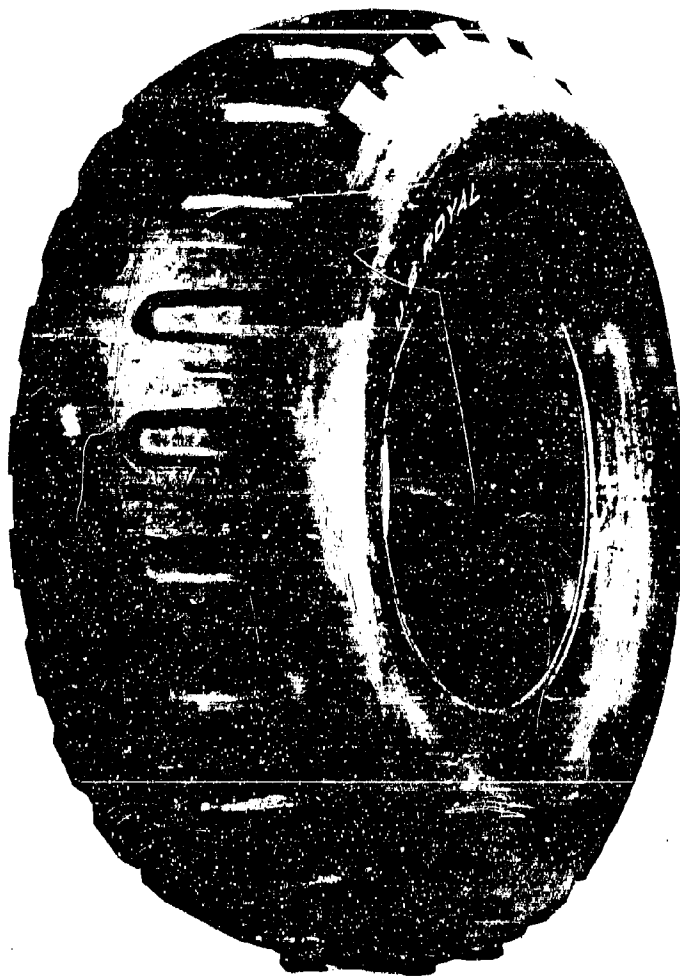
1. The 11.00-20 integral tires performed better on indoor tests than tires previously supplied for field testing.
2. A definite improvement was realized in the 11.00-20 integral tires for circumferential splice opening and liner cracking resistance.
3. An advantage for tread wear traction and puncture resistance for the radial ply tires was indicated by the performance of the tires tested at Camp Bullis.
4. The 11.00-20 integral radial ply wire-belted tire showed a sidewall cracking deficiency during field testing; however, we believe this problem has been corrected.

4.2 Phase II

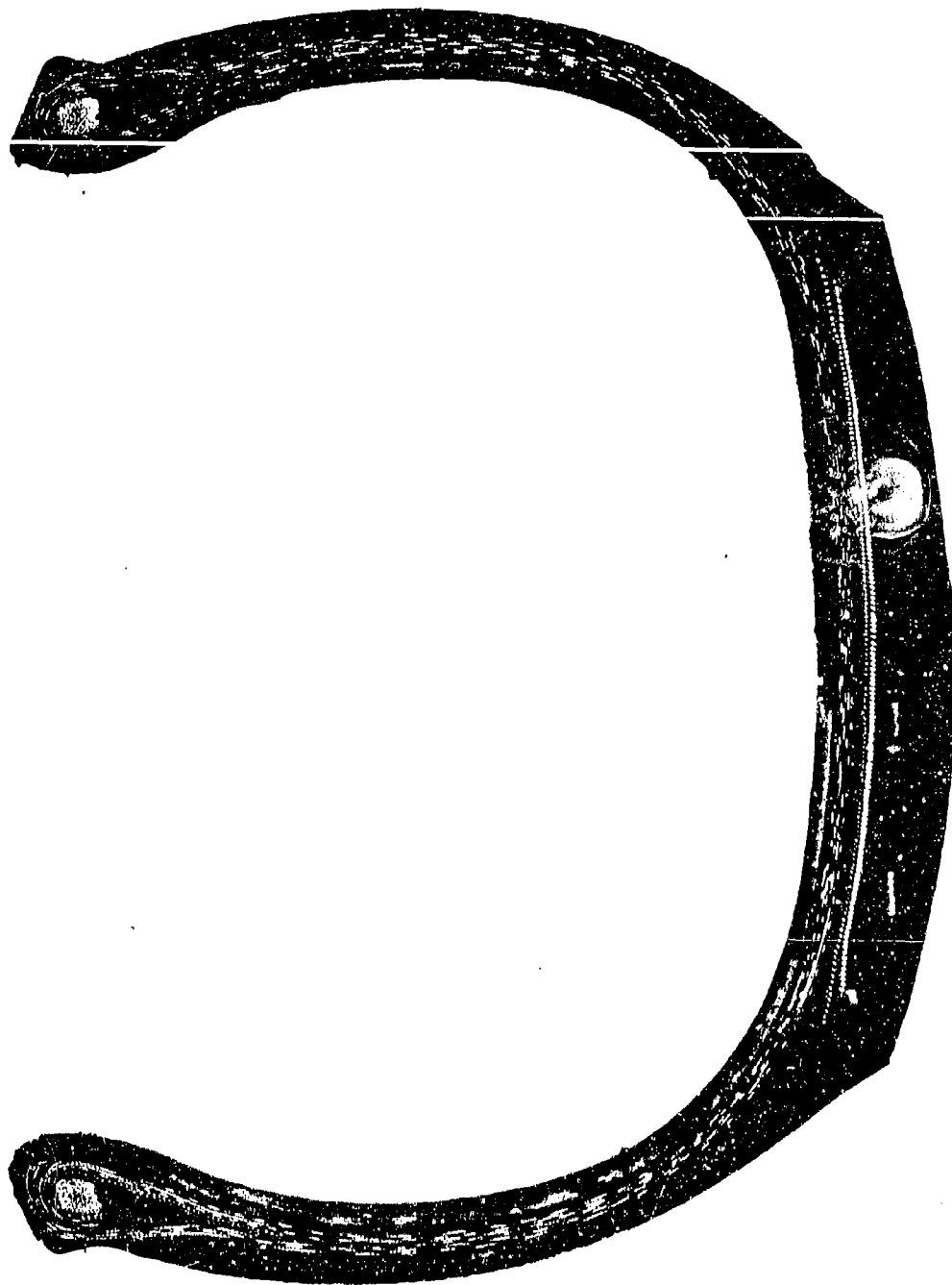
1. Indoor test results indicate that the 16-20 profile tire is more than adequate to meet the demands of the tire.
2. Based on the closed loop deflection curves, the radial ply tactical tires have a low hysteresis loss.
3. The radial ply wire-belted tires afford a more uniformly distributed load in the deflected area.
4. Indoor test results were very favorable for the replaceable tread tire.
5. It is recommended that the feasibility study of the replaceable tread concept be expanded to include the highway type tire.
6. It should be noted that the sidewall cracking resistance of the 16-20 low profile radial ply tire was greatly improved with a natural rubber neoprene veneer sidewall construction. We believe this type sidewall construction would have increased the sidewall cracking resistance of the 11.00-20 integral tires tested at Camp Bullis.



11.00-20
INTEGRAL TIRE SECTION
FIGURE 1



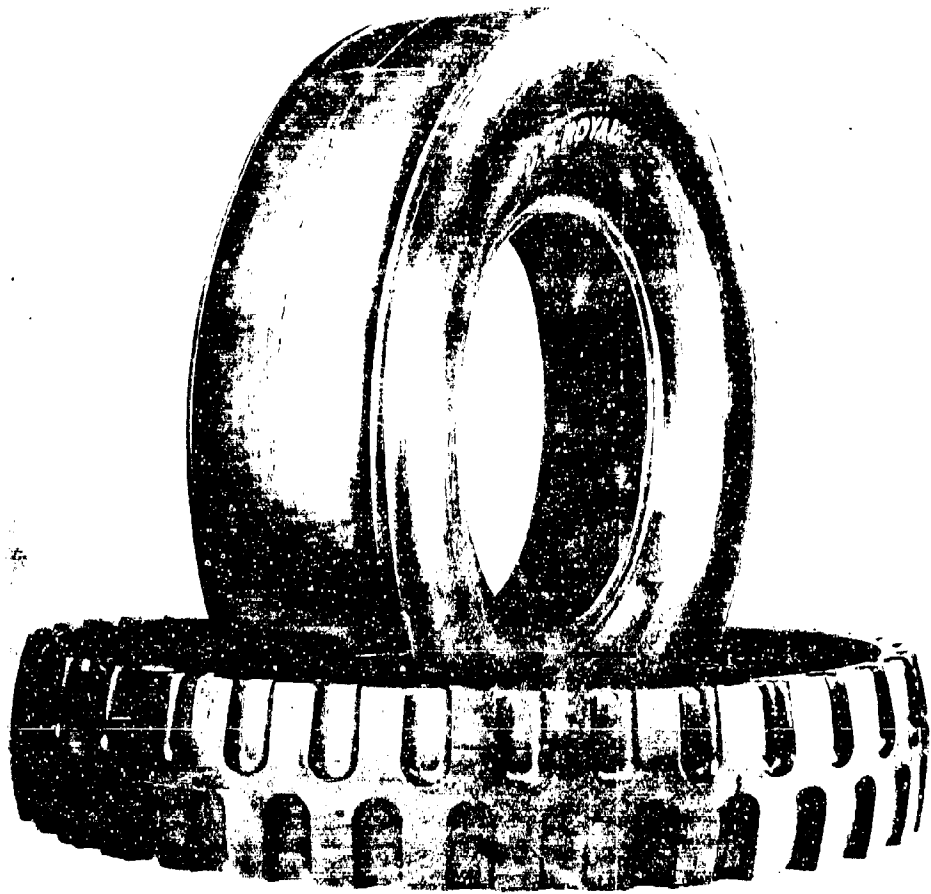
16-20
LOW PROFILE RADIAL PLY TIRE
FIGURE 2



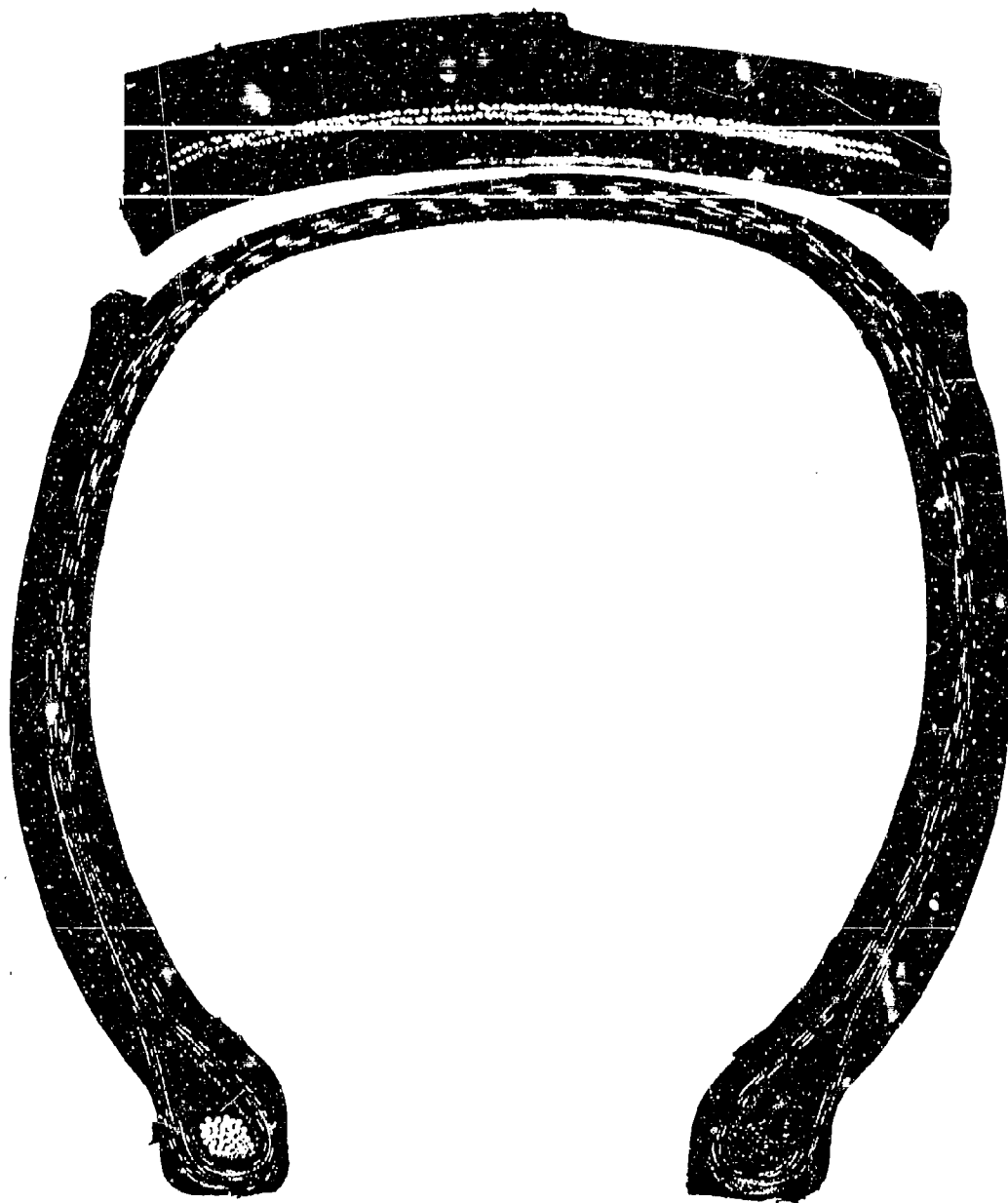
16-20
LOW PROFILE RADIAL PLY TIRE SECTION
FIGURE 3



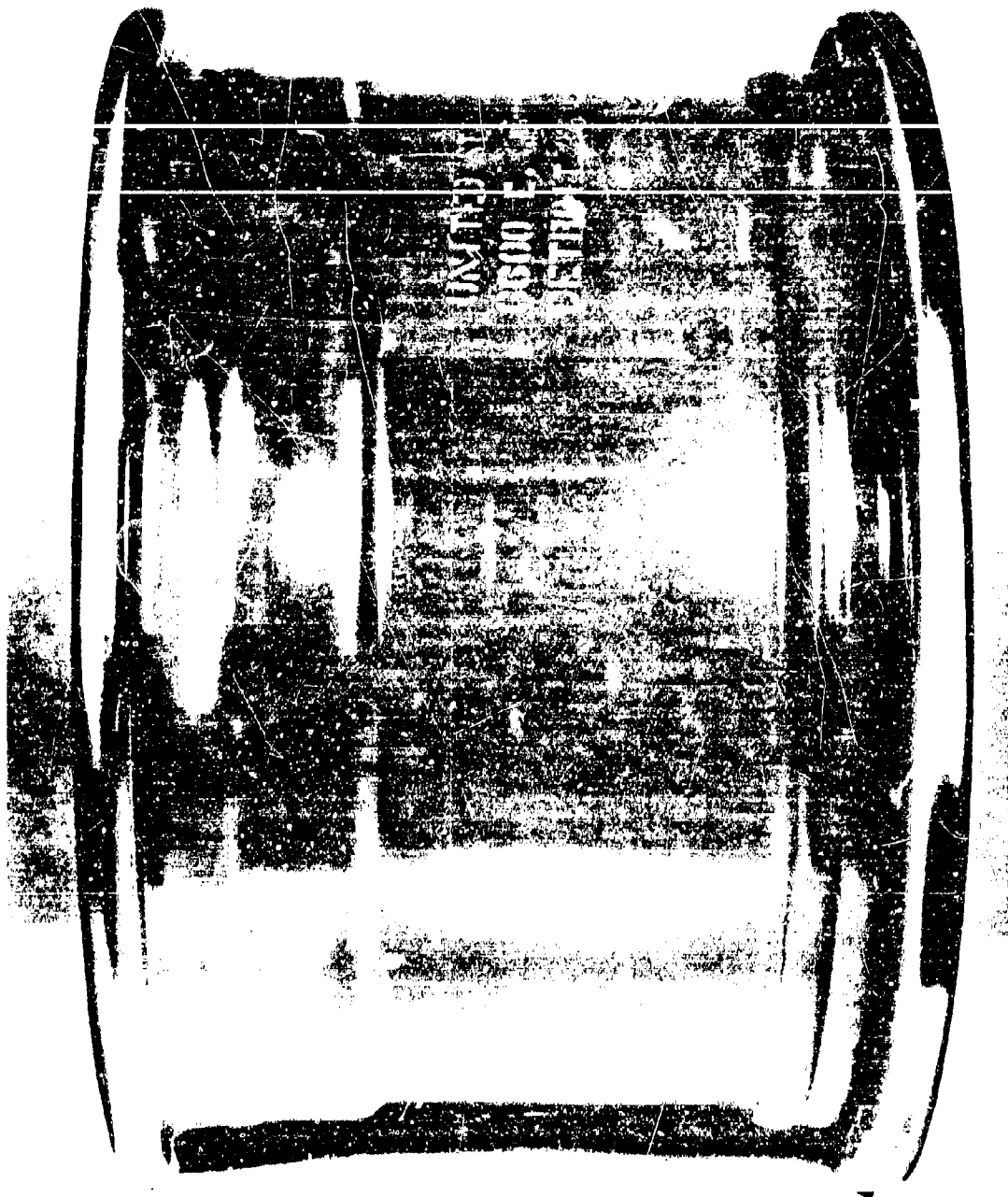
11.00-20
REPLACEABLE TREAD TIRE
FIGURE 4



11.00 20
REPLACEABLE TREAD AND CARCASS
FIGURE 5



11. 00-20
REPLACEABLE TREAD TIRE SECTION
FIGURE 6



MODIFIED SAFETY HUMP. SEMI-DROP CENTER RIM
20 x 12.00 for 16-20/10 P.R. NDCC RADIAL PLY LOW PROFILE TIRE

Figure 7

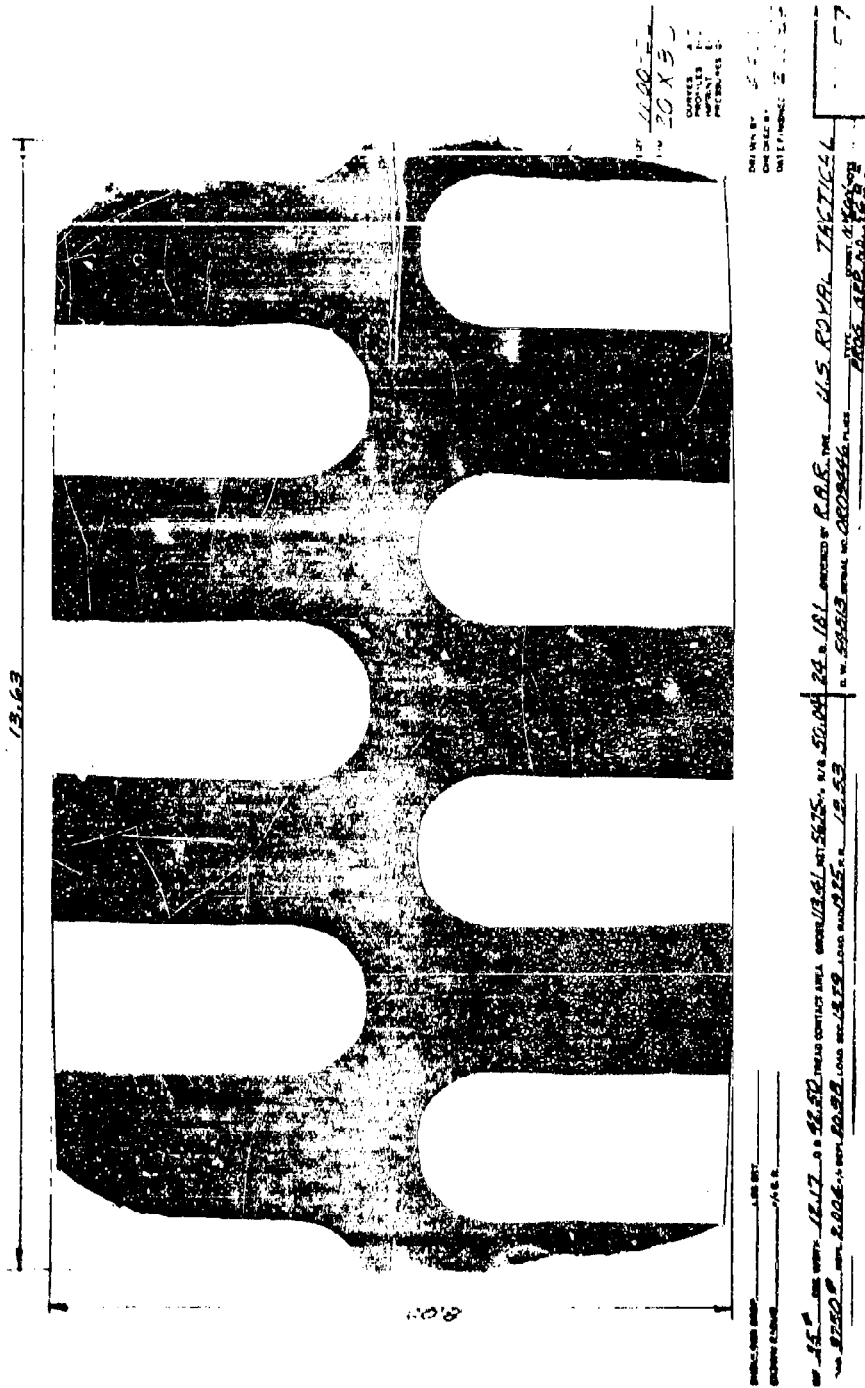
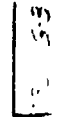


