

E. I. du Pont de Nemours & Company
LABORATORY NOTEBOOK

Book No. E 46321

MAY 14 1993

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E. I. DU PONT DE NEMOURS & COMPANY

Issued to: *ALAN KINZER*.....

.....*RESEARCH - 9092*..... Department

Location: *REMINGTON LEON*.....

Date: *11/15/91*.....

TO BE RETURNED ON REQUEST

Research Costs Time and Money
Protect This Investment

DISCUSS NEW PRODUCTS AND PROCESSES ONLY WHEN
YOUR WORK REQUIRES IT

8/29/91

James Rabbitt
8/28/91

①

NOTEBOOK: E-46301

8/2/91 - DICK JACKSON & MYSELF BRAINSTORMED ABOUT A
ONE PIECE BARREL & RECEIVER FIREARM.
ONE PIECE BOLT BODY ASSY.
LUGS IN REAR

8/2/91 - DEVELOPED BASIC PARAMETERS - ROUGH SKETCH
LASER WELD LUG IN RECEIVER
60° LOCK ROTATION
SIMILAR AS TO 20-83
LIPS IN BOX NOT RECEIVER
UNIVERSAL BOLT LIP - LEAF OR RIGHT.

8/5/91 - REVIEWED MAT'L SELECTION W/ LYNN SIKESMA - (4/40 AND 20-83)
LASER WELD NO GOOD ON RESULFETTER MAT'L
COPPER BRASS WAY TO GO
TOP TANG, TO STOP ROTATION
MIRROR IMAGE CAN CUT
MIRROR IMAGE EJECTOR & EXTRACTOR

8/6/91 - HEADON CONTOUR TO POINTS REQUIRES 1.44" OF MAT'L DIA.
FOR RADII WILL RUN POSSIBLY 1.370" DIA.
RECESS BOLT BODY FOR BOLT HANDLE - FLUSH .015 DIA.
REVIEWED SHOT STRESS W/ SIM THORNTON (GENERAL)
LUG MAT'L TO BE 8640 - POSSIBLE TWO LUGS?

8/7/91 - GATHERED TOOLING, FOR RECEIVERS & BOLTS
WAYNE CABLE HAD TROUBLE DRILLING
4/40 BURNING TREMENDOUS RUNOUT - COULD
BE DUE TO SOFT MATERIAL?

8/8/91 - CALCULATED POSITION OF END OF BOLT FROM FRONT
TRIGGER ASSY HOLE, (USING STD. M/700 DIMENSIONS)
DIM = .8495"
∴ MY BOLT WILL BE $5.600 + .8495 = 6.4495$ " IN LENGTH
OR $6.450 \pm .002$

APPROVED BY

DEVELOPED SPEC SHEETS. DATE

TRIGGER ASSY. HOLE LOCATION ON ASSY WILL HAVE TO CHANGE.

added 8/28/91

*James Rabbia
8/28/91*

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②

8/2/91 CONT'D.

BOLT PLUG, O.D. TO CHANGE TO .810 - MATCH BOLT O.D.
F.P. HEAD DIST - $\frac{1}{4}$ TO ENGAGEMENT SURFACE INCREASE
TO ACCOMMODATE .810 BOLT DIAMETER.

8/7/91 - WROTE HIGH SPOT FOR LUG/BARREL/BOLT
SET UP MYNARD - GUNDRILL & REAM
RESEARCHED CUSTOM CHAMBERING, OPSE.
WAYNE WILL RUN CHAMBER AND .260" DIA
COUNTBORES.

8/10/91 - RAN BARREL/RECEIVER PROGRAM ON MONARCH LATHE
W/ HELP OF JIM RABBIA. PROGRAM IS OΦBID (KEENEY)
CUT RECEIVERS TO 1.250 DIA. DID NOT LEAVE A
STEP.
PROCEEDED WITH MYNARD - CUT BOLT HOLE & REAMED
AT 200 RPM F=0.020 ZPK TO A DEPTH OF
8.500 FROM REAR FACE OF RECEIVER,
SET MONARCH TOOLBOX TO 47" - USE 222 LENGTHS

8/11/91 - PROCESSED RECEIVERS ON FARALL W/ INDEXING UNIT.
PORTS AT 20° ABOVE HORIZONTAL
90° LOCK ROTATION (TANGIAL ONLY)
TOP TANG
LUG IS WIDE (WITH $\frac{5}{16}$ RAD IN ALL CORNERS) BY 1.0 x .375
STD. TAKE DOWN SCREEN POSITION.