FIGURE 8

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19

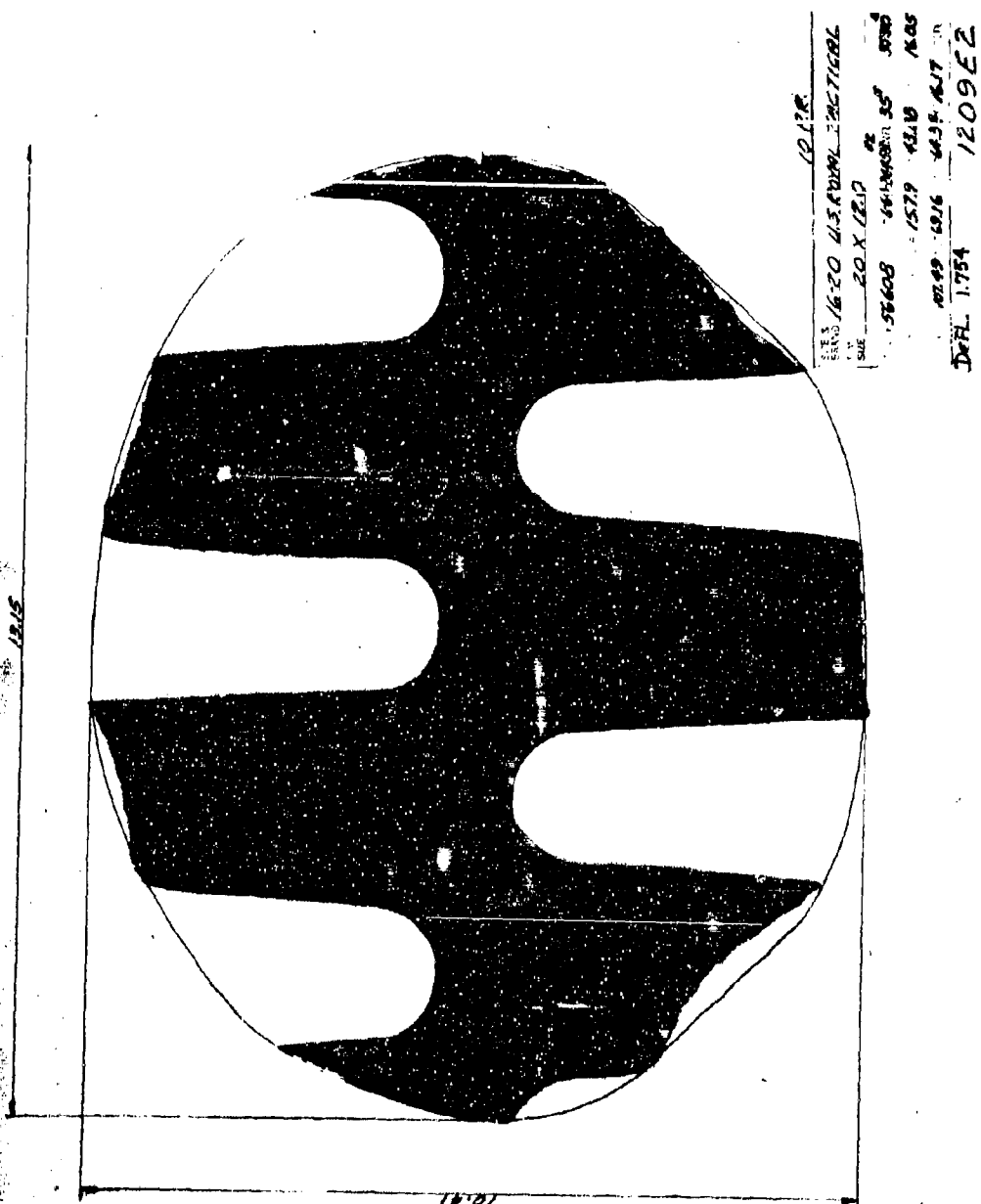


FIGURE 10

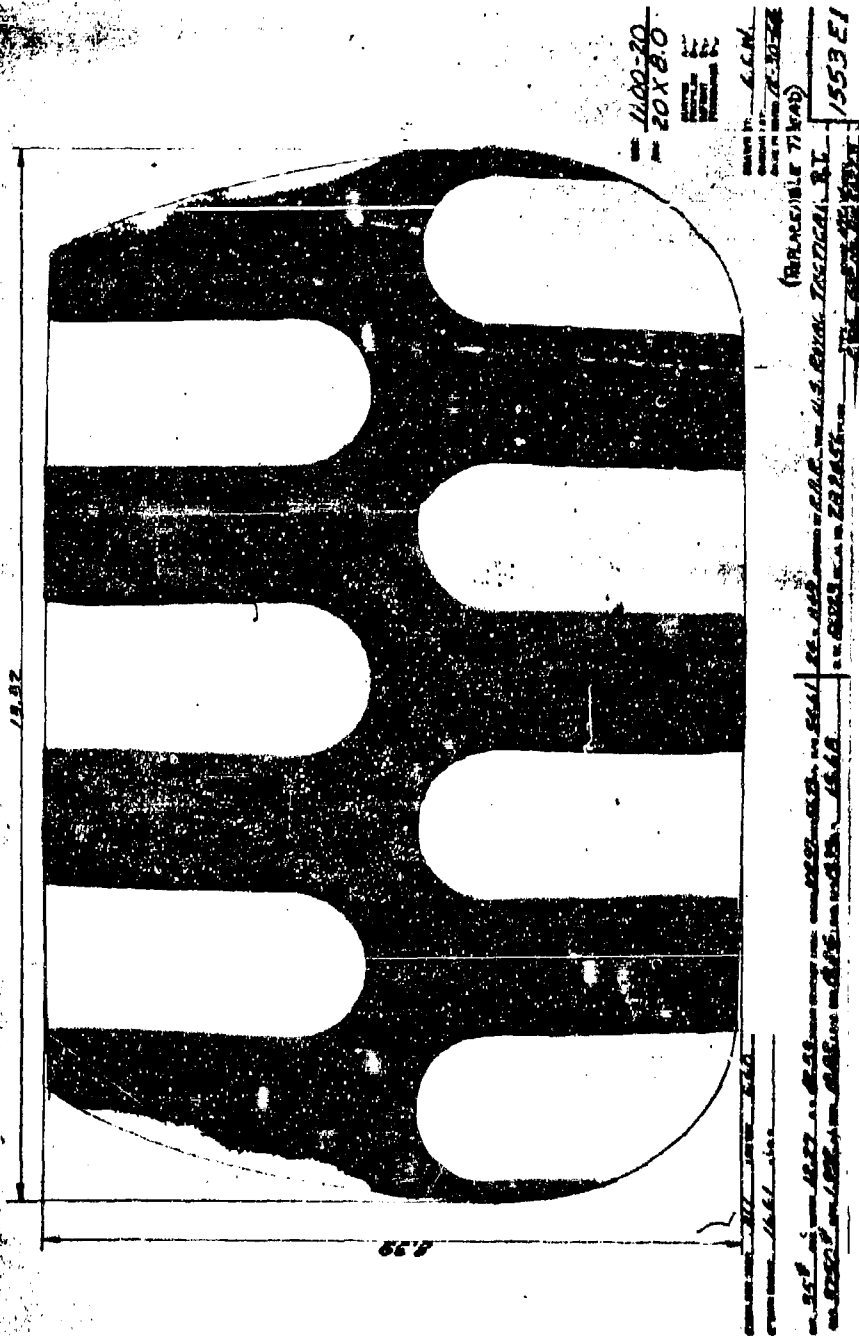


FIGURE 12

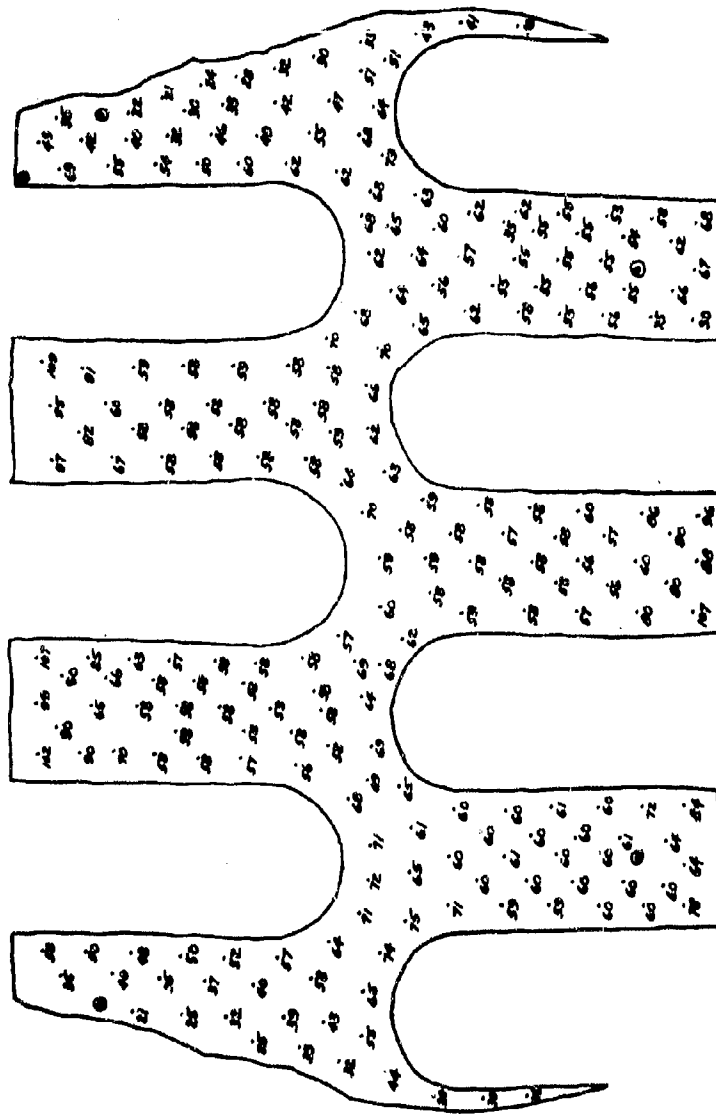


FIGURE 13

DATE 1-20-20
BY 20X80
CARTER
CARTER
CARTER

DATE 1-20-20
DATE 1-20-20
DATE 1-20-20

15-354

RECEIVED 1-20-20
DATE 1-20-20
DATE 1-20-20

RECEIVED 1-20-20
DATE 1-20-20
DATE 1-20-20

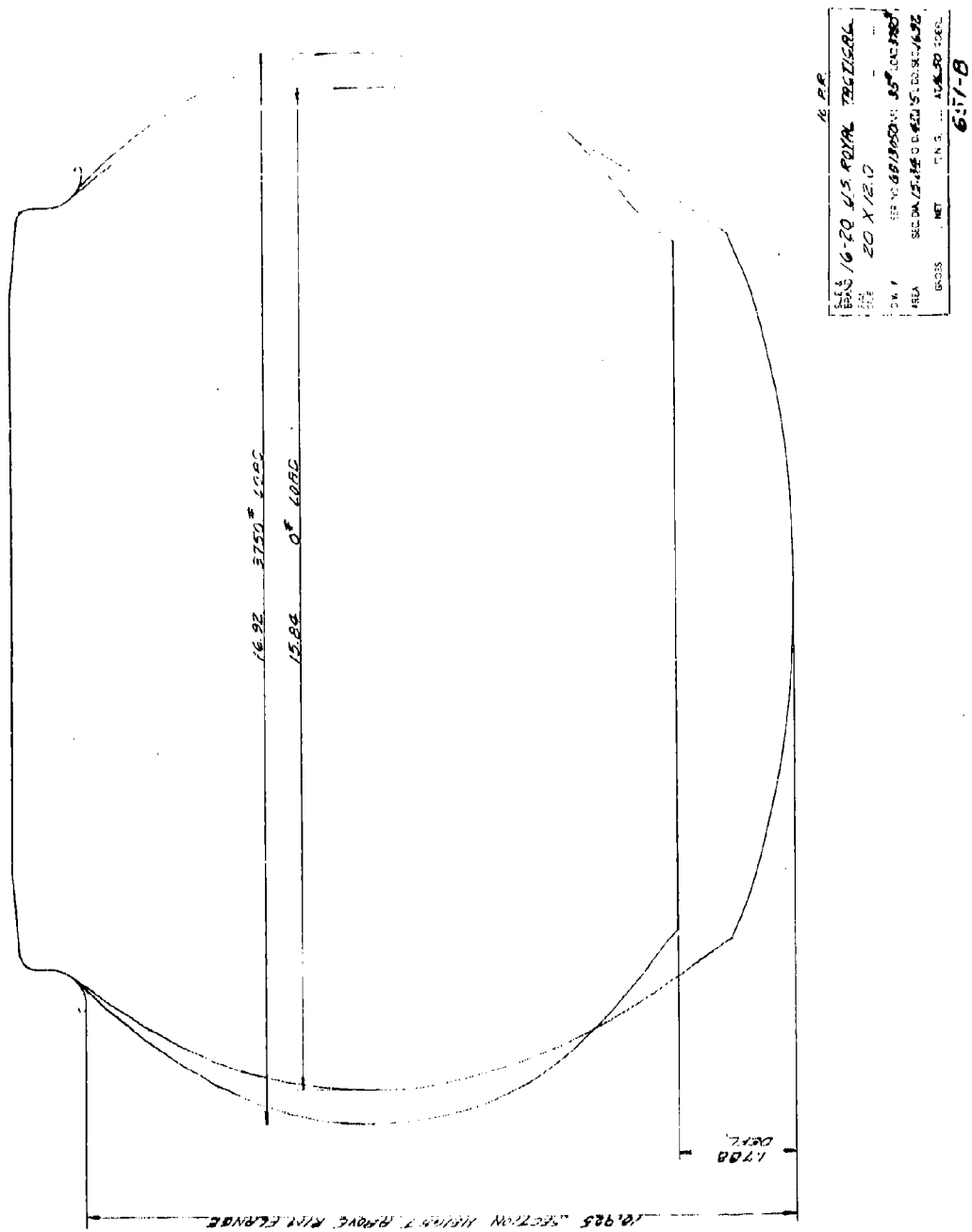
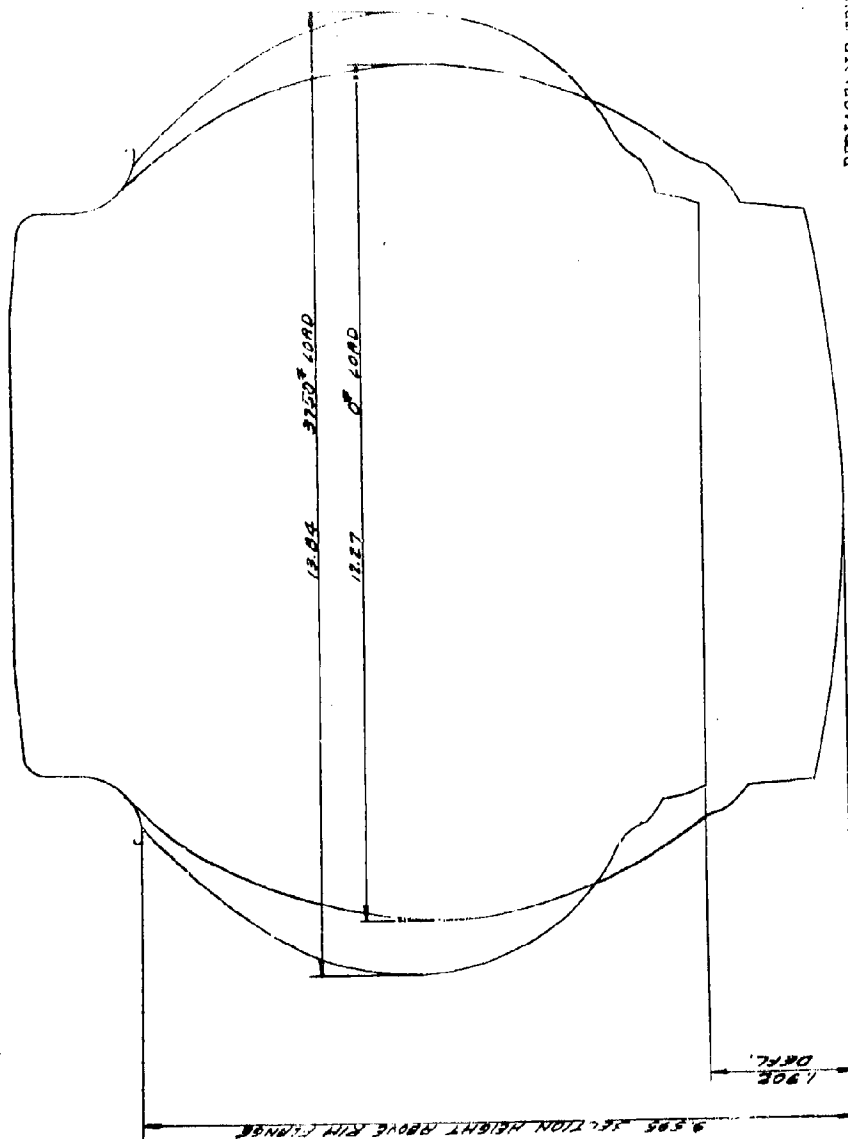


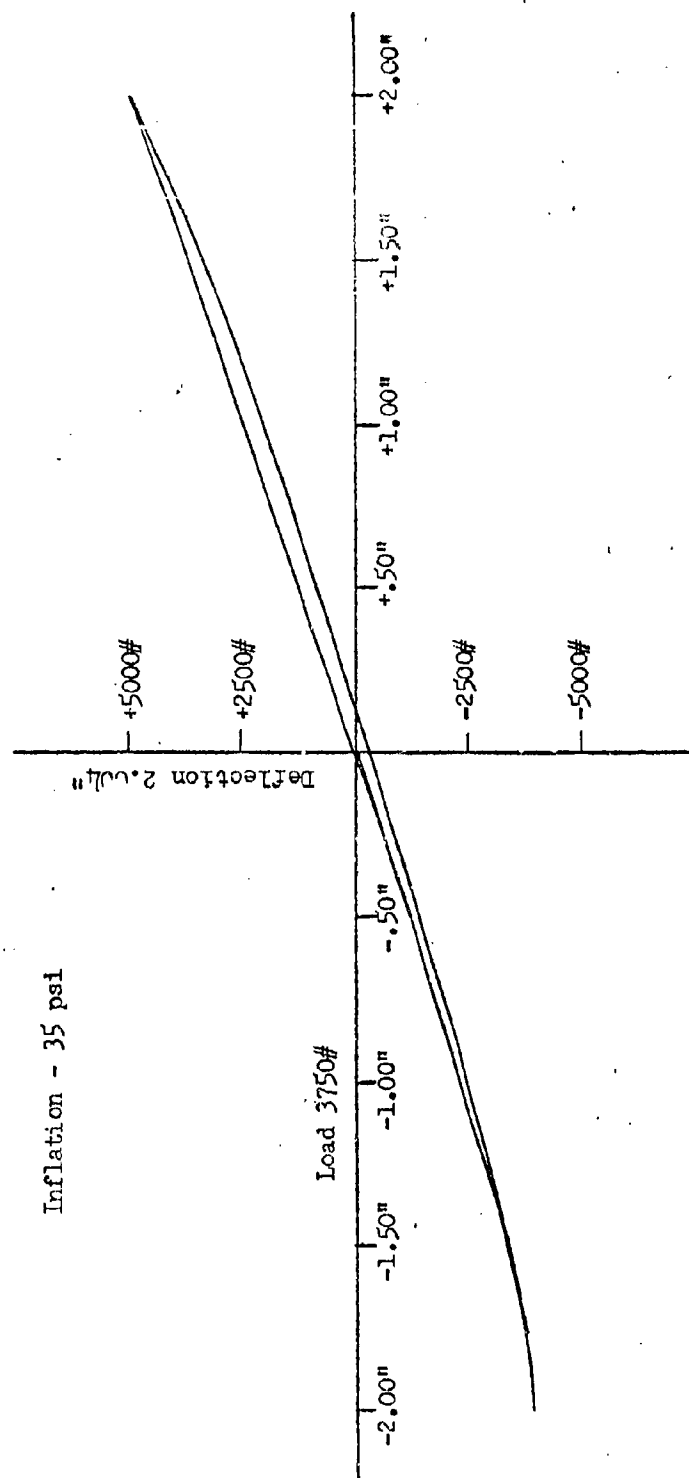
FIGURE 15



REPLACEABLE TRAIL TIRE

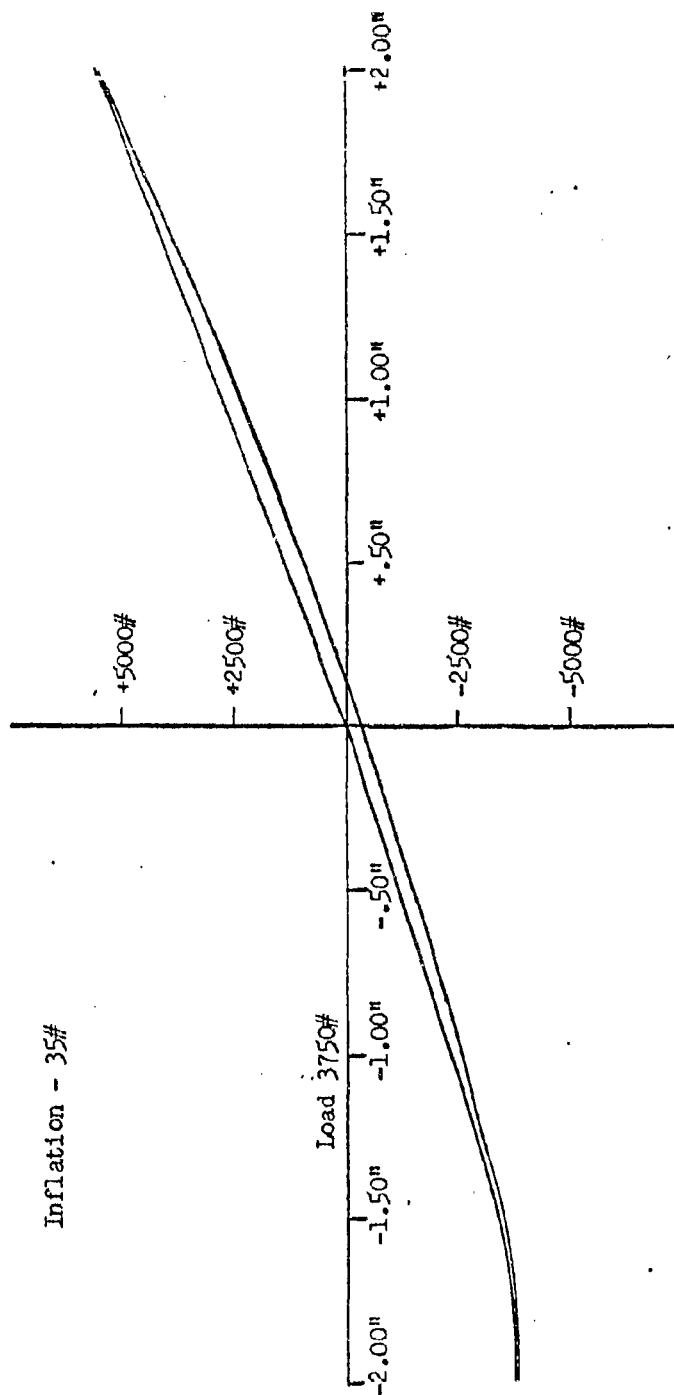
1100-20 U.S. ARMY TACTICAL
20 X 80
56223 282456 55 3000
1127 41:53 16.00
1127 41:53 16.00
1127 41:53 16.00
1558-8-1

FIGURE 16



Closed Loop Load
Deflection Curve for the
U. S. Royal Radial
Tactical Integral Tire
Nylon Carcass (6 Ply) Wire Belt
11.00-20/12P.R.

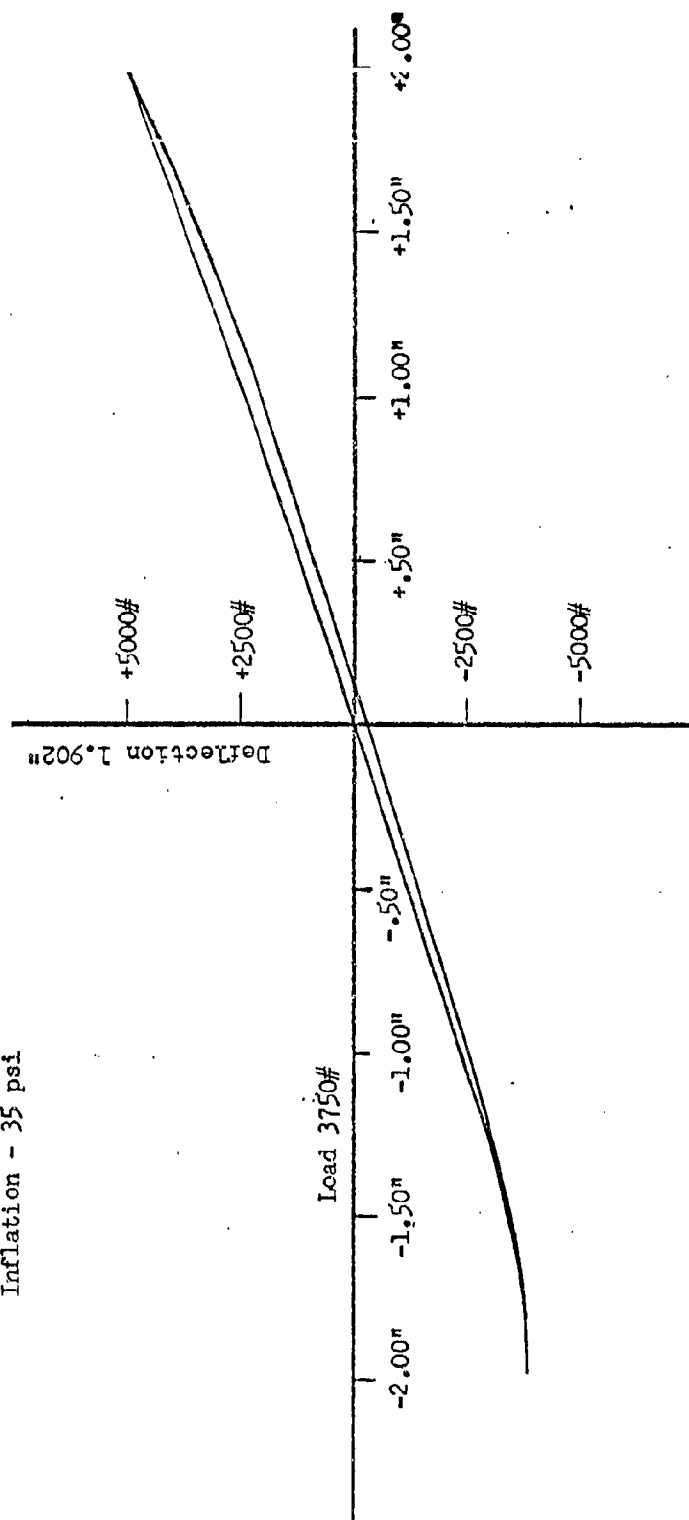
Figure 17



Closed Loop Load
Deflection Curve for the
16-20/10P.R. U.S. Royal Radial Tactical
Nylon Carcass (6Ply) Wire Belt

Figure 18

Inflation - 35 psi



Closed Loop Load
 Deflection Curve for the
 U.S. Royal Radial Tactical
 Replaceable Tread Tire
 Nylon Carcass (6 Ply) Wire Belt
 11.00-20/12P.R.

Figure 19

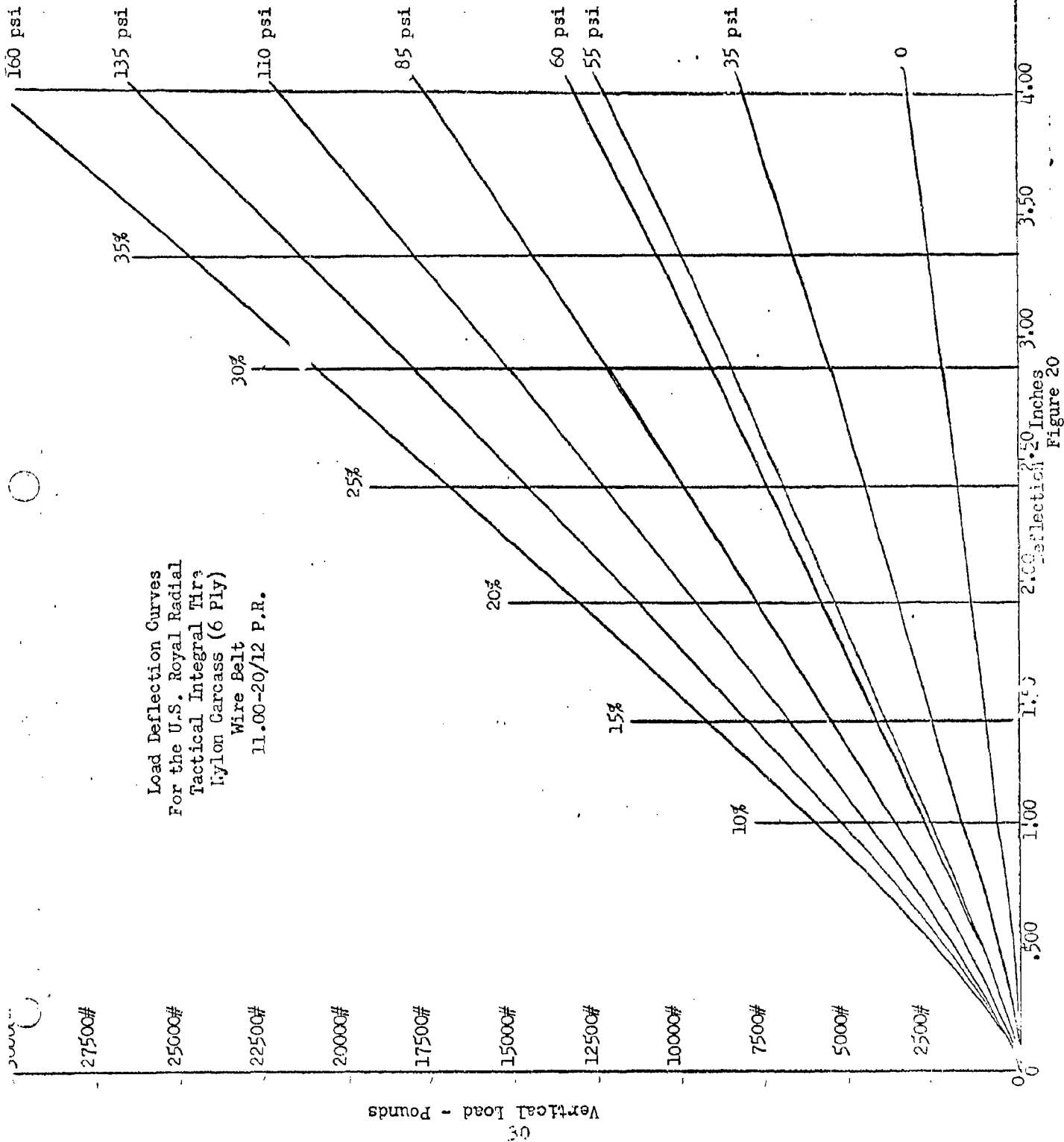


Figure 20

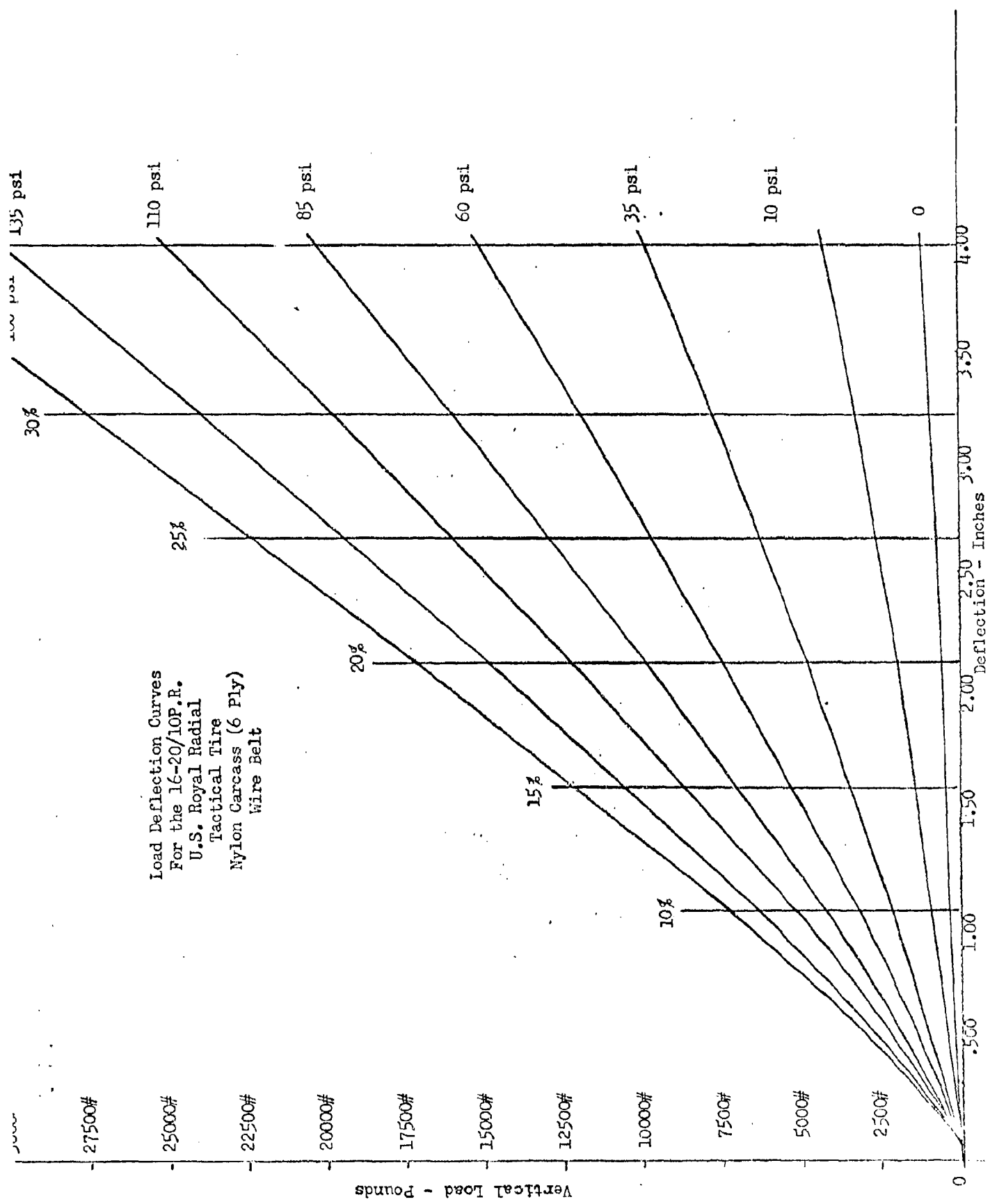
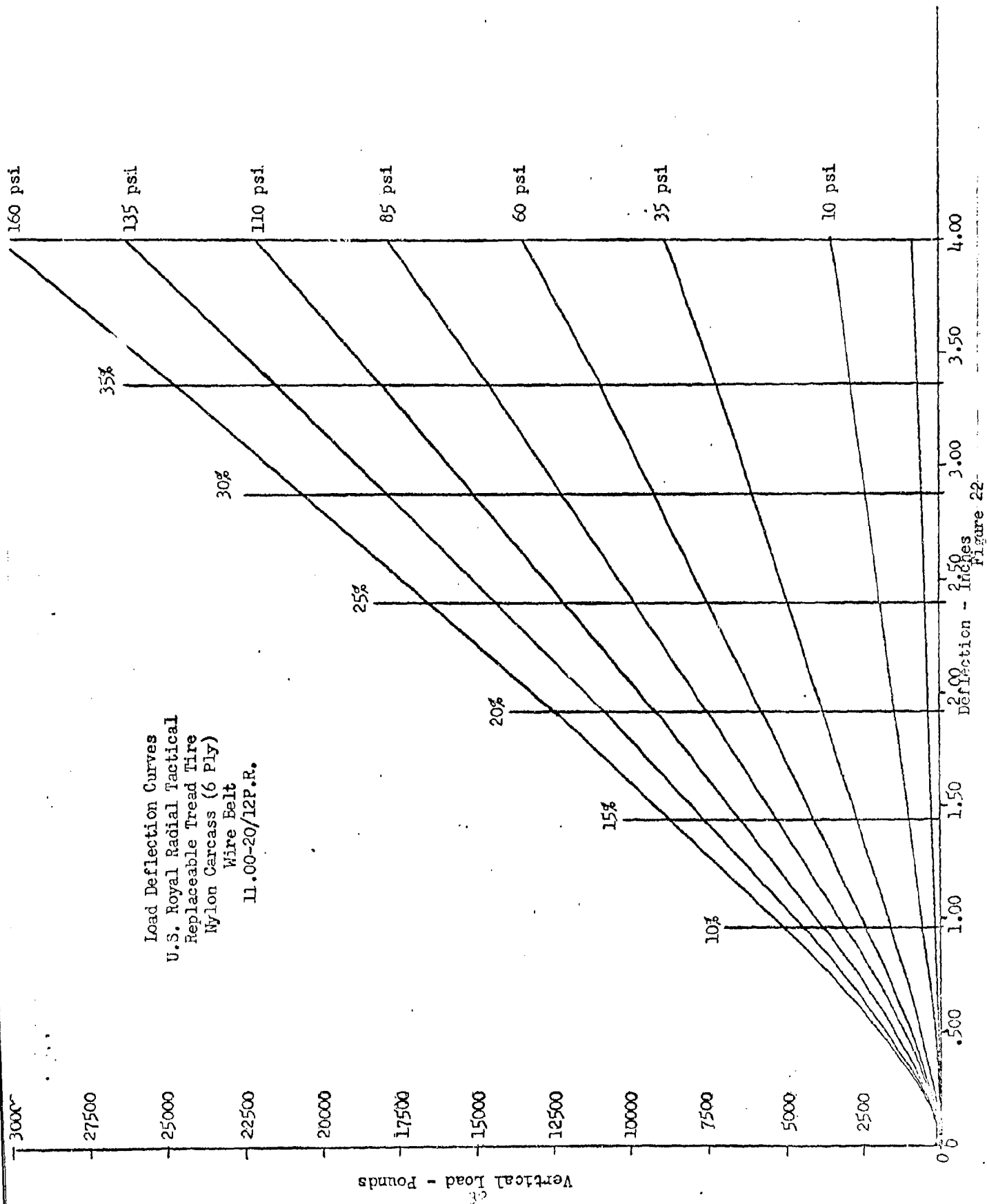


Figure 21



AD

ACCESSION NO.

U. S. Rubber Tire Co., Detroit, Michigan
Development of Tires for the New Family of Medium
Tactical Trucks, R. A. Reichert/E. D. Rogers-ATAC
Final Report Phases I and II
Contract No. DA 20-018-AMC-0585T
Phase I - Field testing of the 11.00-20 tires under
the direction of the Army Tank Automotive Center
revealed a much improved performance over previous
radial tires tested.
Phase II - Conduct a radial ply tire evaluation of
the 16-20 size tire featuring a wide base, low profile
tire design. Perform a feasibility study of the
tire concept in the 11.00-20 size tire, using a radial
ply carcass construction in combination with a
removable tread.

AD

ACCESSION NO.

U. S. Rubber Tire Co., Detroit, Michigan
Development of Tires for the New Family of Medium
Tactical Trucks, R. A. Reichert/E. D. Rogers-ATAC
Final Report Phases I and II
Contract No. DA 20-018-AMC-0585T
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radial tires tested.
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the 16-20 size tire featuring a wide base, low profile
tire design. Perform a feasibility study of the
tire concept in the 11.00-20 size tire, using a radial
ply carcass construction in combination with a
removable tread.

AD

ACCESSION NO.

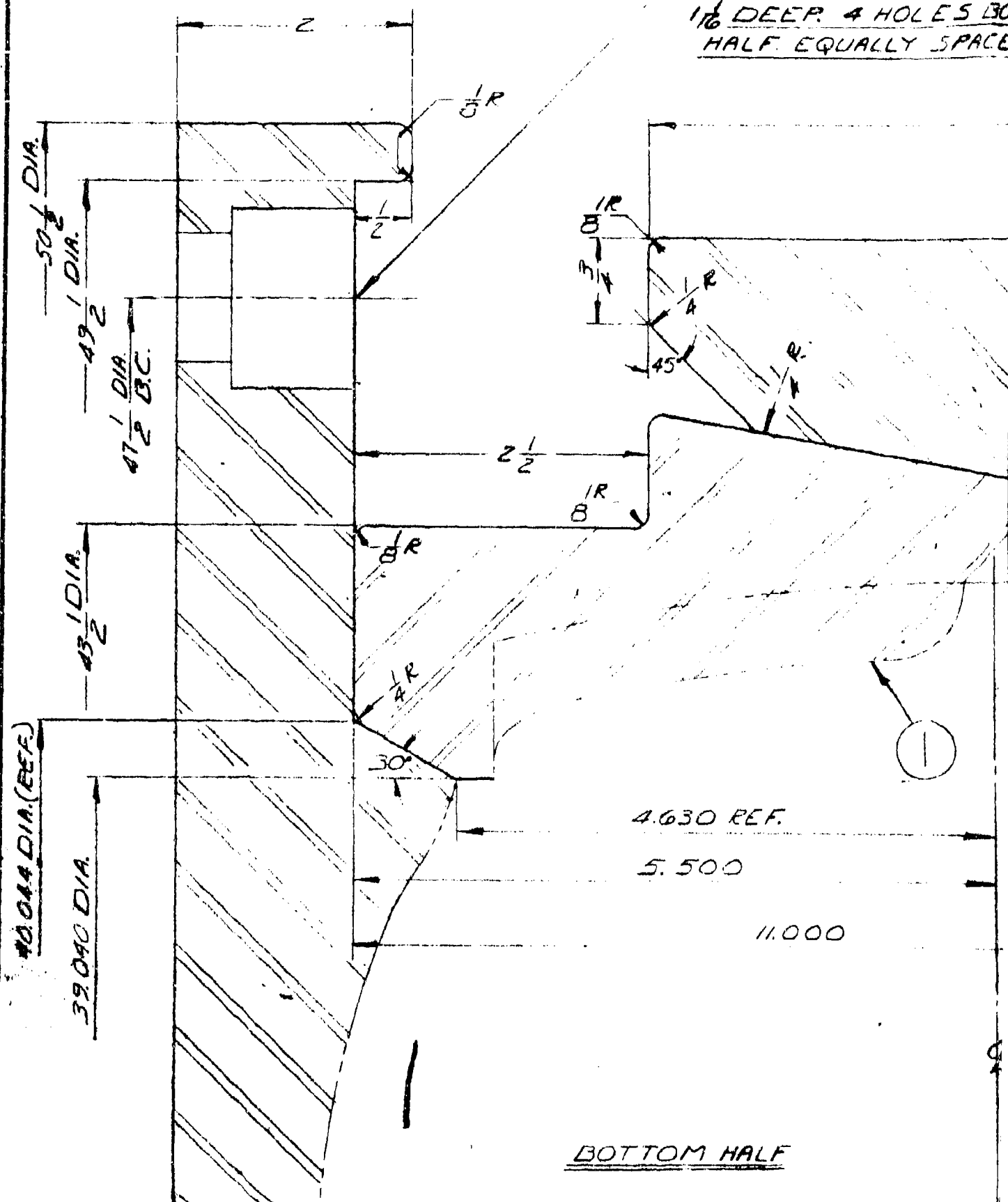
U. S. Rubber Tire Co., Detroit, Michigan
Development of Tires for the New Family of Medium
Tactical Trucks, R. A. Reichert/E. D. Rogers-ATAC
Final Report Phases I and II
Contract No. DA 20-018-AMC-0585T
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the direction of the Army Tank Automotive Center
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the 16-20 size tire featuring a wide base, low profile
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ply carcass construction in combination with a
removable tread.

AD

ACCESSION NO.

U. S. Rubber Tire Co., Detroit, Michigan
Development of Tires for the New Family of Medium
Tactical Trucks, R. A. Reichert/E. D. Rogers-ATAC
Final Report Phases I and II
Contract No. DA 20-018-AMC-0585T
Phase I - Field testing of the 11.00-20 tires under
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radial tires tested.
Phase II - Conduct a radial ply tire evaluation of
the 16-20 size tire featuring a wide base, low profile
tire design. Perform a feasibility study of the
tire concept in the 11.00-20 size tire, using a radial
ply carcass construction in combination with a
removable tread.

- 1/8" DRILL THRU - 1 9/16" C
1 1/16" DEEP. 4 HOLES BO
HALF EQUALLY SPACE



1 9/16 C'BORE
5 BOTTOM
PALED.

STAMP O.D. OF
SIZE - TYPE - DI

7 3/4

②

1/4

2 1/2

1 R/8

1 R/8

48 DIA.

1/16 X 45°

10°

5/16 X 45°

1/16 X 45°

1 R

30°

39.040
DIA.

40.000 DIA. BC

42.500 DIA.
MP GA 1/5.5187

71.0

£

TOP HALF

2

④

FEACH PART THUS IN 2 PLACES
BRAND-SER. N^o PLY

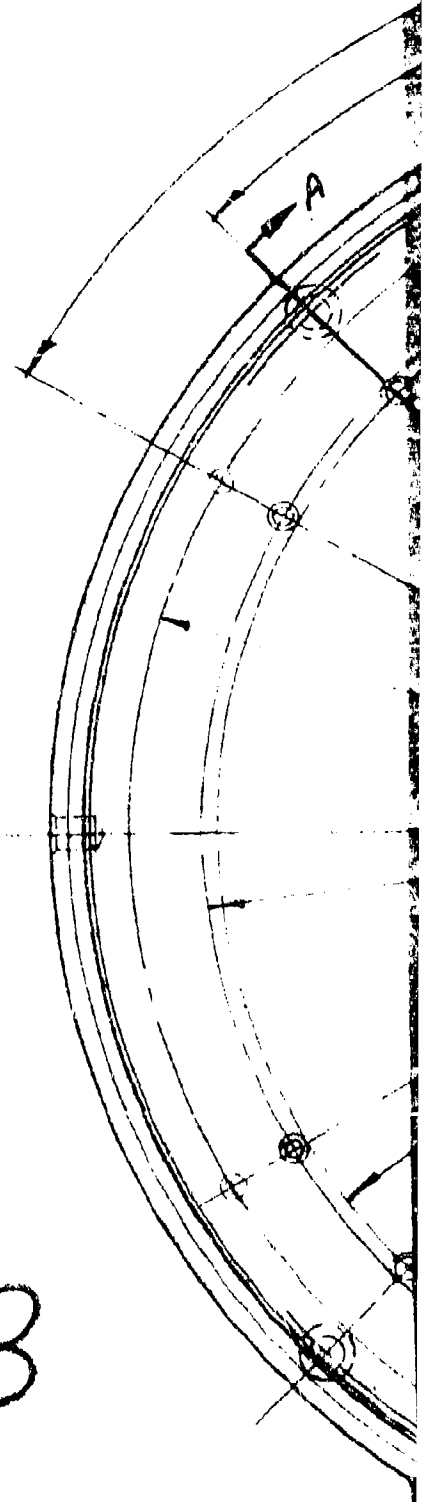
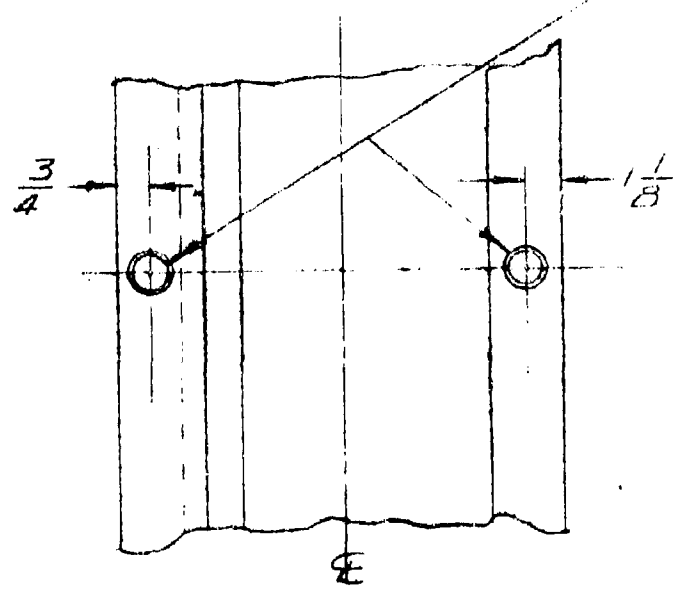
48 1/2 DIA.

44 DIA.

ONE GA 105.55137

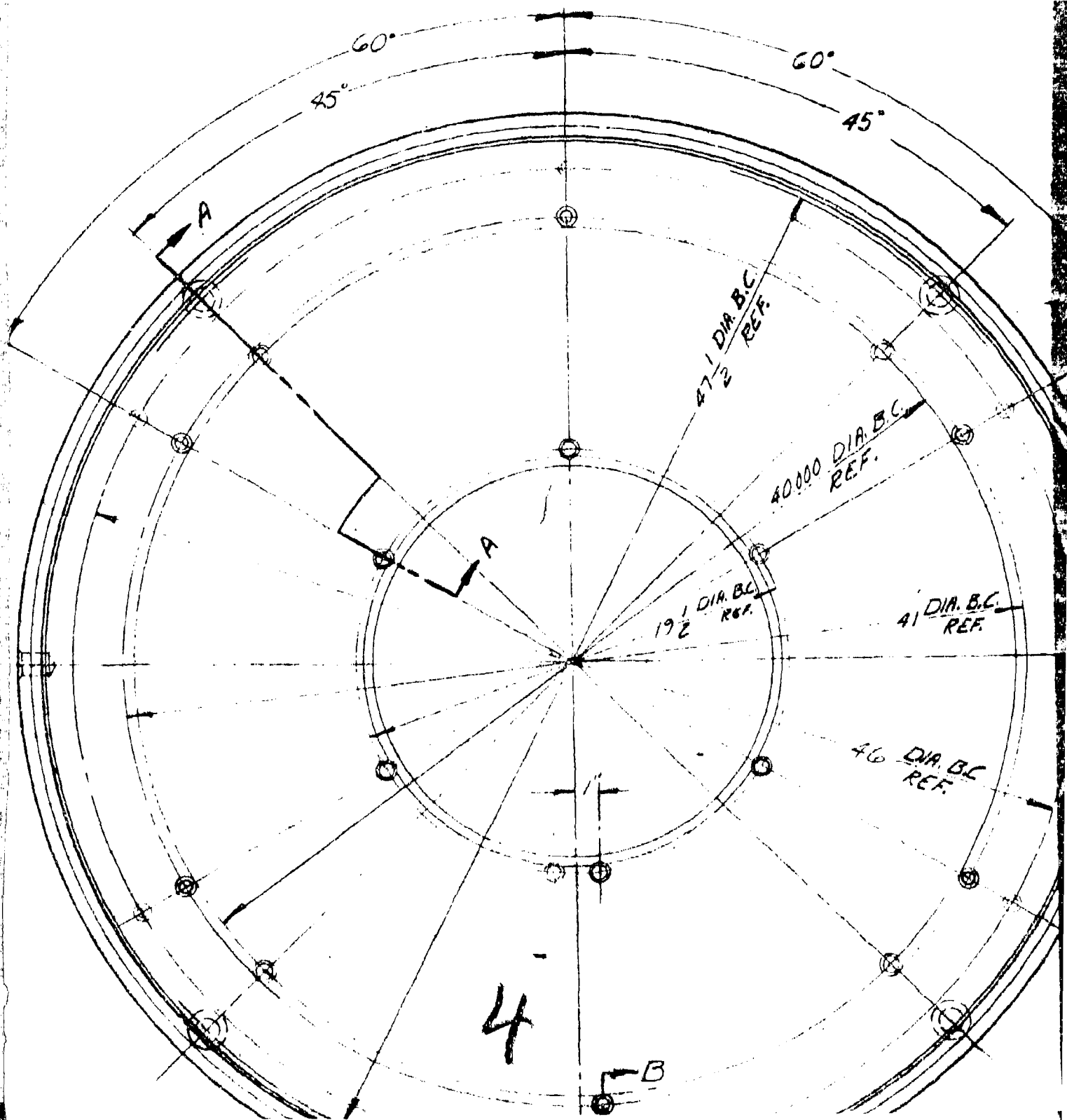
8 N.C. TAP - 1 1/4
DEEP - 4 HOLES
TOP HALF.

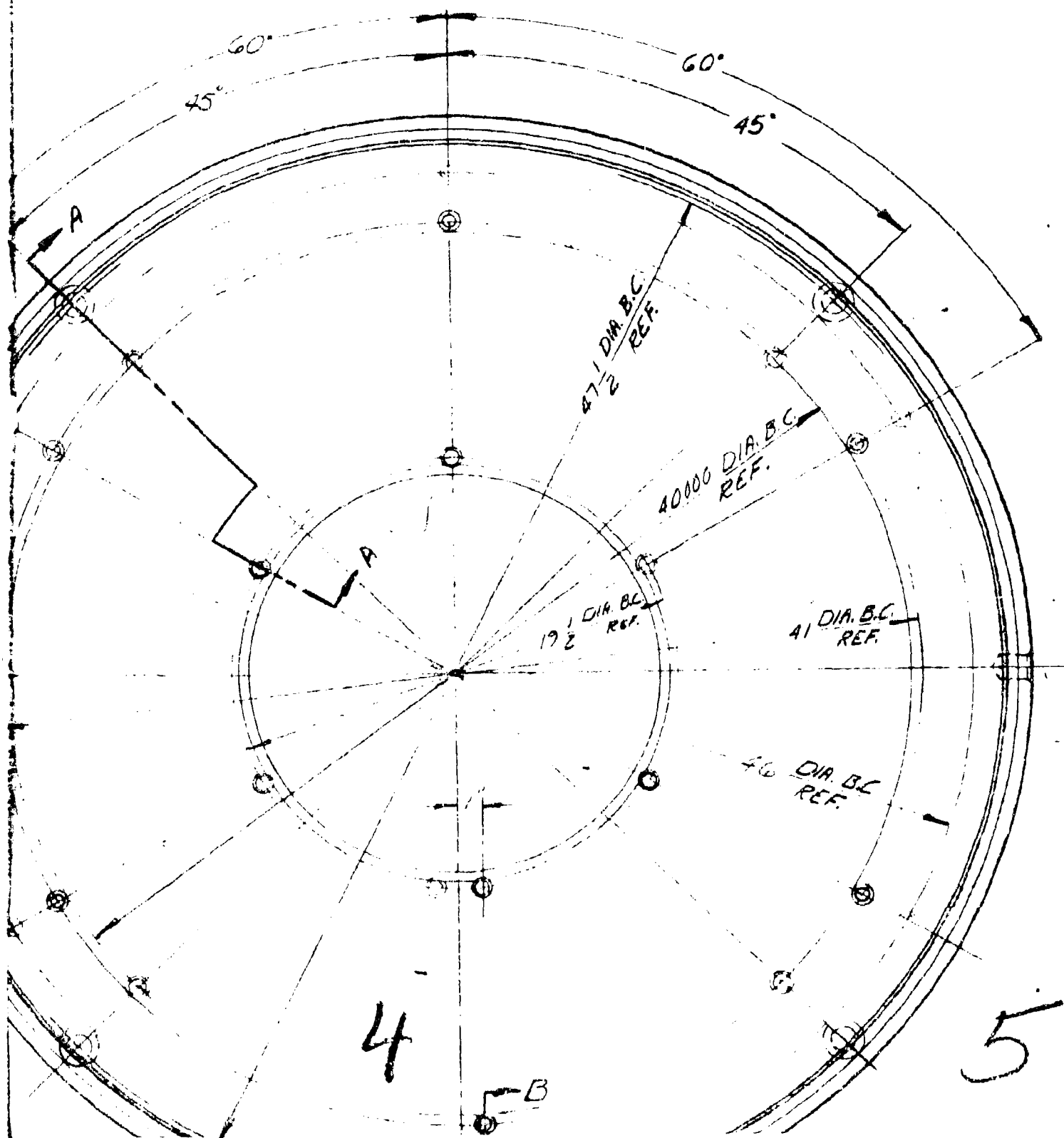
1 1/4 DRILL - 1 3/8 DEEP
1/16 X 45° CHAMFER
2 HOLES EACH HALF.