8/12/91 - C'BORE DIA FOR 2V3 IS .650" DIA.
BOLT OAL - 6.450 - DRILL SHOULDER AT 5.260" FROM REAR
STEP O.D. AT .325" FROM END TO FROM. 696" DIA TO .812" DIA.

8/13/91 - RAN LUG CONTOUR ON MONARCH - PROGRAM 8/10
TURNED BOLTS ON ORVA - 325 AT .698 DIA.
TANG CUT AT .690"
WAYNE DRAINED SLOPE HOLES - FRONT AND REAR TWO SAME DYS.
.690" C'BORE x .150 DEEP.

Walt Starn
James Rabin
8/28/91

③

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8/14/91

- HAND FILED EXTRACTOR - 20° ROTATION w/ 180° SEA FOR EJECTOR
- BOLT PLUGS MINDED
- BOLT HEAD HOLE LOCATION SKETCH

8/15/91

8/16/91 - RESULTS OF PRESENTATION:

WELL RECEIVED FOR CONCEPT.

CONCERNS: REAR LOCK-UP - RECEIVER STRETCH

BEARING DIA. OF BOLT - POSS. 700 BOLT SHAFT

SOLUTIONS: DOUBLE LOCK-UP IN FRONT.

90° LOCK ROTATION

WILL TEST w/o BOLT SHAFT - IF LUGS

WITH STAND LOAD (250,000 PSI) BOLT

SHAFT SHOULD NOT BE REQUIRED.

CAN CUT, THREADS & BOLT HANDLE ONE

UNIT PRESSED INTO REAR OF BOLT BODY.

8/19/91 - LUGS: PATE REVIEWING, HEAT TREATMENT.

8/21/91 - FOR TWIN LOCKING, LUGS. POSITION 20° BELOW HORIZONTAL

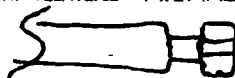
POINTS 30° ABOVE HORIZ.

RING BOLT .5" x 360°

LUG WIDTH .5" ?

90° LOCK POSITION WILL BE REQUIRED.

w/ 20° POSITION



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8/28/91 - DEVELOPED TWO SAMPLES:

(1) RECEIVER - / FRONT LOCK UP

TWO LUGS AT 20° BEHIND HORIZ.

OAL = 8.0"

LUG RADUS 2 $\pm$ (3/16 DIA CUTTER)

STRENGTHENED FROM SINGLE BARREL SAMPLE IN

VACUUM FURNACE - HARDNESS REQUESTED AT

R₂ 28. NOT HIGH ENOUGH

WILL RUN IN CONTROLLED FURNACE - RESULTS MAY

SHOW WARPAGE AND SCALE

RAN 7 BARRELS THROUGH MILLING - READY FOR

PORT CUTS.

Welded
8/28/91
James Rabbie
8/28/91

9/4/91 - REVIEWED WITH LUG, IN FRONT OF DICK JANSSEN,

DICK PROPOSED 60° LOCK ROTATION OVER 90° ,WON REMAINING, 20° LUG ORIENTATION, 70° LOCK ROTATION WOULD BE ~~UNUSUAL~~ ULTIMATESPIRIT LOCK ROTATION, SO THAT C₂ OF LUG,IN RECEIVER MATCHES C₂ OF LUG ON

BOLT - PRODUCE FULL SUPPORT OF LUG,

SURFACES.

⑤

9/5/91

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LOCATION OF TRIGGER ASSY HOLES:

CURRENT 200 LOCAT. IS .500 BELOW C_2

DUE INCREASED BOLT DIA, HOLE C_2 LOCATION
WILL REQUIRE CORRECTION OF ~~.050~~ ".05825"
IN C_2 OF T.A. HOLES WILL BE ~~.5783~~ ".5783"
 C_2 OF NEW RECEIVED.

9/11/91

FOR EXTRACTION: RUN C'BORE AT ANGLE TO

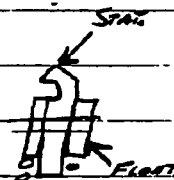
FORWARD EXTRACTOR OVER RIM OF SHELL:



RUN PRIMARY w/ SUPPLEMENTAL ON OPPOSITE

SIDE USING SPRING LOADED BUSHING, AS

PRIMARY EXTRACTOR AT 120° FROM EXTRACTOR.