PRY BLOCK
2 REQ'D ON EACH TREAD
RING SEGMENT

3





3

19005 ± .005 DIA.

18 DIA.

$\frac{9}{16}$

7

SECTION
FULL 5.

6

ITEM NO	DESCRIPTION	MATERIAL
5	PRY BLOCKS	STEEL
4	TOP HALF MOLD	STEEL
3	BOTTOM HALF MOLD	STEEL
2	REGISTER RING	STEEL
1	TREAD RING SEGMENT	STEEL

NOTE:
FOR CAVITY DETAILS SEE
PROFILE DWG P. 14591-R

$\frac{27}{64}$ DRILL THRU - $\frac{5}{8}$ C-BORE
6 HOLES EACH HALF.
(20.81E X 20° DRILL JIG.
*R-3285)

$19\frac{1}{2}$ DIA.
 B.C.

39040 DIA.
 $13\frac{1}{2}$ DIA.
 REF.

19005 DIA.
 19005 DIA.

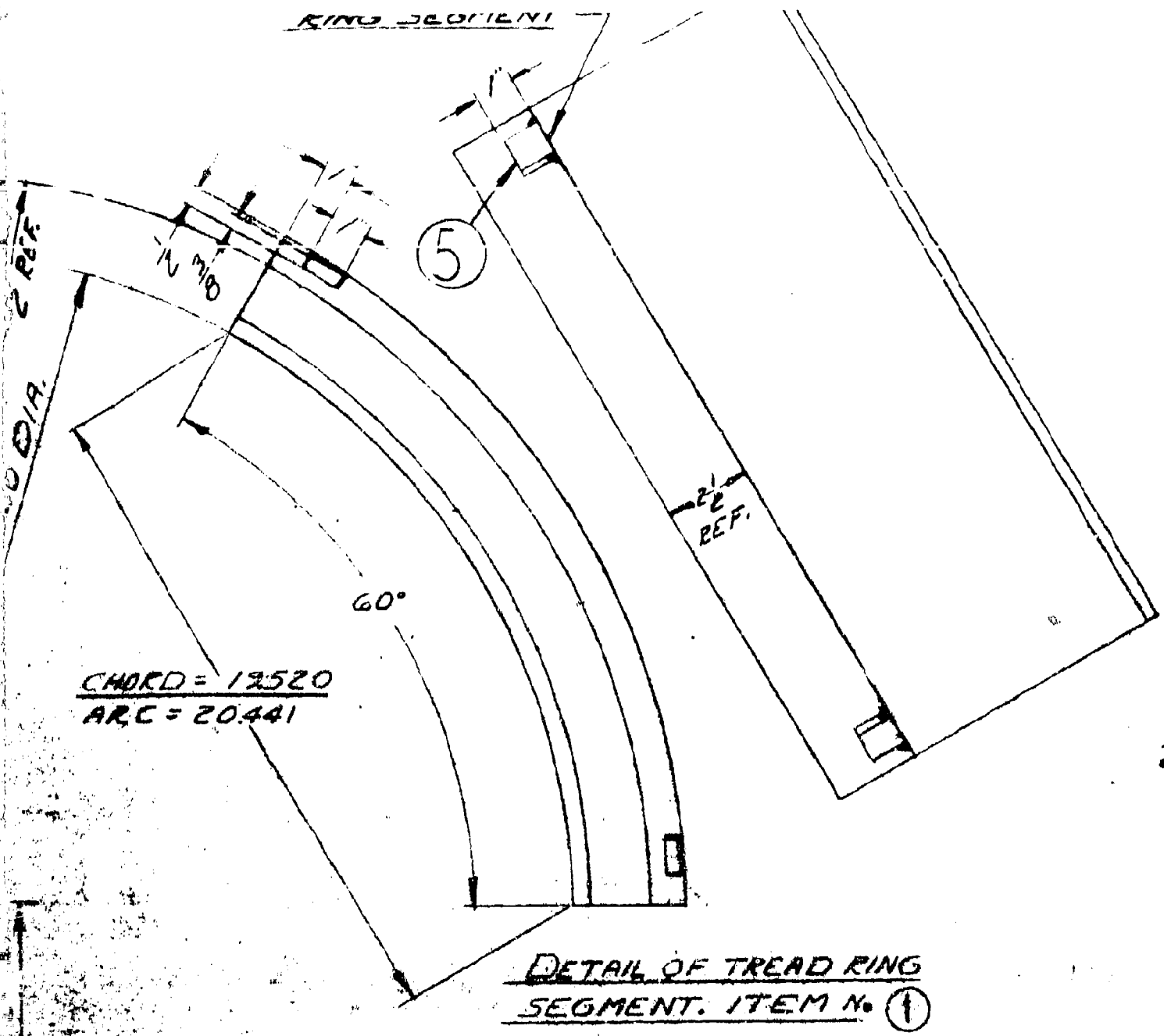
ON A-A
SIZE

STEEL	12	WELD TO SEGMENTS
WEL PLATE	1	
CASTING	1	
WEL PLATE	1	
WEL	1	WELD OR CAST ON
WEL PLATE	6	PATTERN *J-5655
CASTING		

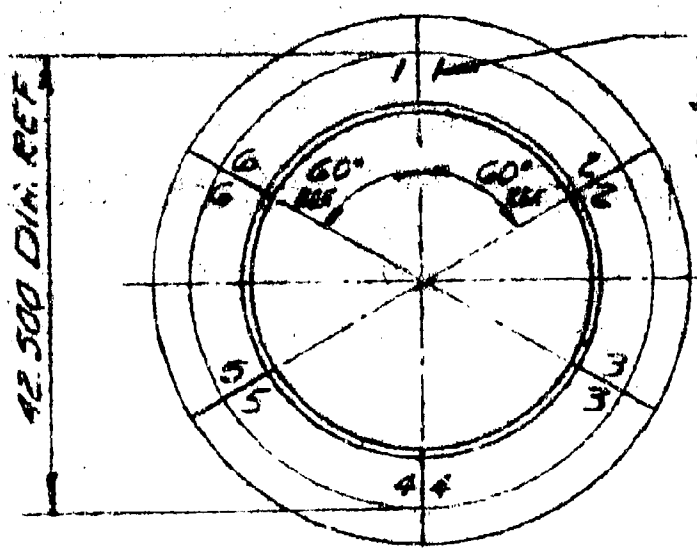
7

RING SEGMENT

57
W/L
R/L



DETAIL OF TREAD RING
SEGMENT. ITEM N. ①



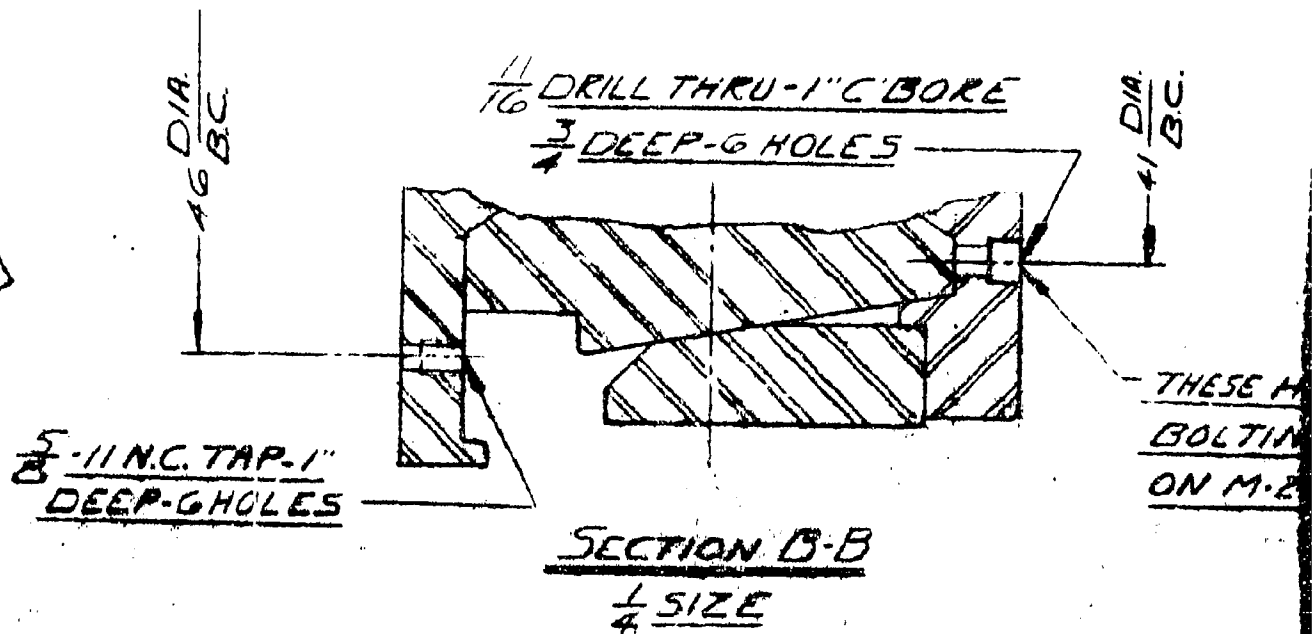
STAMP SEGMENT MATCH
NA WITH 1/2 FIGURES
ON TREAD SEGMENTS

PLAN VIEW SHOWING
STAMPING ASSEMBLY

8

STAMP FRONT HERE
WITH $\frac{1}{2}$ R.H. LETTERS
BOTH HALVES

PLAN VIEW
 $\frac{3}{16}$ SIZE

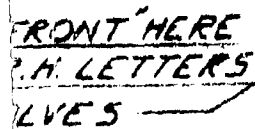


SEGMENT MATCHING
FIGURES
10 SEGMENTS

9

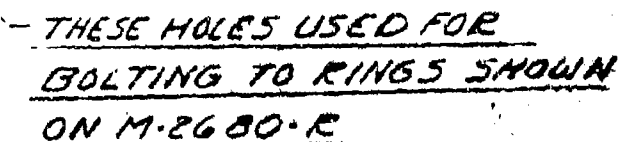
	ADDED NOTE
	46" REF. DIA. & PLAN VIEW
REF.	CH
UNITED STATES	
CENTRAL DETROIT	
11.00-20 FIN	
SEGMENTAL	
MACHINING D.	
FOR 55 & 63	
DESIGNED BY	CHECKED BY

NOTICE
 Constructing and method of manufacturing this tire may be covered by one or more of the following patents: 2,637,362; 2,781,815; 2,781,830; 2,786,507; 2,786,516; and other Patents Pending.



3 5/25

D/A. G.C.



AP-1
4025

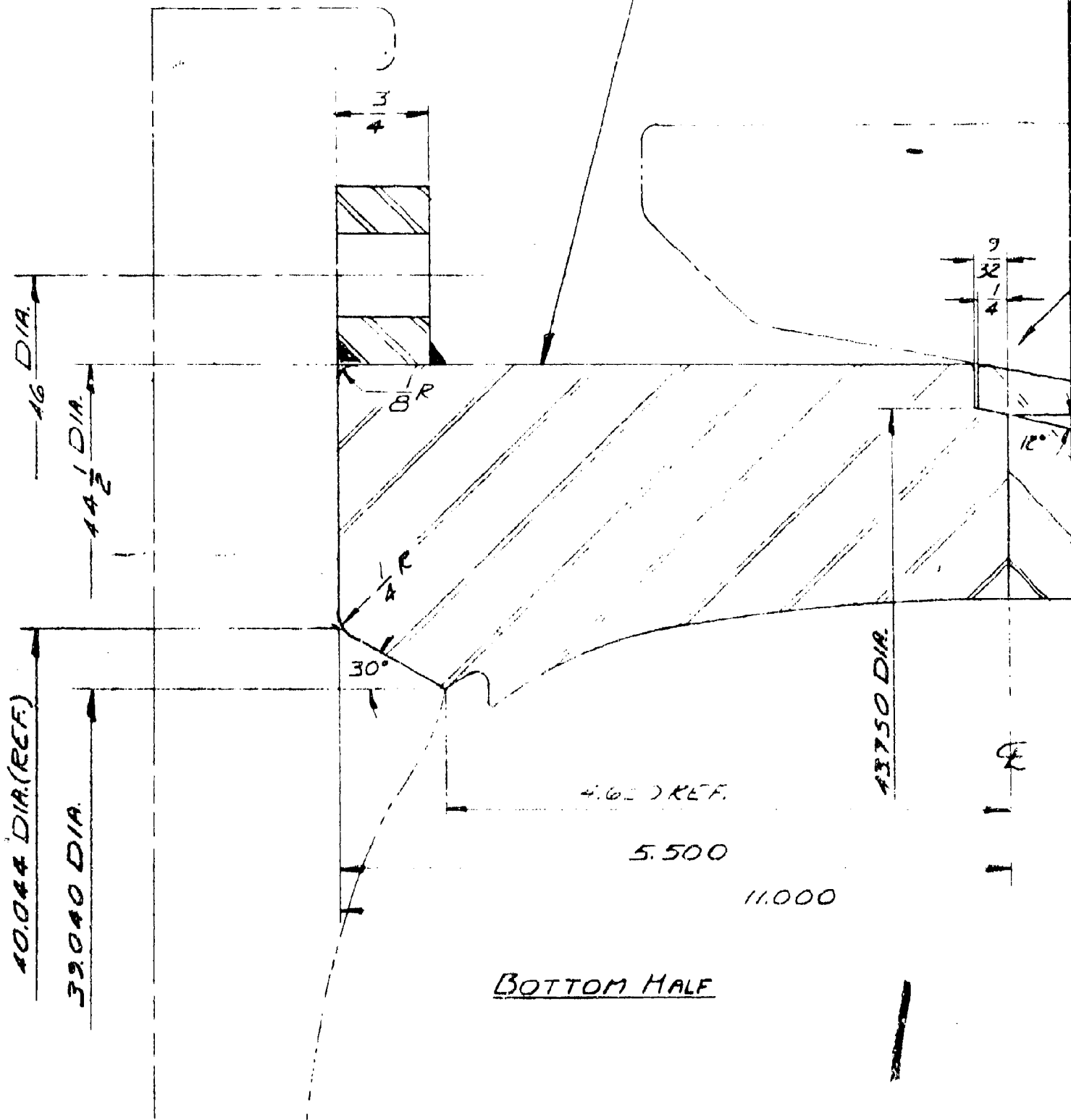
1/4 SIZE

[illegible]

NOTICE

Construction and method of manufacturing this fire
may be covered by one or more of the following patents:
1,244,124; 2,781,819; 2,780,801; 2,781,287; 2,988,812.

STAMP O.D. OF EACH
SIZE-TYPE-BRAND-

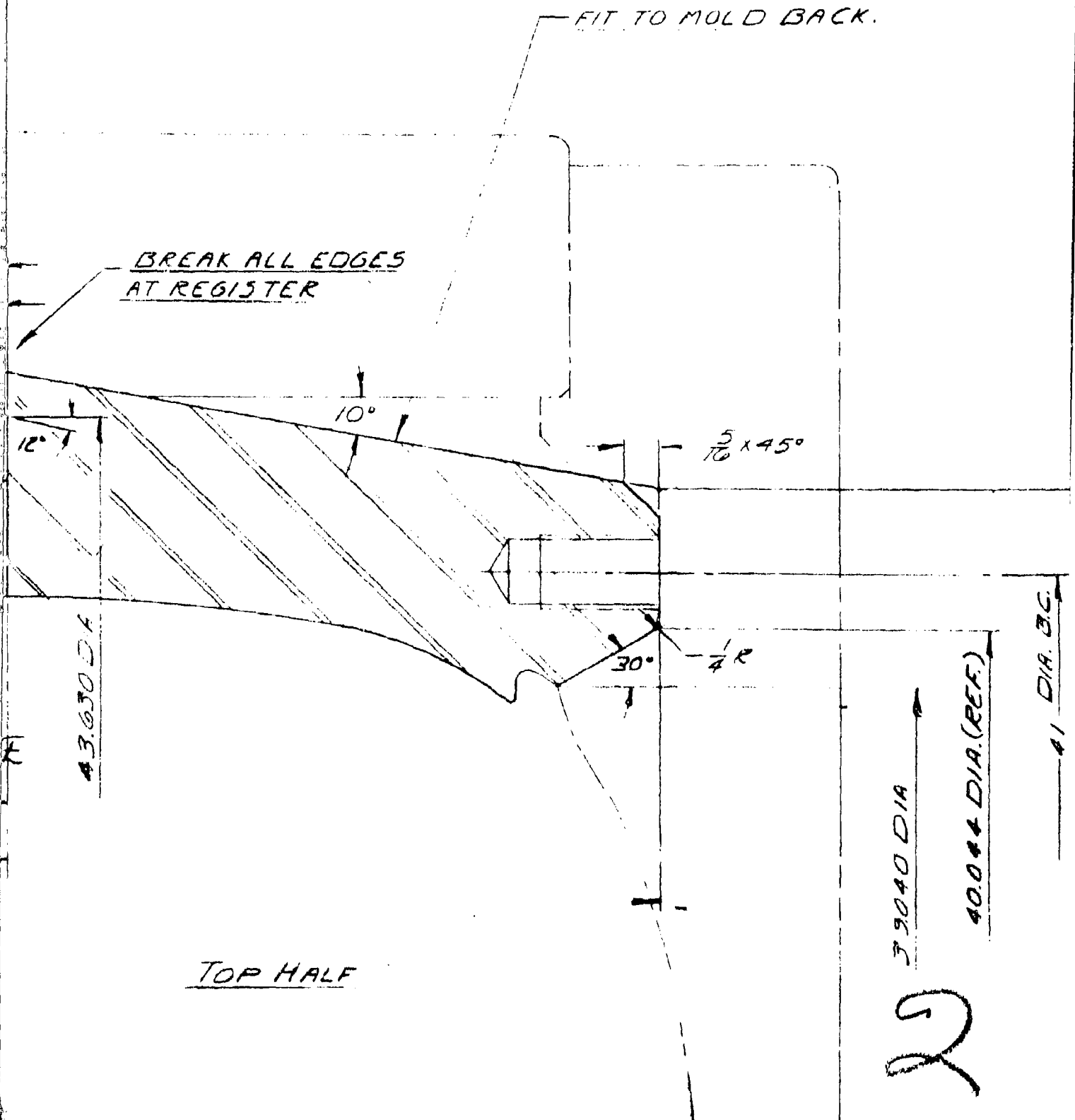


ETCH RING THUS IN 2 PLACES.

ND - SER. N° - PLY

FIT TO MOLD BACK.

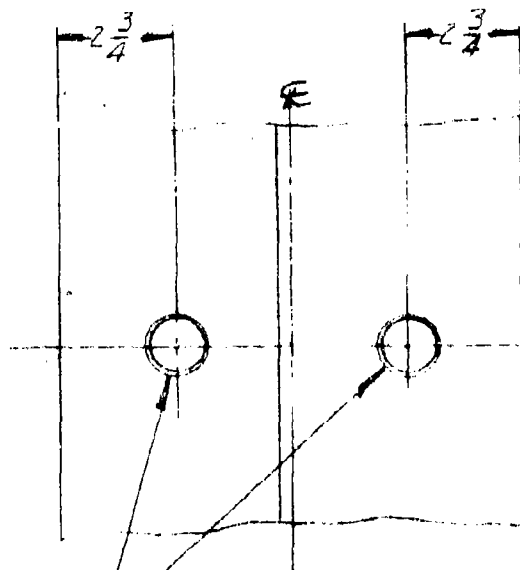
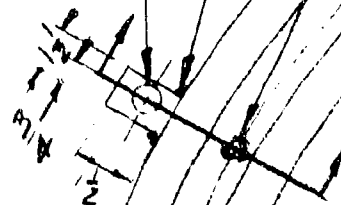
BREAK ALL EDGES
AT REGISTER



$\frac{5}{8}$ -11 N.C. TAP - $\frac{7}{8}$ DEEP
6 HOLES TOP HALF ONLY.

WELD ALL AROUND

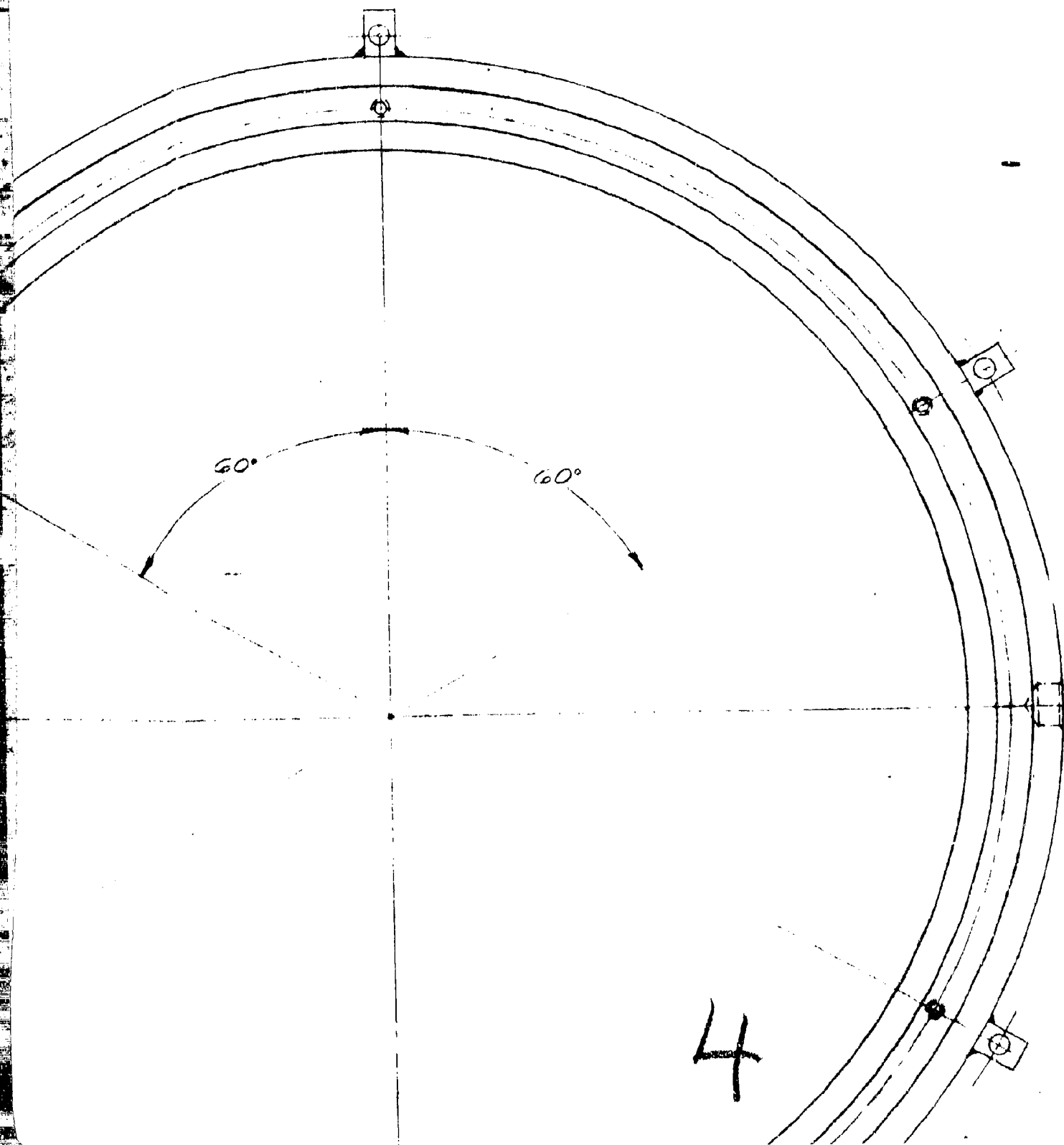
$\frac{11}{16}$ DRILL THRU



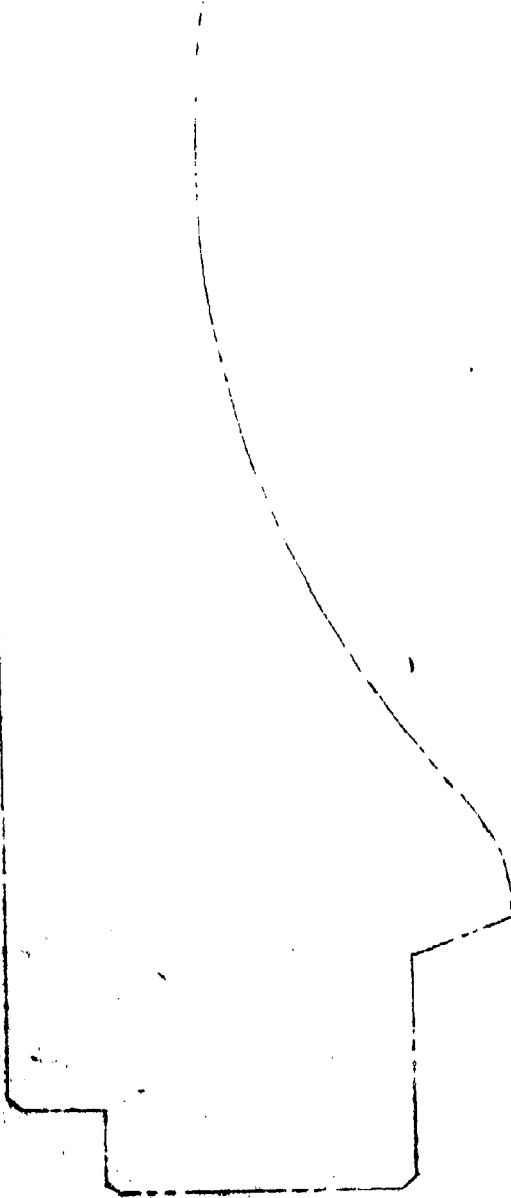
$\frac{1}{4}$ DRILL - $\frac{7}{8}$ DEEP
 $\frac{1}{16}$ X 45° CHAMFER
2 HOLES EACH HALF

42.500 DIA.
BAR GA. U.S. 55137

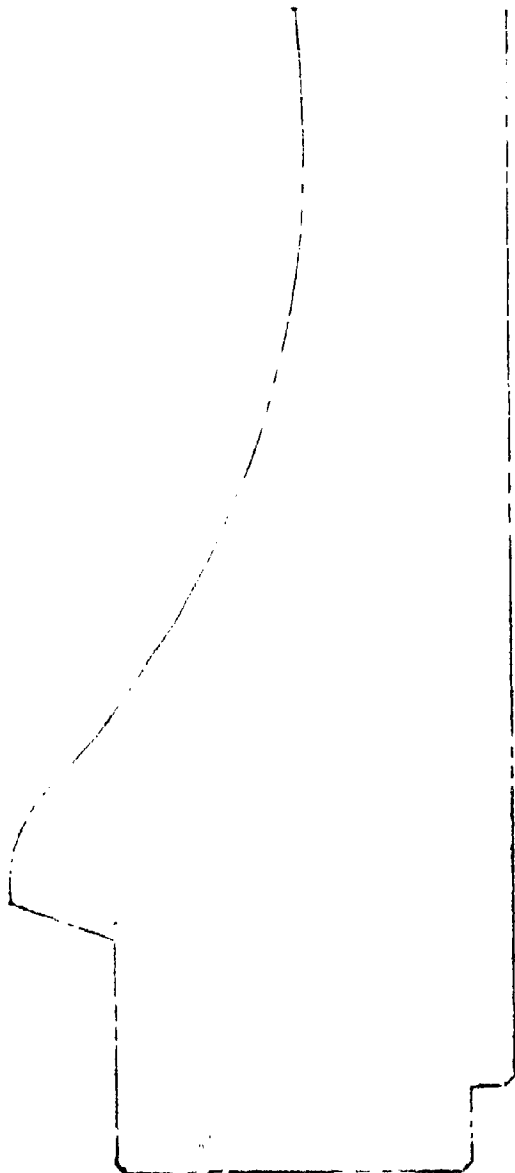
3



FOR CAVITY DETAILS SEE
PROFILE DWG PER ORDER

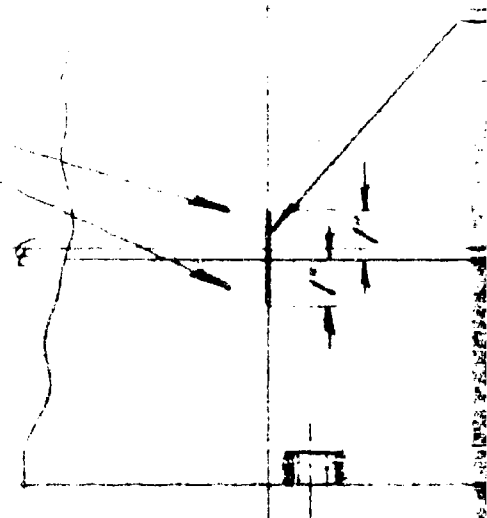


5



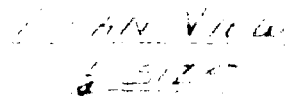
6

1. PARTITION WITH
 $\frac{1}{2}$ RAIL TIES ON
EACH HALF

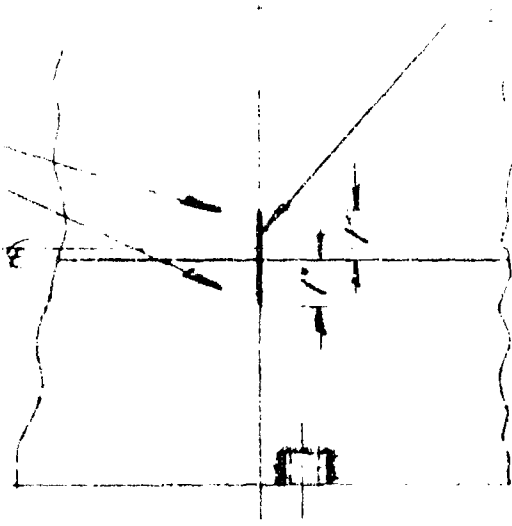


MATERIAL: STEEL PLATE

7



WATER LINE - $\frac{1}{32}$ DEEP
(FOR MATCH UP PURPOSES)



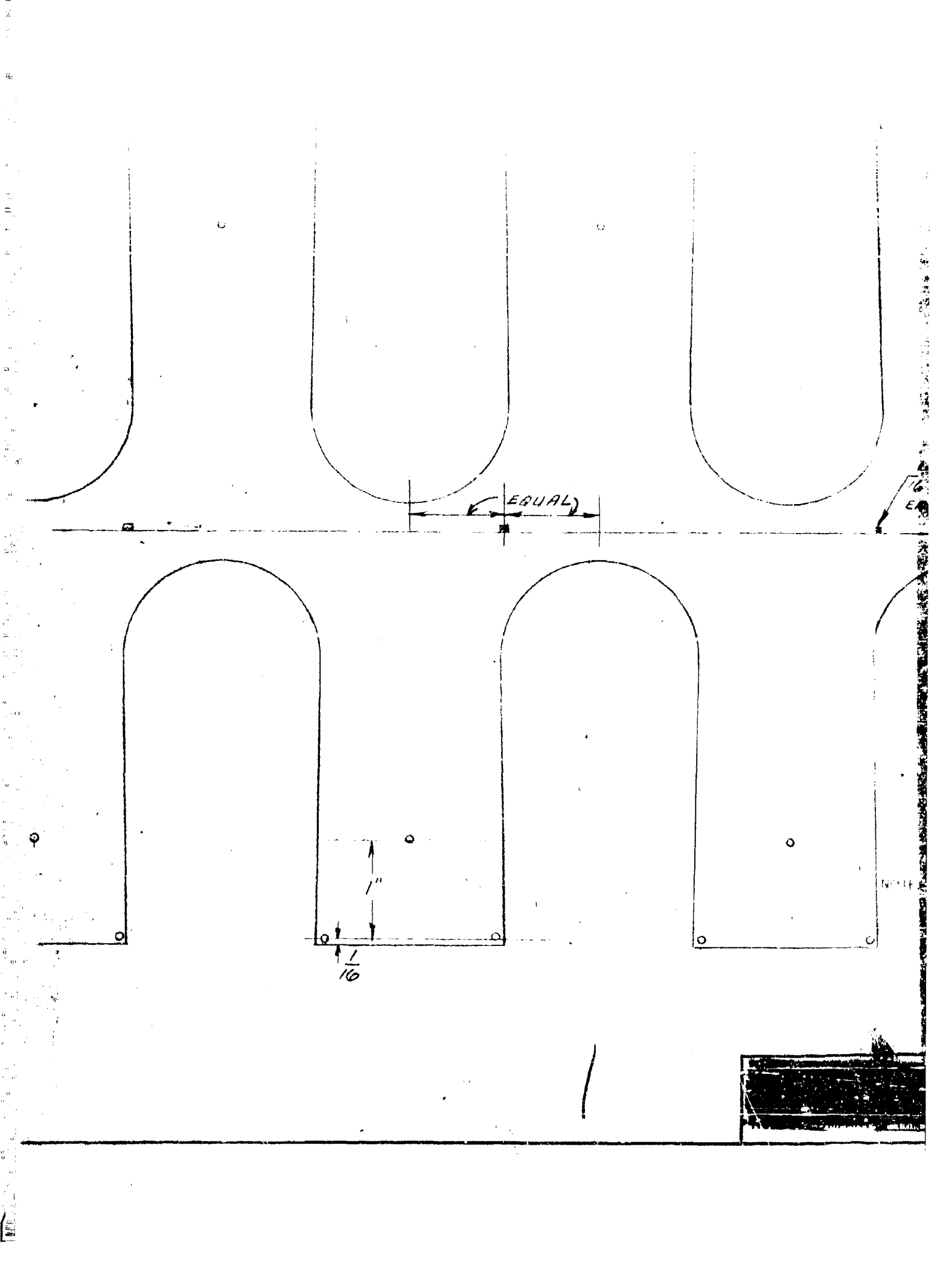
7

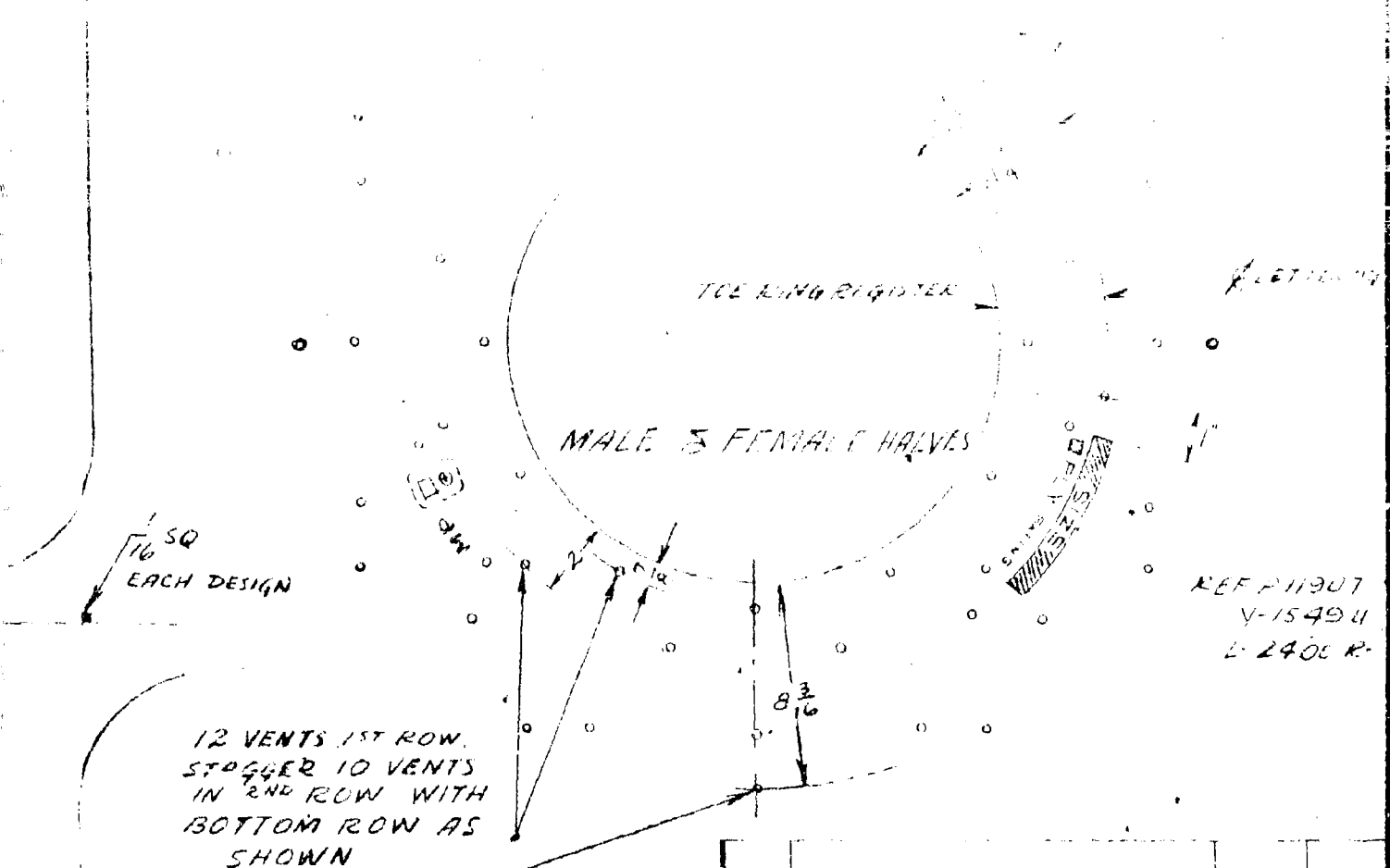
8

NOTICE

Construction and method of manufacturing this tire may be covered by one or more of the following patents: 2,637,362 2,701,815 2,282,840 2,186,501 2,729,616 and other Patents Pending

REF.	CHANGE	DATE	SUB
UNITED STATES RUBBER COMPANY			
CENTRAL MOLD DIVISION			
DETROIT - - MICHIGAN			
1100-20 TREAD RINGS (CARCASS)			
FOR USE IN M-2679-R			
(55" & 65" M ^o NEIL ONLY)			
DRAWN BY JAN 11/54		CHECKED BY L. KERRY	SUPERSEDES
DATE STARTED JAN 11/54		DATE FINISHED JAN 13/54	SUPERSEDED BY
APPROVED BY		REFERENCE P. 1423-R	MOLD OWN.
			M-2680
			P





REF P11907
V-15494
L-2400 R

12 VENTS 1ST ROW,
STAGGER 10 VENTS
IN 2ND ROW WITH
BOTTOM ROW AS
SHOWN

12 VENTS EQUALLY
SPACED IN LINE
WITH BOTTOM ROW.

NOTE: OMIT ALL VENTS WHICH FALL INTO LETTERING
SPECIFICATIONS FOR DRILLED VENTS:
No. 50 (.070) - .010 DIA. DRILL - BREAK SHARP
EDGE ON CAVITY SIDE WITH 1/64 x 45° CHAMFER
TREAD VENTS MUST BE RADIAL ± 10°.
ALL SIDEWALL VENTS MUST BE PERPENDICULAR
TO PARTING LINE OF MOLD.
STANDARD VENT PATTERN - ANY PORTION MAY BE
ELIMINATED AT LOCAL PLANT DISCRETION.

2

REF.	CHANGE	DATE	SUB.
UNITED STATES RUBBER COMPANY DETROIT - MICHIGAN			
VENTING FOR:			
U. S. ROYAL TACTICAL EXPERIMENTAL			
PRODUCT DEVELOPMENT DIVISION		MOLD DIVISION	
DRAWN BY J.P.	DATE 8-28-59	DRAWN BY	SUPERVISOR
CHECKED SW	8-28-59	CHECKED	SUPERVISOR
APPROVED		APPROVED	MOLD DIV.
REFERENCE STOKES DW 12195-59		SCALE -	
		V-1583	
		U-	

REF.	CHANGE	DATE	SUB
UNITED STATES RUBBER COMPANY			
DETROIT PLANT			
DETROIT MICHIGAN			
12-10-58 AND 11-10-58 TOE RING			
12-10-58 REMAINING TOP & BOTTOM RING			
12-10-58 AND 12-10-58 BOTTOM RING ONLY			
M/C NEIL CARR			
DRAWN BY		CHECKED BY	SUPERSEDES
APPROVED BY		REFERENCE	SUPERSEDED BY

92.540 DIA.
 912.43 DIA.
 650
 1003
 547
 DROP
 38.420 DIA. 2060
 40.380 DIA.

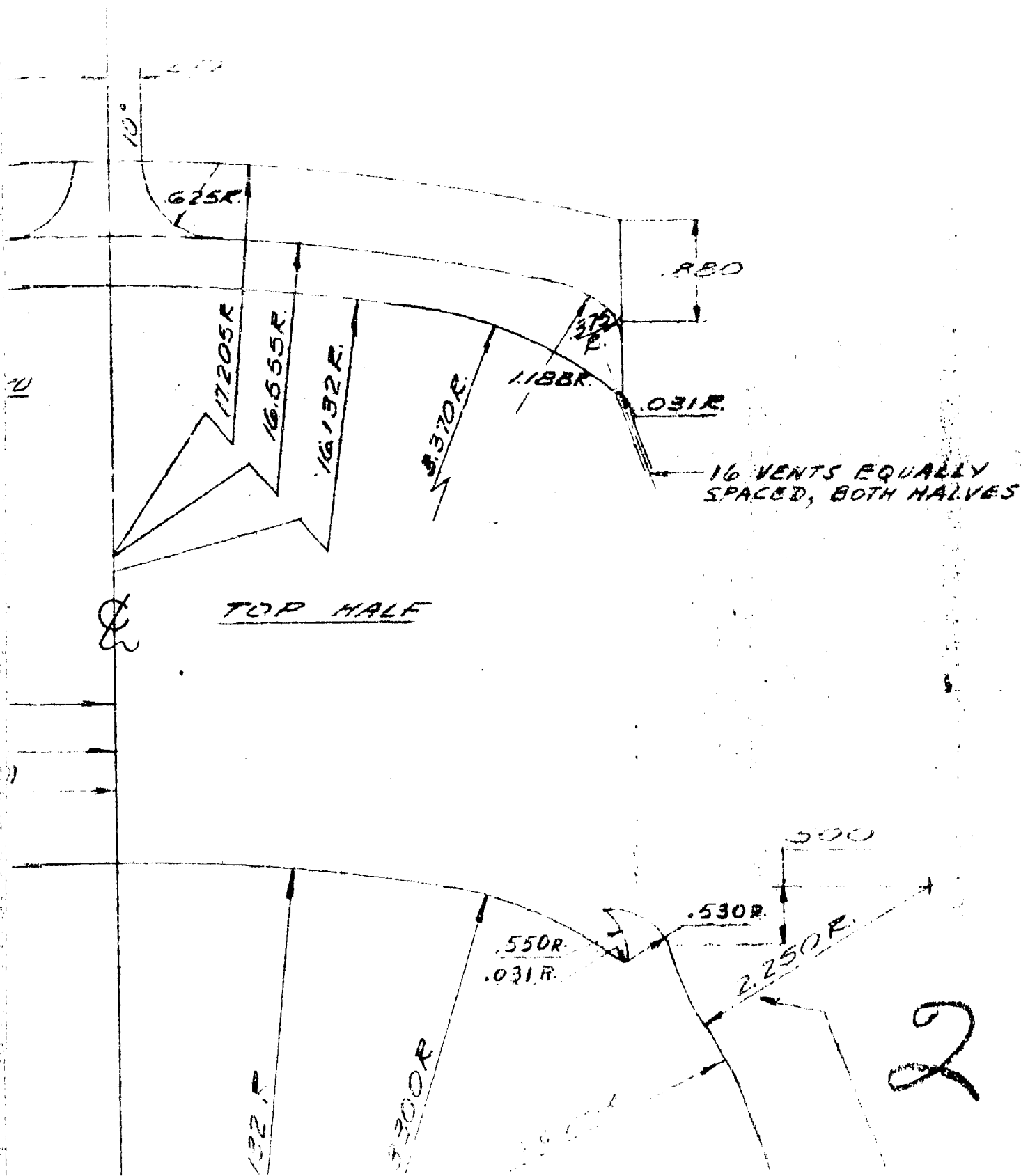
SECTION THRU
TREAD MOLD

BOTTOM HALF

90.560 DIA.
 38.760 DIA. 900
 760
 470
 HOLD

4630
 4290
 4.090 (HOLD)

RE CUT



YES

8700

4350

1245

219

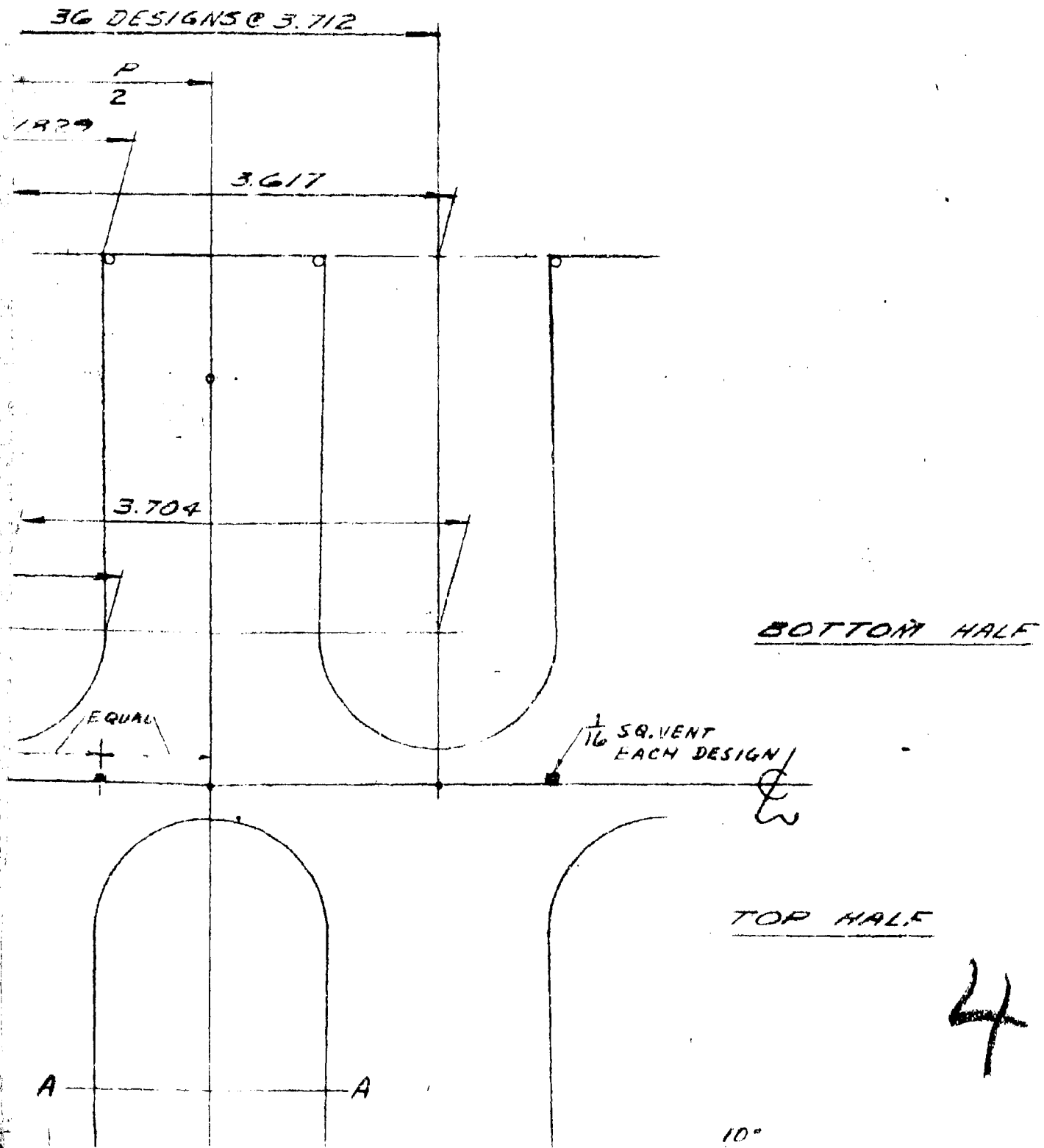
1772

2650

3

THE TIRE

DEVELOPED LENGTHS



10.249

5.172

20.062 DIA.

20.812 DIA.
BARE GA. U.S. 12487

.603
±.002

2°

4.000

.625

4.625

SECTION THRU
CARCASS MOLD

TEMPLATES: (CARCASS MOLD)

U.S. 55135 CAVITY SHAPE

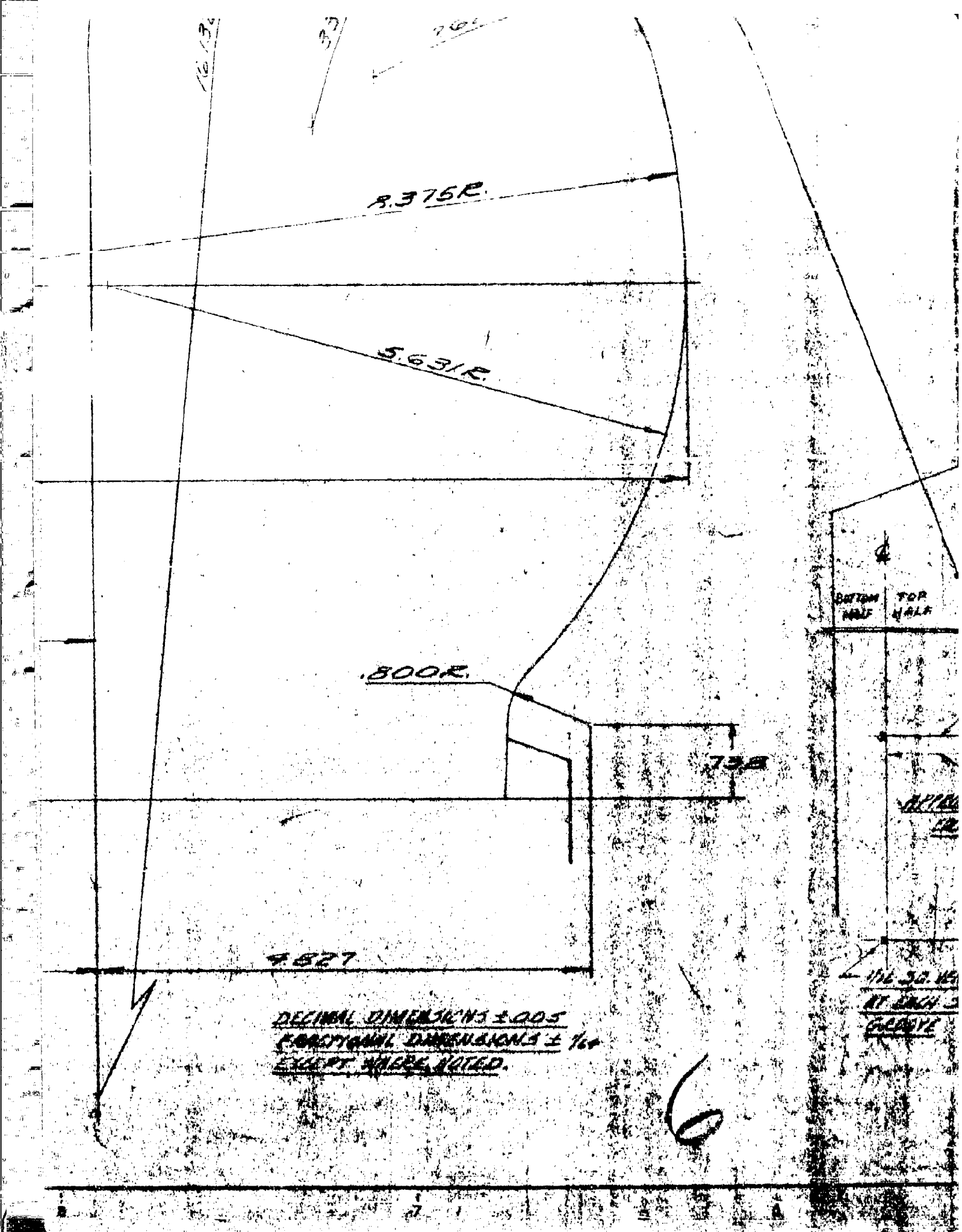
55139 CORRUGATION

TEMPLATES: (TREAD MOLD)

U.S. 55140 CAVITY SHAPE

55141 TREAD CORRUGATION

55142 TREAD DESIGN



FALL 1971

VENTING

(ENLARGED)

DOB 1/32

32 EQUALLY SPACED
SCRATCH GROOVES ON CROWN,
16 FROM SHOULDER STAGGERED
WITH 16 FROM MOLD 2 AS JAWNY.

OP
1/16

RADIAL
APPROX CENTER
FROM MOLD HALF

DRILL VENTS IN SCRATCH GROOVES

3/16 DIA
1/16 DIA
1/16

RADIAL

APPROX CENTER
OF EACH MOLD HALF

OMIT ALL VENTS WHICH FALL INTO LETTER
SPECIFICATIONS FOR DRILLED VENTS.
NR 50 (.070) $\pm$.010 DIA. DRILL - BACK
EDGE ON CAVITY SIDE WITH $1/16 \pm$.010 X
CHAMFER.
TREAD VENTS MUST BE RADIAL $\pm$ 10
SIDEWALL VENTS MUST BE 90° TO
PARTING LINE OF MOLD.
STANDARD VENT PATTERN - ANY POR.
BE ELIMINATED AT LOCAL PLANT OR

7

VENTING

5ELT A-A

16 VENTS EACH
EQUALLY SPACED
STILLER AT 5

SHOULDER EDGE

-32 VENTS EQUA

BOTH HALVES

13 WHICH FALL INTO LETTERING

#3 FOR ROLLED VENTS.

2) + 010 DAW DRILL - BLECK SHARD

RTY SIDE WITH $\theta \pm .010 \times 45^\circ$

IT MUST BE READ 110° - 0°

VENTS MUST BE 90° TO

ONE OF MANY.

VENT PATTERN - ANY PORTION MAY
BE USED AT LOCAL PLANT OPTION.

D. P. = _____
T. W. = _____ % OF _____
T. R. = _____ % OF _____
D. H. _____
C. S. _____ = _____ = _____
RIM FIT = 7.5 ADV. (TIGHT)
N/G = _____
TOE RING NO. _____

VENTING SYSTEM IN ALL 2002
LETTERING REF: 1-3206A
MODEL NO.

OLD DWS. NO.
M-EG79-R M-EG80-R FM-2681-R

REKNERI	ADD RECD
5B203	EDGE (U)
	ADDED:-
	HOLD NO'S.

14	2000
----	------

UNITED STATES
DETROIT

1100-20 USA

DETACHABLE

PRODUCT DEVELOPMENT	NO
---------------------	----

WALL GATE DETAIL

10°

.625 R

SECT A-A

16 VENTS EACH ROW
EQUALLY SPACED.
STAGGER AS SHOWN.

SHOULDER EDGE

32 VENTS EQUALLY SPACED

BOTH HALVES

D. P. =

T. W. = % OF

T. R. = % OF

D. H.

C. S.

RIM FIT = 7.5 ADV. (TIGHT)

N/G =

TIRE RING NO.

T-779

VENTING METHOD (INCLUDED)

(LETTERING REF. L-3206 R)

MODEL NO.

MOLD DWG. NO.

M-2679-R, M-2680-R, M-2681-R

REMARK: ADD RECT OF SHOULDER
SB203 EDGE (U. 4) PHASE NO. WASHT 1-14-66 2
ADDED: RING SEAT P. DW'S,
MOLD NO'S. AND TEMPLATES 8764 1

REV.

CHANGE

DATE

SHE.

UNITED STATES RUBBER COMPANY

DETROIT - MICHIGAN

1100-20 U.S. ROYAL (TACTICAL)

PHASE II

DETACHABLE TREAD & CARCASS

TYPE "G"

PRODUCT DEVELOPMENT
DIVISION

MOLD DIVISION

SCALE: 1" = 1" 1/2"

DATE

12-24-63

DRAWN BY

DIADON

42.540 DIA

6.067

6.50

1.403

41.240 DIA

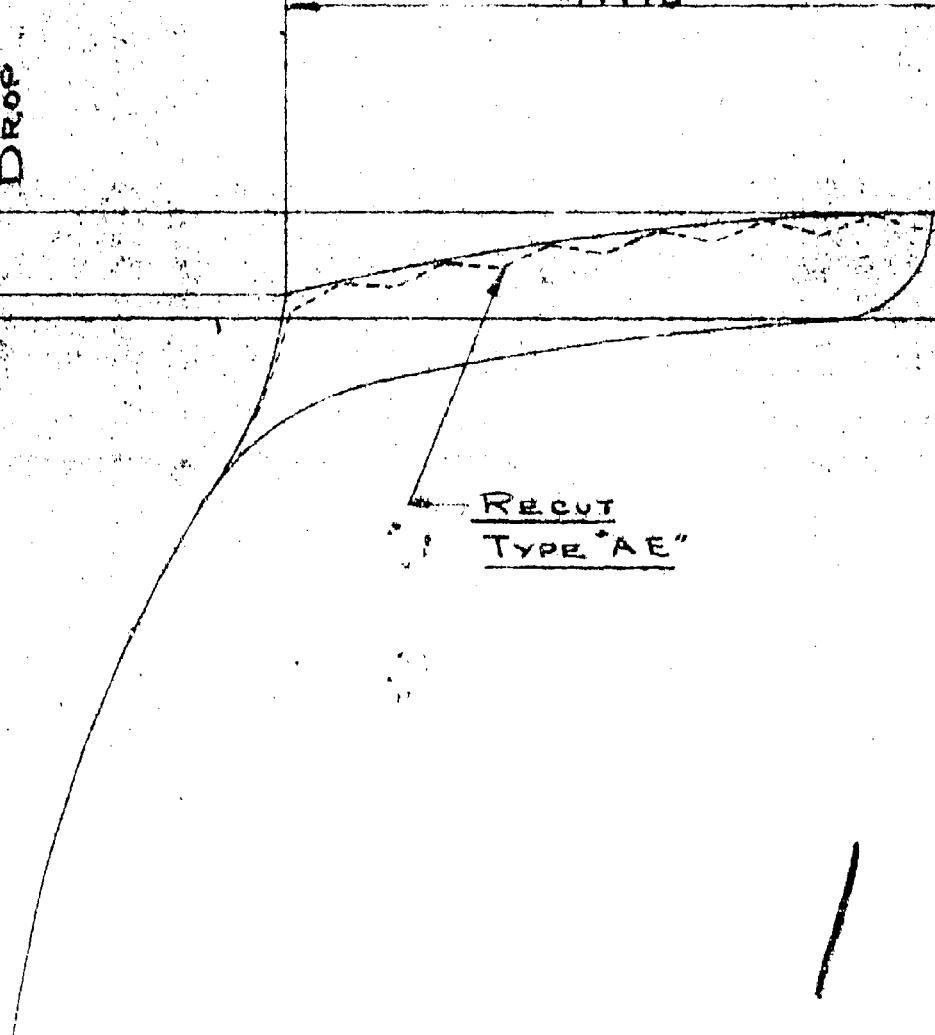
REFERENCE
P.11287(R.)

.500
DROP

MALE HALF

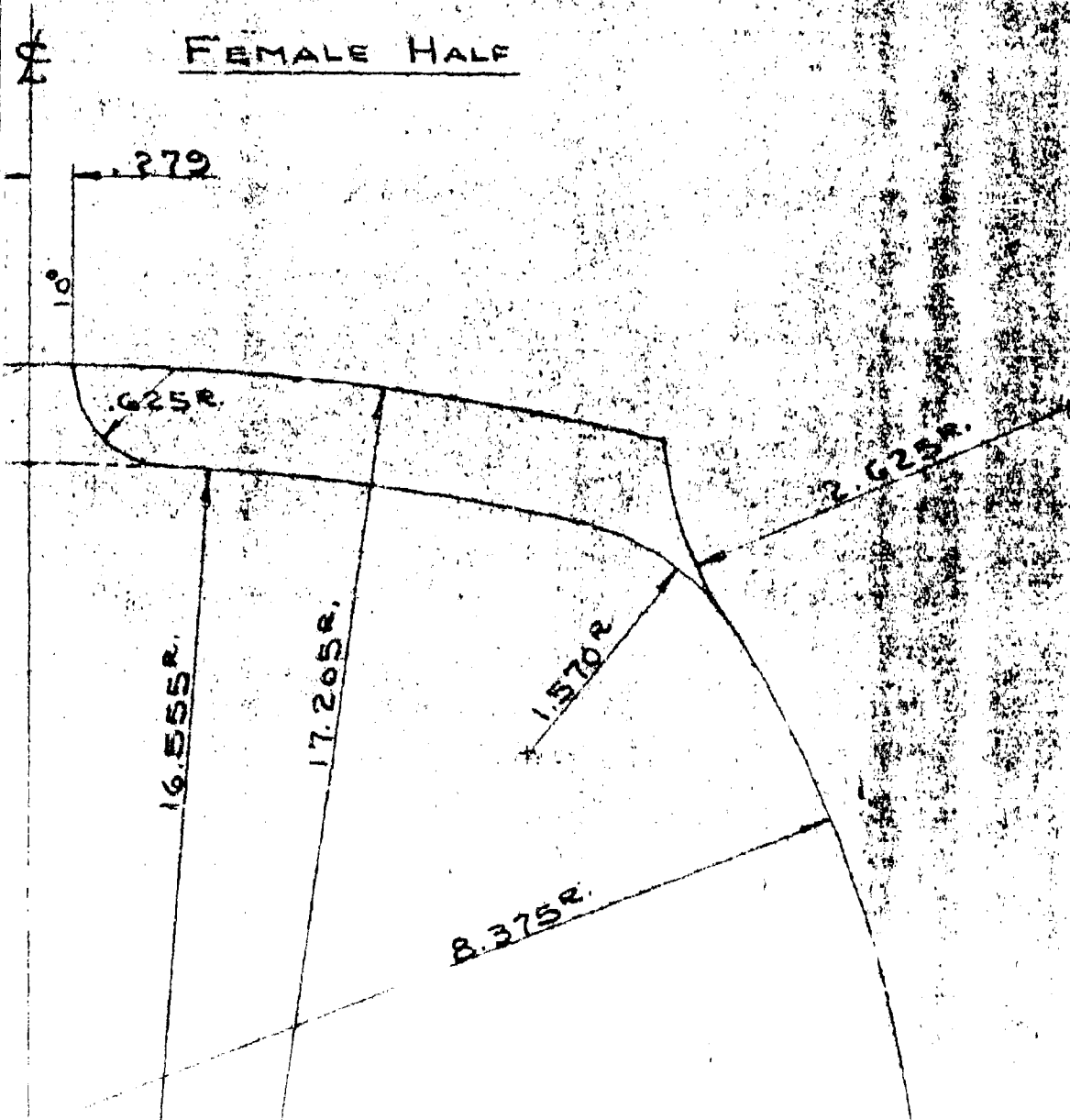
4.118

RECUT
TYPE "AE"



VENT

FEMALE HALF



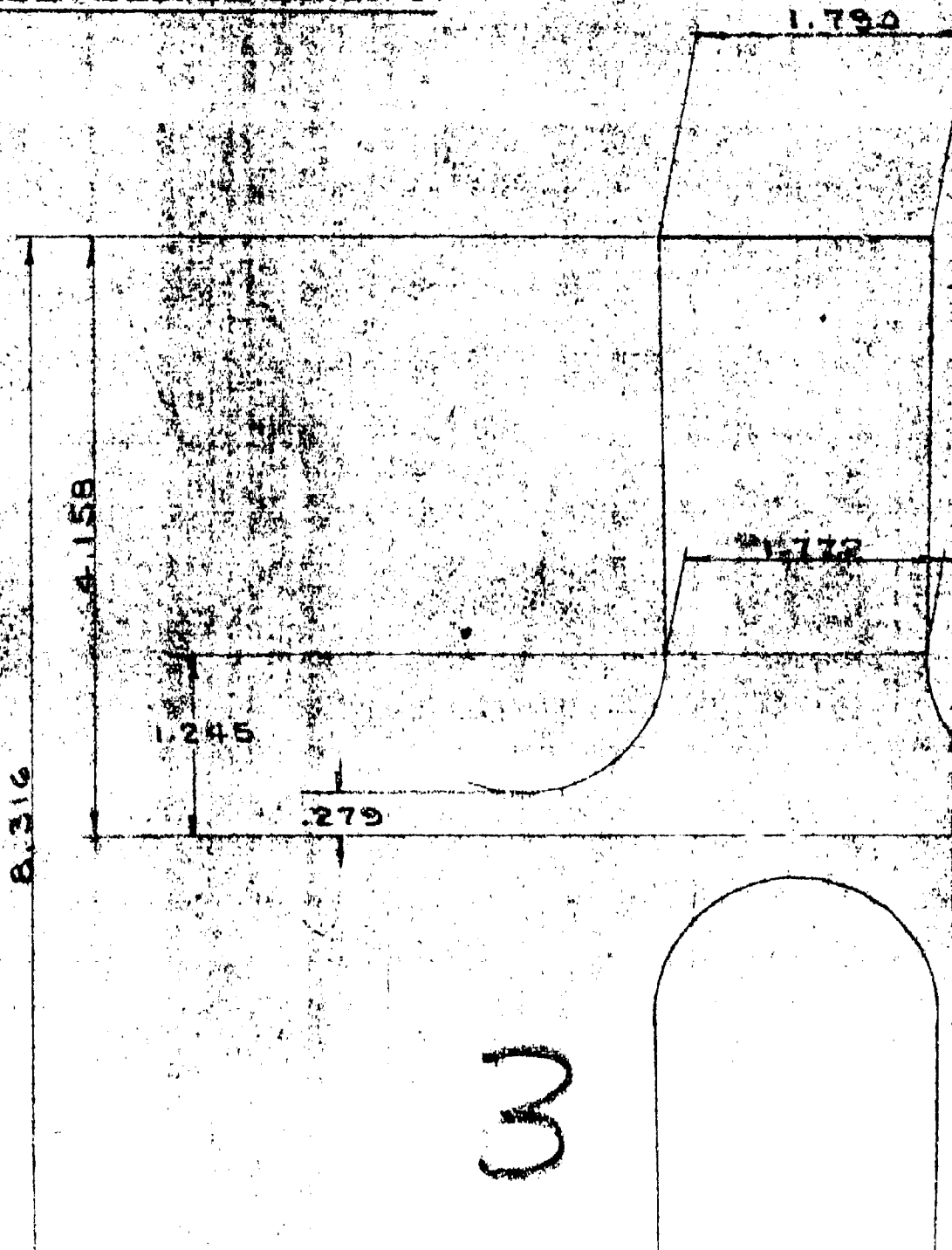
2

DWG. NO. V-1583, U

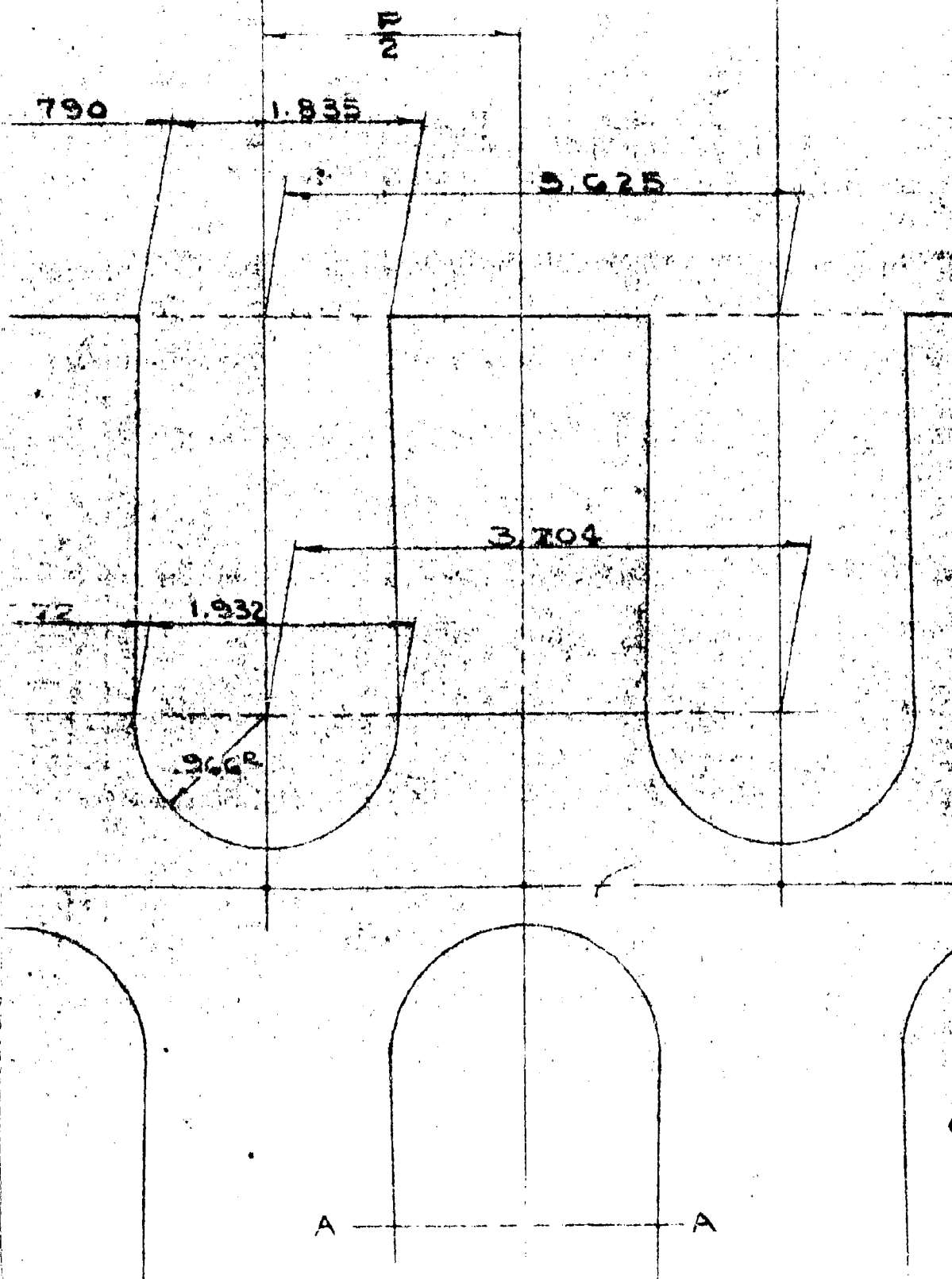
TREAD VIEW OF TIRE

DIMENSIONS SHOWN ARE

DEVELOPED LENGTHS



36 DESIGNS @ 3.712

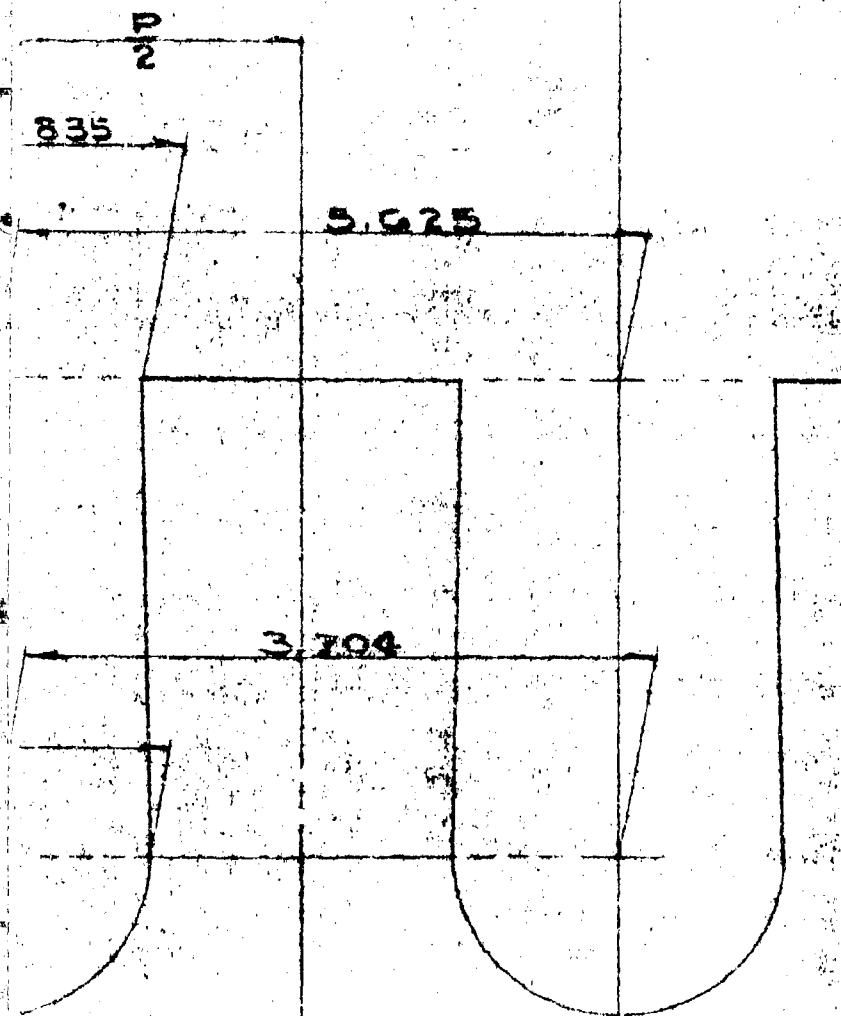


4

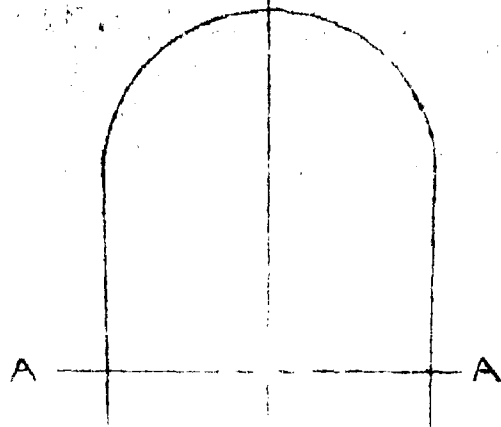
MA

FE

36 DESIGNS @ 3.712



MALE HALF



FEMALE HALF

4

5

5.172

31.4032

11.600

4.000

20.062 DIA.

20.812 DIA.
BAR GA #U.S.12487

.603
r.002
20°

.031

2° TAPER STARTS HERE

.665

4.625

SECTION THRU MOLD

TEMPLATES:

U.S. 49023 CAVITY SHAPE (UPPER)

U.S. 49024 TREAD DESIGNS

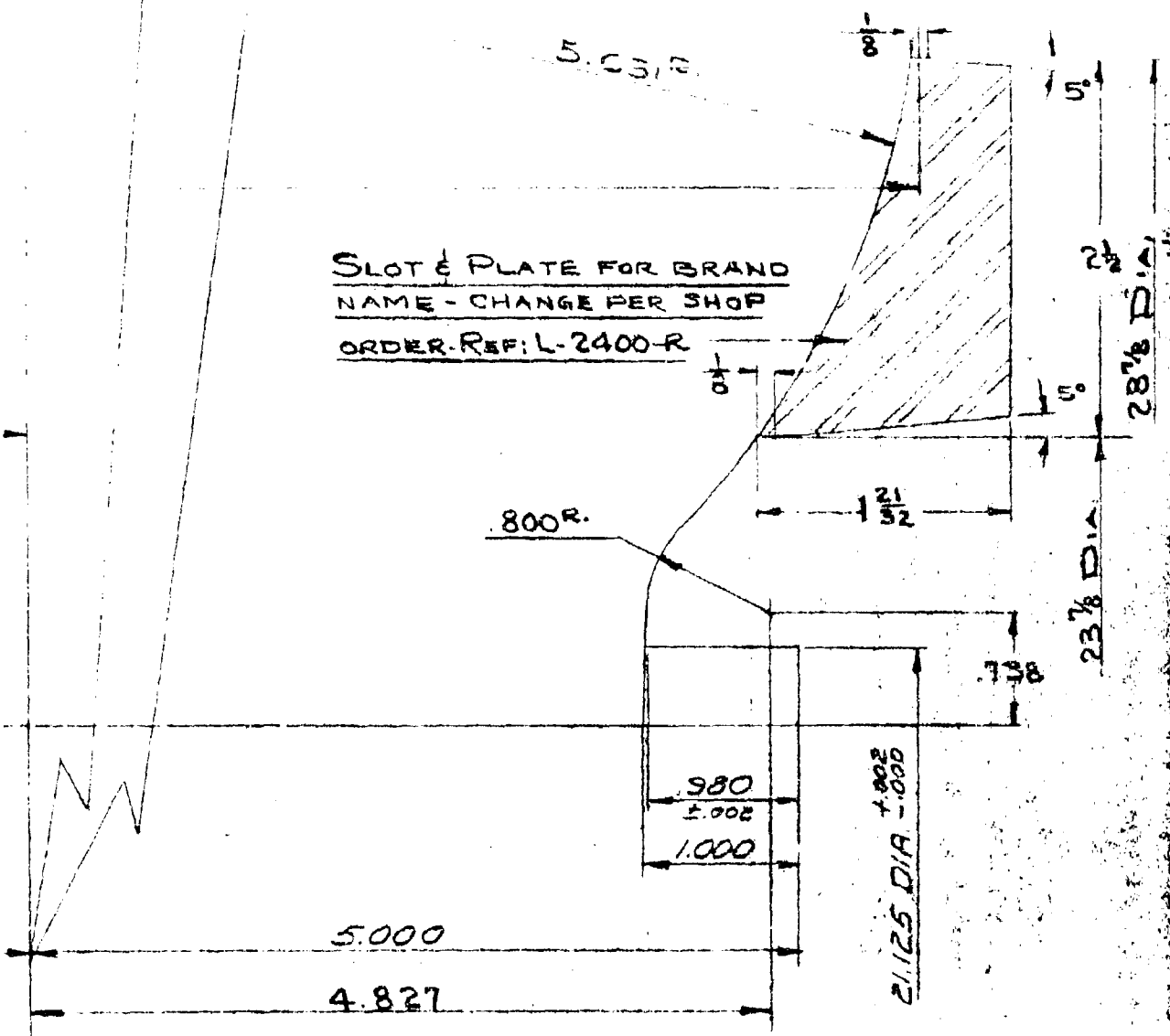
6

600

E

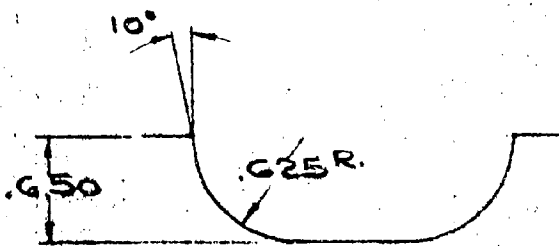
D

SLOT & PLATE FOR BRAND
NAME - CHANGE PER SHOP
ORDER REF: L-2400-R

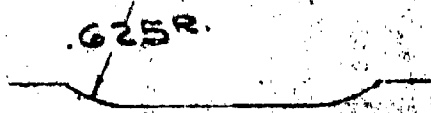


TOE RING N° T-779

7

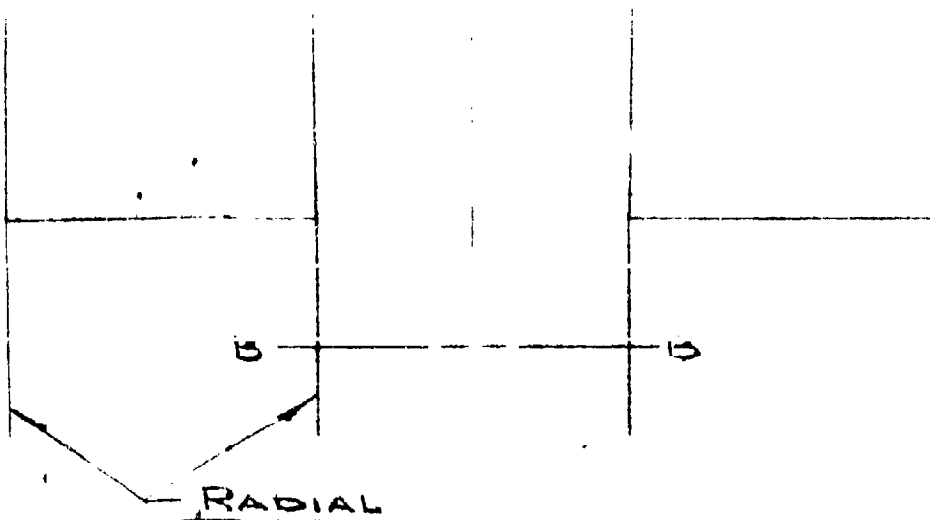


SECTION A-A



SECTION B-B

8



T.W. = 72.5% of 11.47

T.R. = 150% of 11.47

D.H. = $\frac{10.589}{11.600} = .913$

RIM FIT = 7.5 ADV. (TIGHT)

9

NOTICE

Construction and method of manufacturing this tire may be covered by one or more of the following patents: 2,337,332; 2,781,615; 2,782,620; 2,788,507; 2,789,616; and other Patents Pending.

REF.	CHANGE
UNITED STATES RUBBER CO.	
DETROIT - MICHIGAN	
11.00-20 U.S. ROYAL T.	
EXPERIMENT	
TYPE "D"	
RECUT & INSTALL TREAD R.	
DWG. NO. P-11523-F	
PRODUCT DEVELOPMENT DIVISION	MOLD DIVISION
DRAWN BY	DATE
B-1253	JAN 1953

RADIAL

T.W. = 72.5% of 11.47

T.R. = 150% of 11.47

D.H. = $\frac{10.589}{11.600} = .913$

RIM FIT = 7.5 ADV. (TIGHT)

9

NOTICE

Construction and method of manufacturing this tire may be covered by one or more of the following patents: 2,637,942; 2,731,616; 2,782,839; 2,756,587; 2,780,616; and other Patents Pending.

REF.	CHANGE	DATE	SUB.
UNITED STATES RUBBER COMPANY DETROIT — MICHIGAN			
11.00-20 U.S. ROYAL TACTICAL EXPERIMENTAL			
TYPE "D"			
RECYCLE INSTALL TREAD RING, TYPE "E"			
DWG. N° P-11525-F			
PRODUCT DEVELOPMENT DIVISION		MOLD DIVISION	
SCALE - FULL		D11007	
DRAWN BY	DATE	DRAWN BY	DATE
TS	8-12-53	WERP	

3/16" CHAMFER ALL
LETTERS AND
FIGURES THUS

SECT A-A
(ENLARGED)

BOTTOM HALF 11

TOP HALF

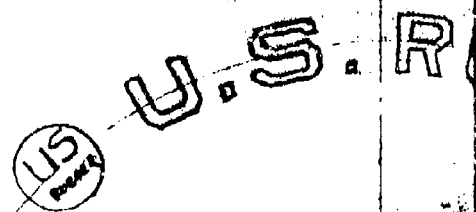


MAST. PLATE
NO US-7404
(BOTTOM HALF ONLY)

FRONT
OF
MOLD

SCREWED IN
SERIAL TIN.
(B.O.M. PRESS)
SEE DWG. L-2906 1 J

BOTTOM HALF



HALF 90°

ROYAL

$\frac{1}{16}$
 $\frac{3}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{8}$

$\frac{1}{16}$

ROYAL

SHOULDER EDGE

120°

2

2

2

2

2

2

2

2

2

2

1
2
3
4
5
6
7
8
9
10
11
12

A SIZE SEE
SCHEDULE FOR DETAILS

SEE
L. 1470

$\frac{1}{2}$

$\frac{1}{8}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

REFUGEE

THE UNIVERSITY OF CHICAGO

2

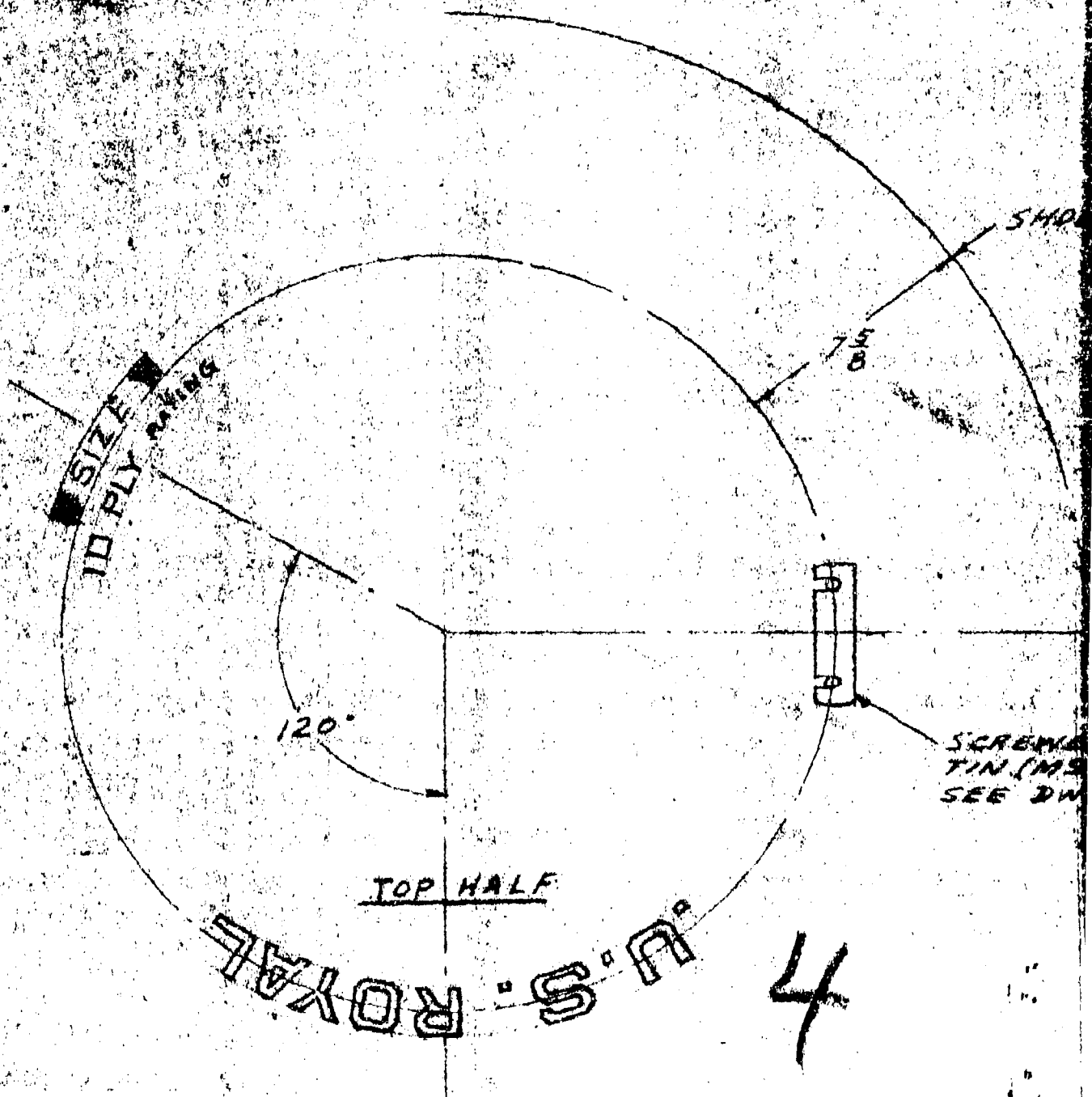
1000

[illegible]

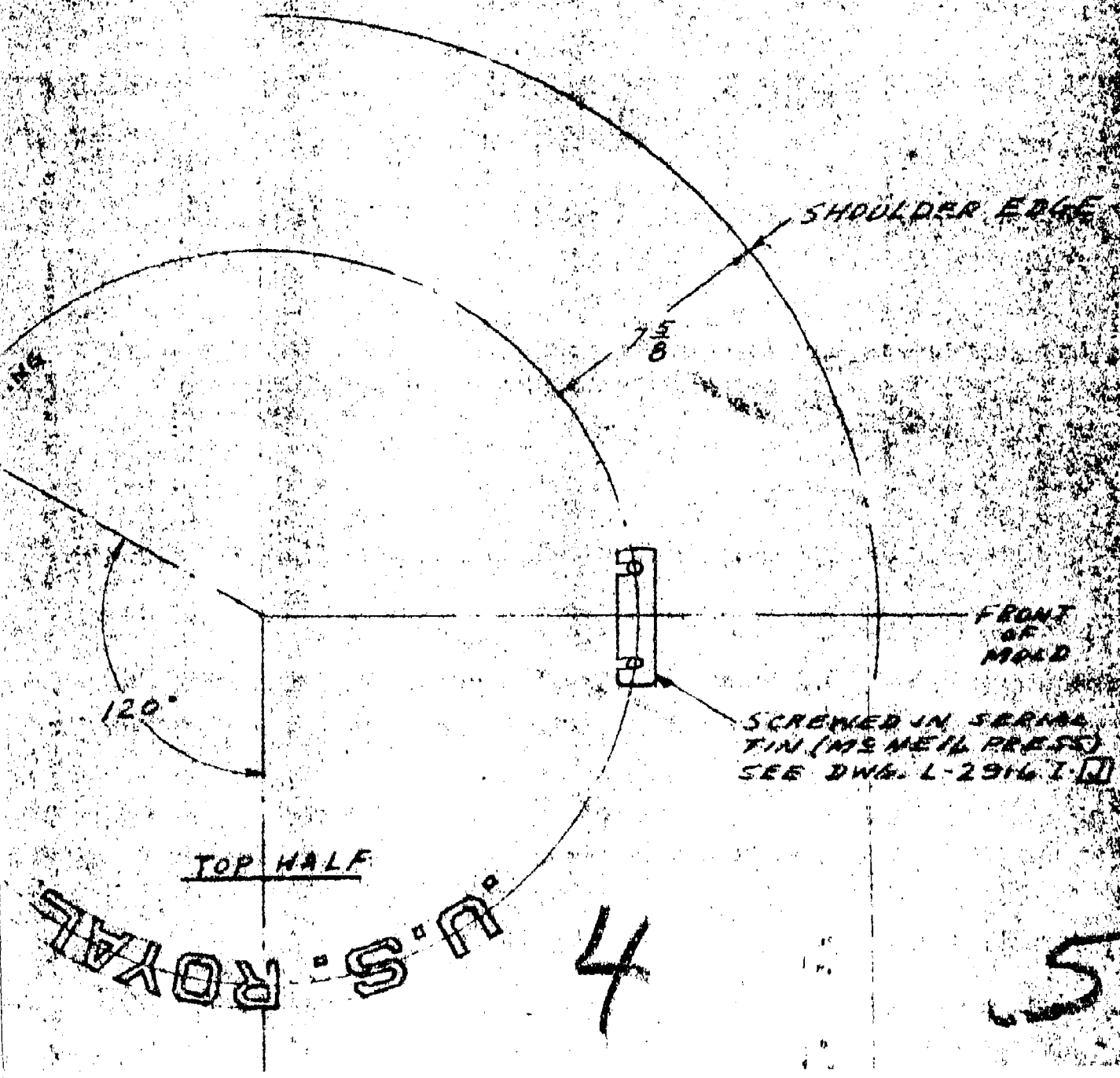
THE

3

THE WORDS "U.S. ROYAL" MUST APPEAR DIAMETRICALLY OPPOSITE IN TWO
ALL LETTERING IN MOLD IS LEFT HAND, MAX. DEPTH = .031
ALL PITCHES TAKEN AT TOP OF LETTERS AND FIGURES



AL MUST APPEAR DIAMETRICALLY OPPOSITE IN TWO HALVES OF MOLD
MOLD IS LEFT HAND, MAX. DEPTH = .031
OPEN AT TOP OF LETTERS AND FIGURES



1

5

27/32			
10	3	3	3
22	4	4	4
14-20			

PLYMOUTH

2 1/2

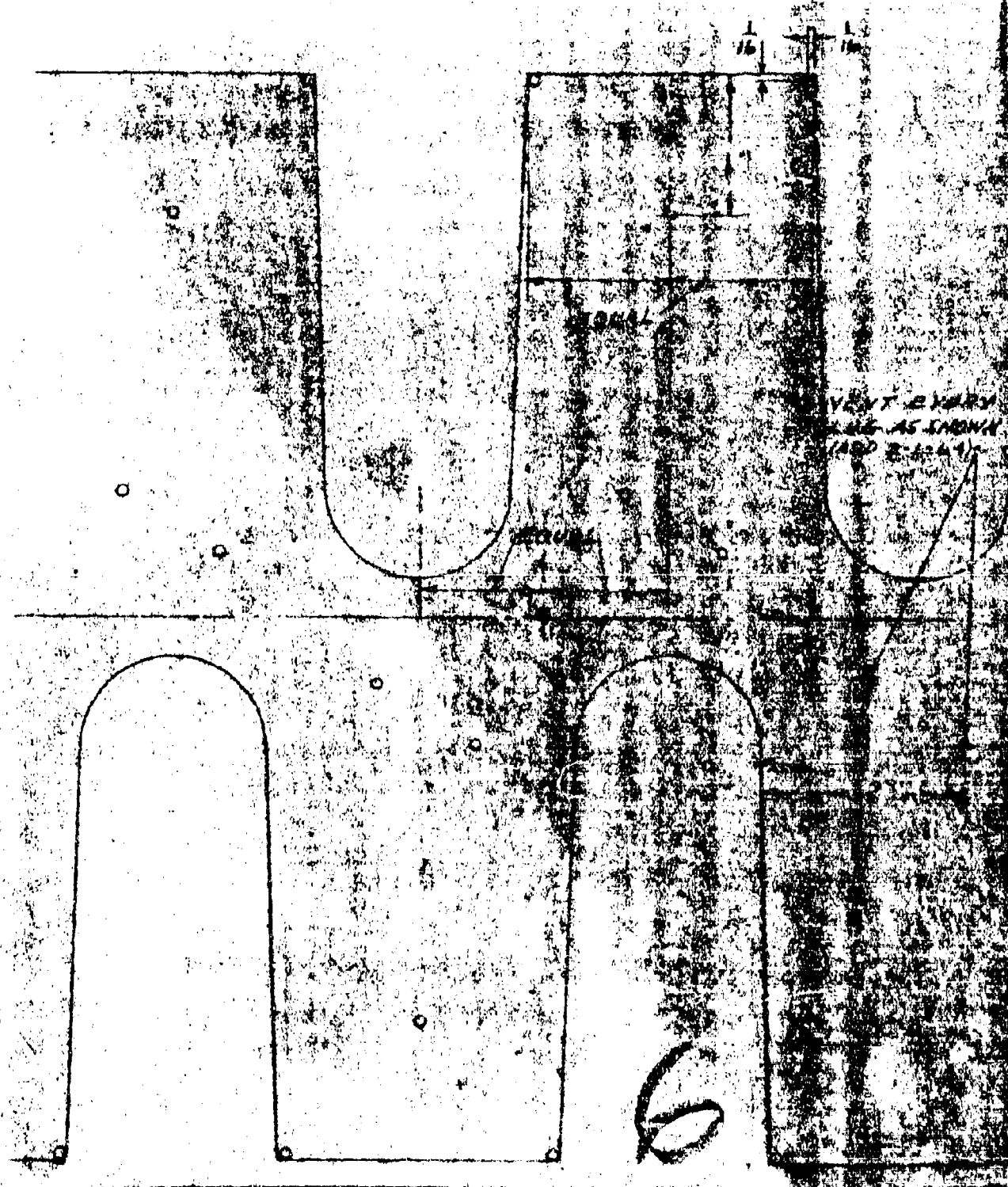
3 6 3 9 2 2 2 2 2 2

10 16 32 8 32 16 8 4 2

M D B

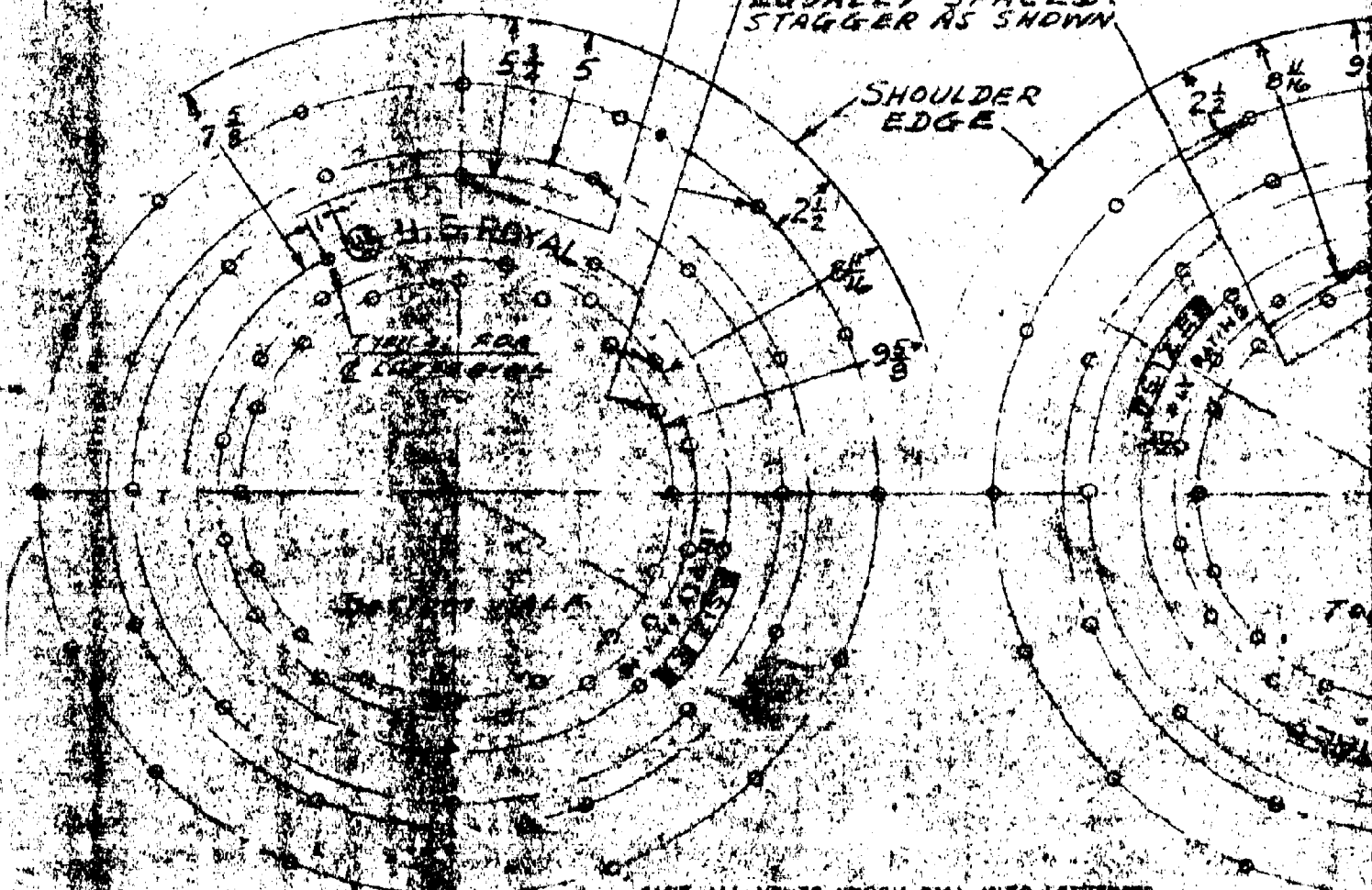
1 1 1 1 1 1 1 1 1 1

10 24 1 8



16 VENTS EACH ROW
EQUALLY SPACED.
STAGGER AS SHOWN.

SHOULDER
EDGE.

[illegible]

BOTTOM HALF

43.950 D/A.

6.950

11.274

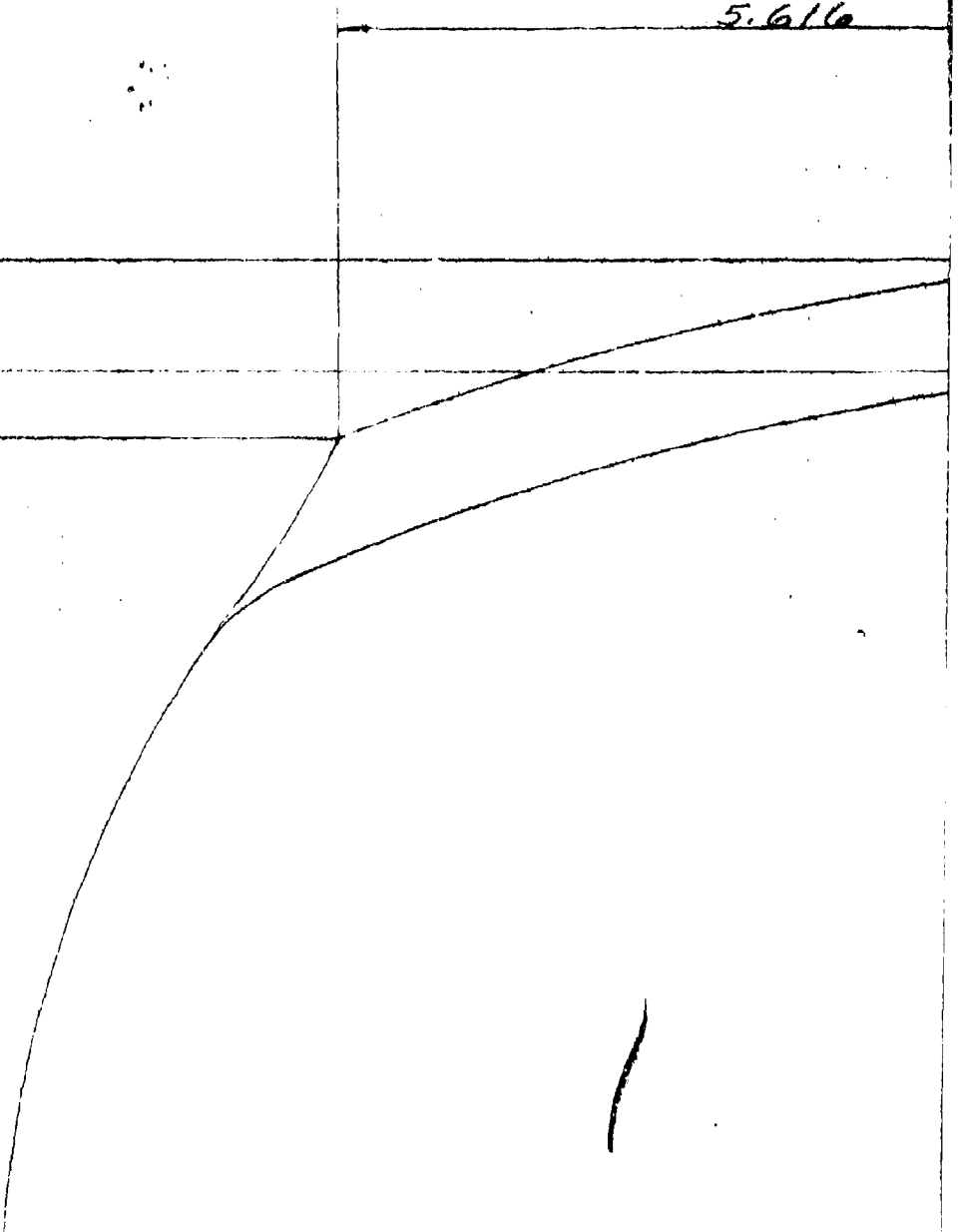
42.610 D/A.

.670

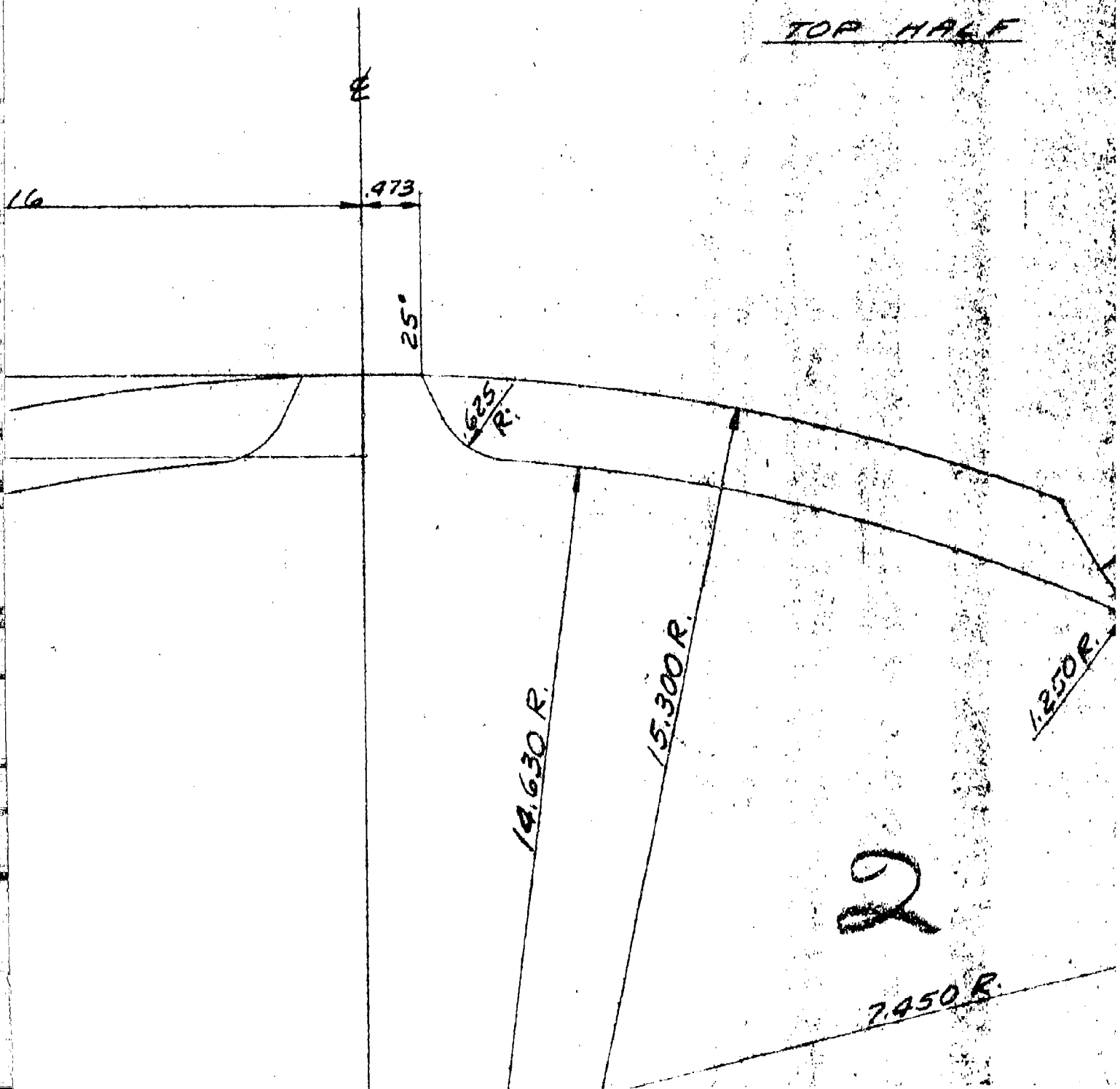
±.003

1.068
DROP

5.616



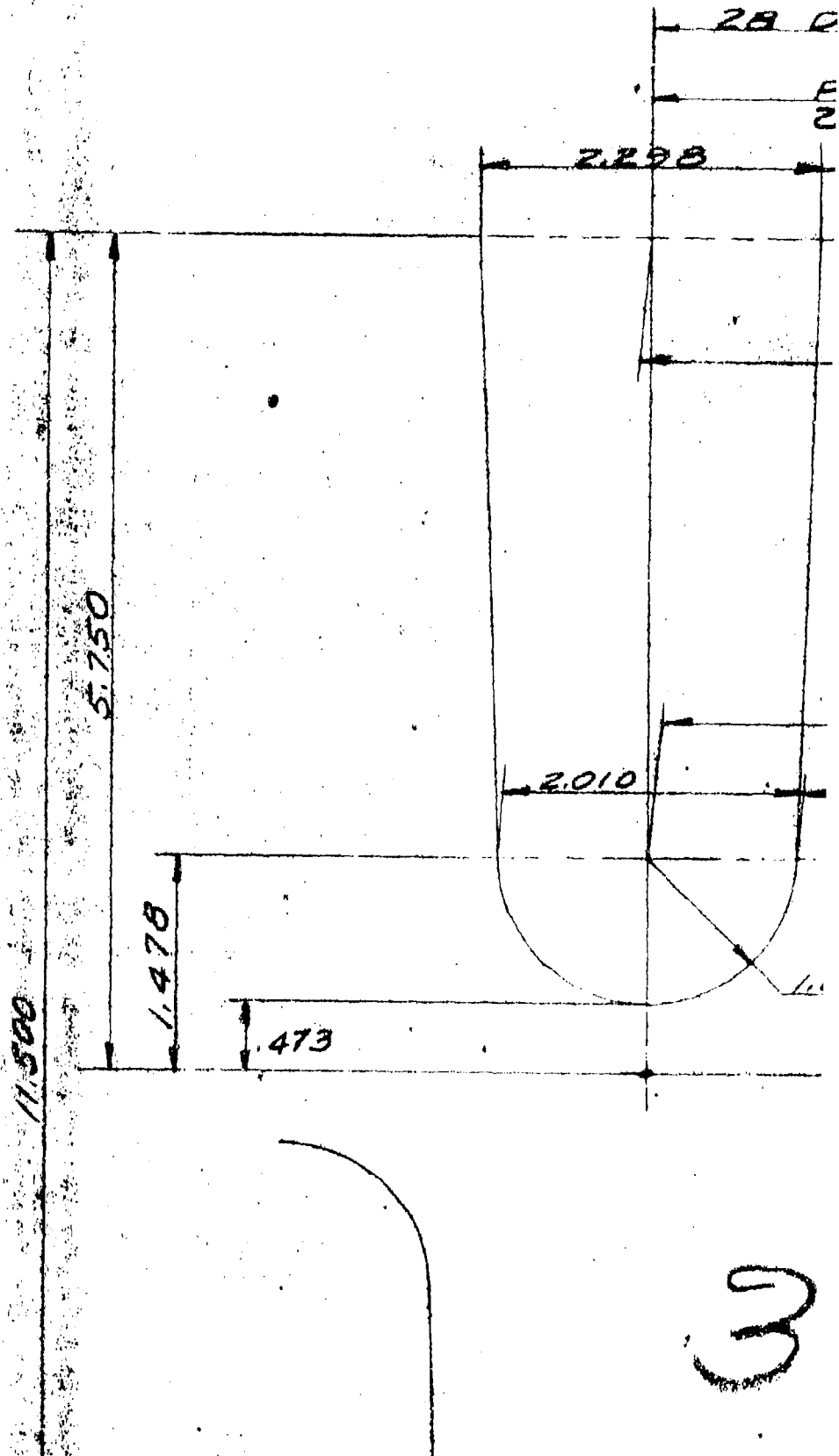
TOP HALF



THIS IS A TREAD VIEW OF THE TIRE.

ALL DIMENSIONS SHOWN ARE DEVELOPED

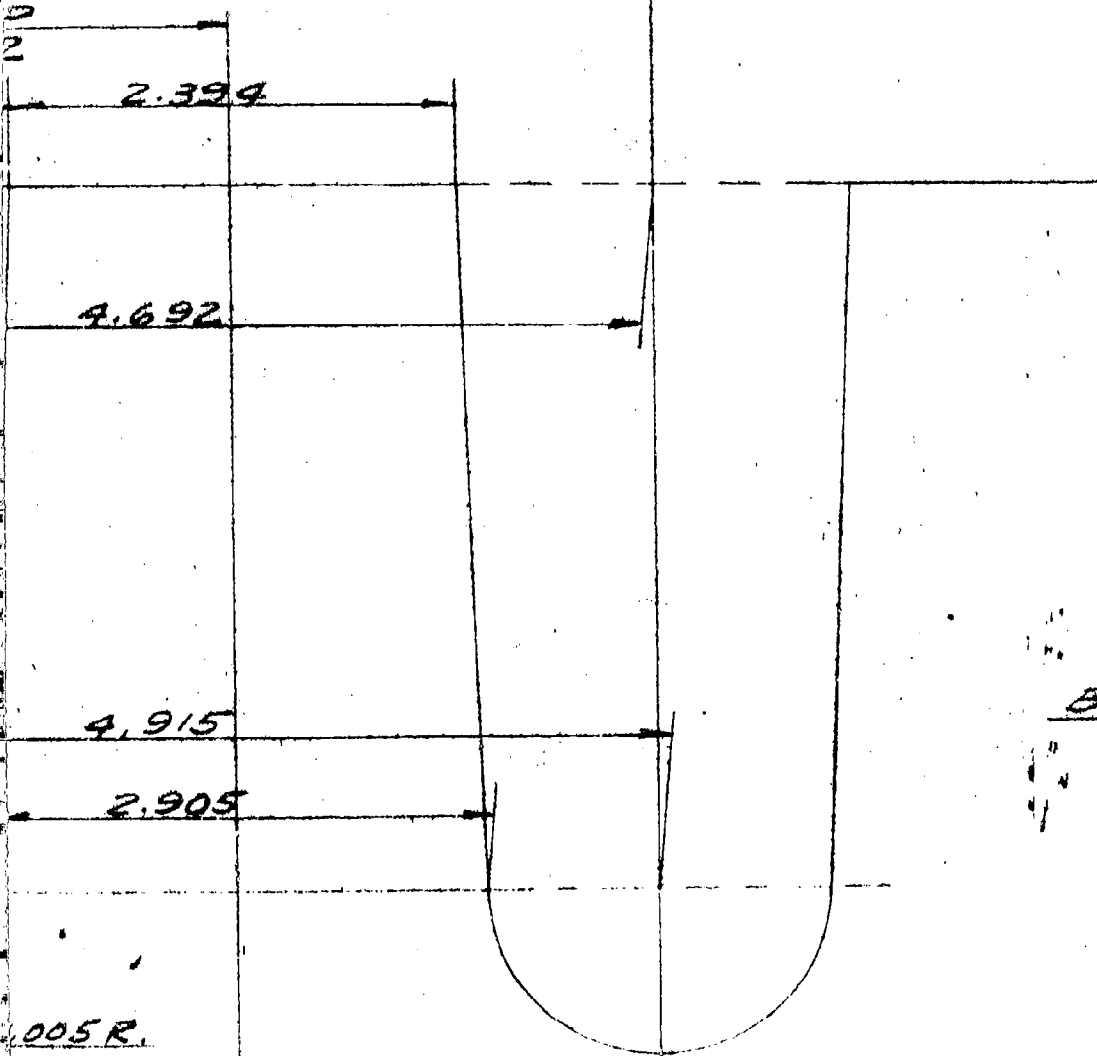
G.000 R.



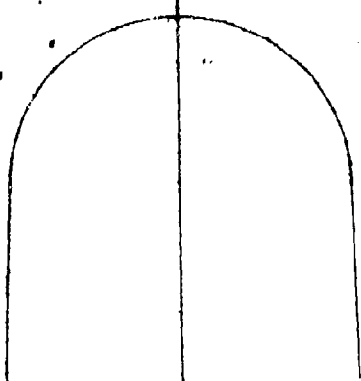
3

D LENGTHS.

DESIGNS @ 4.931 AT 4.



BOTTOM HALF



TOP HALF

4

11.944

5.434

15.1

6.000

.733
±.002

2°

20°

.750

6.750

20.062 DIA.

20.500 DIA. BAR GA. #U.S. 10G/11-B

TEMPLATES:

#U.S. 54566 CAVITY SHAPE & CENTER RIB

" 54567 TREAD DESIGN

5

15.300

7.837 R.

.437 R.

6.457

6

A

B

RADIA

.563

25°

.625R.

SECTION A-A

.625R.

SECTION B-B

7

A

B

D.P. =
 T.W. = 73.02% OF 15.75
 T.R. = 97.14% OF 15.75
 D.H. = $\frac{11.274}{15.300} = .737$
 C.S.
 RIM FIT = W-14 L
 N/G = 61.9 %
 TOE RING NO. T-1854
 VENTING DWG. NO. LV-3169 R-
 MODEL NO.
 MOLD DWG. NO. M-2313 R

DEV. ER	ADD LETTERING / VENTING	11-1-63	2
325B-1	DWG NO		
	ADDED: RING SEAT DIM'S, MOLD NO., AND TEMPLATES	10-28-61	1
REF.	CHANGE	DATE	MM
UNITED STATES RUBBER COMPANY DETROIT - MICHIGAN 16-20 U.S. ROYAL TACTICAL C.C TYPE "D"			
PRODUCT DEVELOPMENT DIVISION		MOLD DIVISION	SCALE = FULL
DRAWN BY	DATE	DRAWN BY	
2.C.W.	10-3-63		
			D 14017

39040 DIA

37 DIA

37 DIA

36.7 DIA

2.0 DIA. 1.0 DIA. 1.0 DIA.
1.0 DIA. 1.0 DIA. 1.0 DIA.
1.0 DIA. 1.0 DIA. 1.0 DIA.

1.0 DIA. 1.0 DIA. 1.0 DIA.
1.0 DIA. 1.0 DIA. 1.0 DIA.
1.0 DIA. 1.0 DIA. 1.0 DIA.

1000
1000
1000

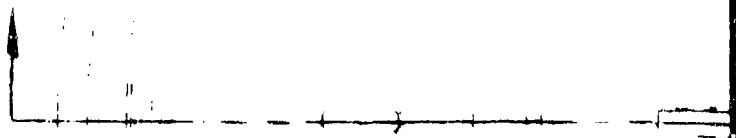
1000
1000
1000

1000
1000
1000

2

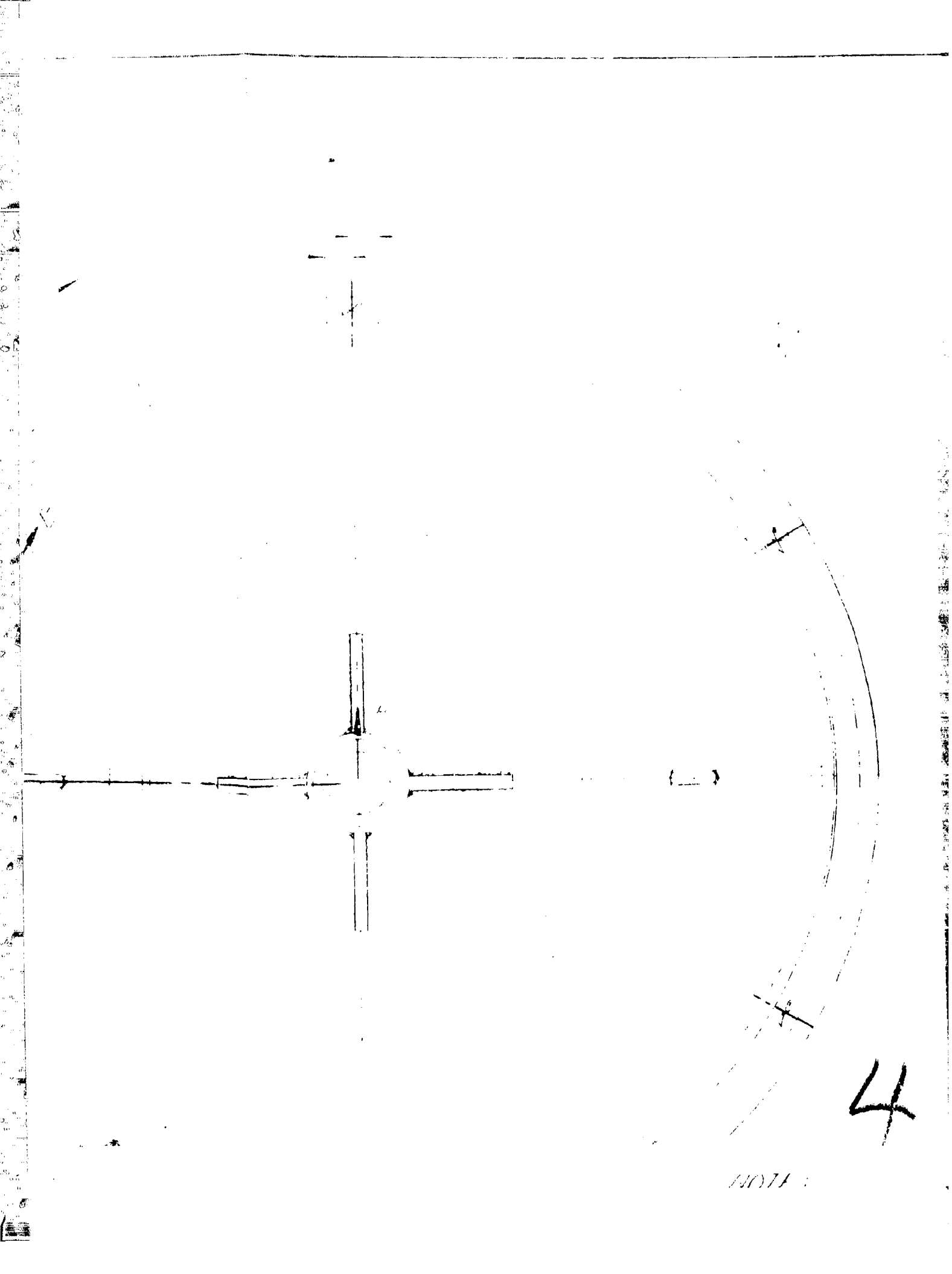
NOT

1. 1000 1. 2 1000 22
2. 1000 1. 2 1000 22
3. 1000 1. 2 1000 22



3

NOTE:



4

NOTE :

21 1/4 DIA.
20.812 DIA.
GAR GA. U.S. 2488

17 7/8 DIA.

17 3/8 DIA.

1/8

1/2

OR

1 5/8 DIA.

4 1/2

REQ.
SECTION

5

REQ'D EACH PLATE

SECTION A-A

3 1/2 DIA.

3 1/2 DIA.

2 DIA.

4 x 4 x 1/2 GUSSET PLATES
4 REQ'D

3/16

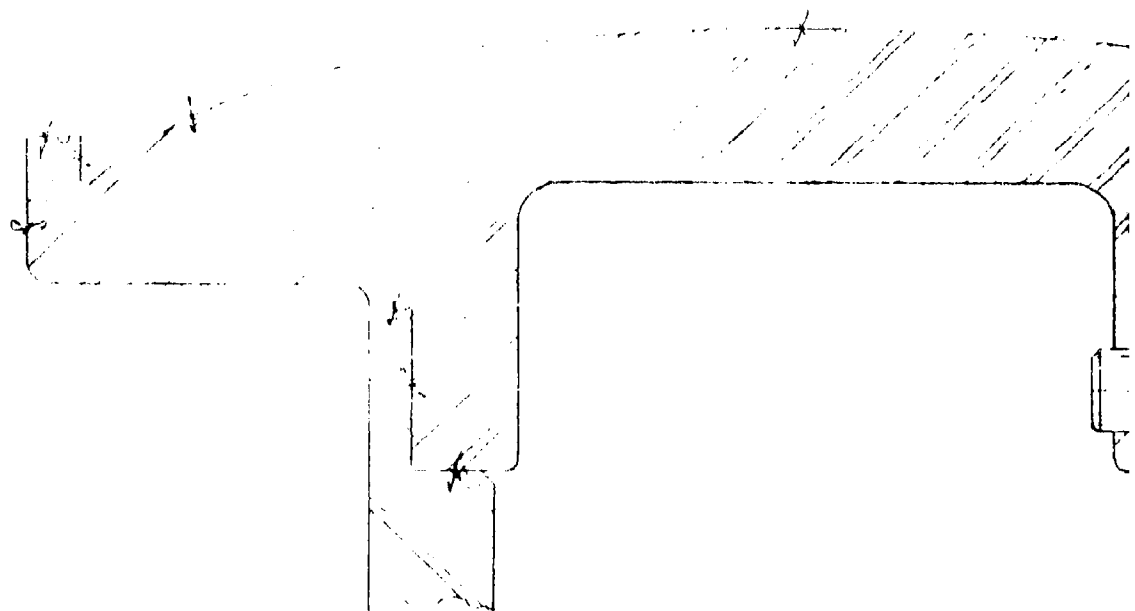
3 7/16 DIA.

4 DIA.

6

NOTE:

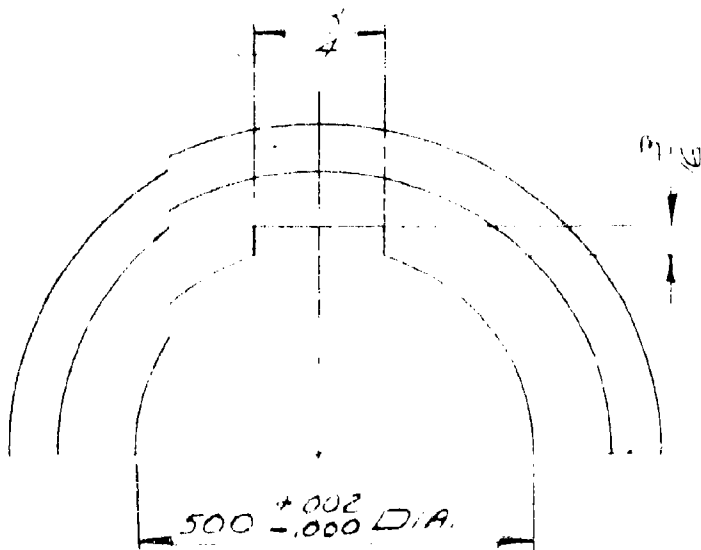
1. ALL DIMENSIONS ARE IN INCHES
2. NOT TO SCALE



PARTIAL SECTION B-B
FULL SIZE

MATERIAL:

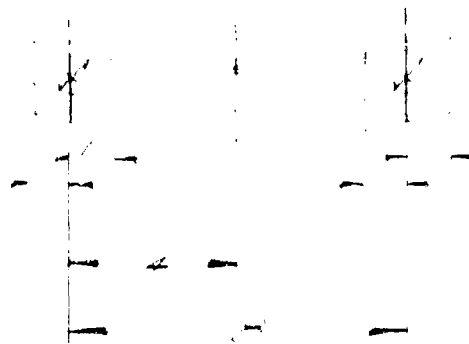
STEEL PLATE EXCEPT TREAD
TREAD - STEEL CASTING
PATTERN # J-5650



7

NOTE

USE OF THE TAP MACHINE
BUILDING MACHINE • 0757
(SEE FIG. 77)



PLAN VIEW
1/2 SIZE

- PROCEDURE
- (1) LAY RING SEGMENTS ON FLOOR IN AN APPROXIMATE CIRCLE. SEGMENTS TO BE HANDLED WITH AID OF 1/2" EYE BOLT FOR WHICH A TAP HOLE IS PROVIDED ON THE TOP SIDE. ANGLE IN THE CENTER OF EACH SEGMENT.
 - (2) LAY TOP PLATE ON TOP OF ASSEMBLED RING SEGMENTS. ALIGN PLATE AND FASTEN WITH SCREWS AT ENDS OF SEGMENTS.
 - (3) SET ASSEMBLED UNIT ONTO BOTTOM PLATE. PLACE UNIT SO THAT HOLES LINE UP WITH SCREWS PROJECTING FROM BOTTOM PLATE. FASTEN SECURELY.
 - (4) ASSEMBLY IS NOW COMPLETE AFTER NECESSARY STEPS TO MAKE TREAD ARE COMPLETED. REVERSE ABOVE PROCEDURE TO REMOVE TREAD FROM SEGMENTS.

1/2" BNC SCOK HD CAP
SCR. 1 LONG - 14 REQ'D

3/8" DIA
B.C.

IN TOP PLATE:
17 DRILL THRU-
32
4 HOLES REQ'D
IN RING SEGMENT:

1/2" BNC CAP THRU-2 HOLES
REQ'D IN EACH SEGMENT.

8

NOTICE

Continued use of method of manufacturing this tool may be necessary. The use of all the following patents is hereby acknowledged: 2,637,815; 2,638,815; 2,639,815; 2,640,815; 2,641,815; and others. Patent Pending.

REF.	CHANGE	DATE	SUB
UNITED STATES RUBBER COMPANY			
CENTRAL MOLD DIVISION			
DETROIT - MICHIGAN			
100-20 MOLD & BUILDING DRUM			
TO BE USED WITH MOLD M-2679-R			
1			
DRAWN BY S. J. JONES		CHECKED BY J. L. JONES	SUPERSEDES
DATE STARTED 10/1/57		DATE FINISHED 10/1/57	REWORKED BY
			M-2681