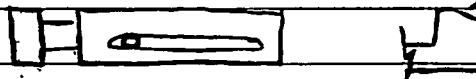


FOR PROCESSING, SQUARE HOLS AFTER BORE WITH

I.D. GOVERNING TOOL.

FOR BOLT STOP/GUIDE - PLUNGER FROM SIDE

INTO SLOT IN BOLT (BEHIND RECESS) ANGLE

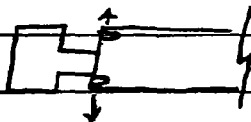
ANGLE
ON BUSHING

PLUNGER TO AID IN BOLT INSERTION/ALIGNMENT.

⑥

9/13/91 - IN THE CASE OF HEAD FAILURE, TO INSURE NOTEBOOK E-46321

THE SEAL OF GAS FROM OPERATOR, A PRESS
IN SECONDARY BOLT EACH WILL SEAL RAPIDLY
AGAINST RECEIVER



W.D. 9/13/91

9/19/91 - DISCUSSION ABOUT LUG ATTACHMENT,

WILL TEST HIGH TEMP SILVER SOLDER.

LODGE HAS BEEN COMPLETED, REQUIRES

H.T. & TESTING.

9/23/91 - RESULTS OF MEETING W/ FORD SENIOR & DICK JACKSON,

LOOKING LUGS WHICH ~~NOT~~ SHOULD NOT REQUIRE COPPER

BASE. SUGGESTED LOCALIZED INDUCTION HEATING.

FORD WILL REVIEW LUG DESIGN AND REVISE.

PREPARING BARREL FOR TESTING. STRESS RELIEVE

AND THEN H.T. BY STEEL TREATERS. LUGS WILL

BE SILVER SOLDERED IN PLACE AFTER H.T.

TEST TO BE PROGRESSIVE TEST LOAD, PROP, EXTEND

HIGH PRESSURE, PULSED BORE.

* EXPECTED MODES OF FAILURE: HIGH PRESS. LOAD WILL

SWELL/EXPLODE CASE HEAD, ALLOWING PRESSURE

INTO RECEIVER. BORE WILL FLOW BACK INTO LODGE

PRESS IN BOLT. GAS SHOULD OBSTRUCT SECONDARY

BOLT FACE AND BORE LUGS FROM SOLDER SEALING ACTION

9/23/91

⑦

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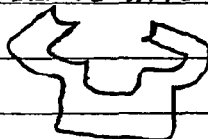
9/23/91 GWT'D -

RECEIVER; BARREL SHOULD SHOW NO SIGNS
OF FAILURE. GUN WILL BECOME INOPERABLE,
BUT SHOULD NOT CAUSE DAMAGE TO SHOOTER.

TEST TO VERIFY WHETHER SILVER SOLDER WILL HOLD
UNDER CASE HEAD FAILURE STRESS.

TO REDUCE DAMAGE DUE TO GAS PRESSURE,
A RELIEF VALVE IS UNDER CONSIDERATION TO
FUNNEL GAS OUT OF THE BOTTOM OF THE
RECEIVER.

REVISED GUN DESIGN W/ INTEGRAL BARREL BRACKET,
PRESS FIT & BRAZE INTO RECEIVER.



Michael D. Hunt
9/23/91

(3)

NOTES: E-46321

10/3/91 RESULTS OF INITIAL TEST ON (6MM CALIBRE) 9/27/91

CONDITIONS: - BARREL/REC R443

- NO BOLT SHOULD/BE FINE - TRIM LUGS R443

- .650" DIA C'BORE IN REC - MIG WELDED LUG/RECEIVER JOINT

- .810" DIA BOLT - NO LUGS RECEIVER HOLE

- 1.25" DIA RECEIVER - OPEN BORE

1ST ROUND - STANDARD PRODUCTION ROUND

NOTE: RESULTS AS EXPECTED,

NO VISUAL FAILURE

2ND ROUND - STANDARD PROOF LOAD

NOTE: RESULTS AS EXPECTED

NO VISUAL FAILURE

3RD ROUND - HIGH PRESSURE - EST. 140,000 PSIRESULTS: MECHANICAL FAILURE OF
RECEIVER.

① BOLT WAS SEPARATED FROM RECEIVER

② BOLT REMAINED IN RECEIVER BUT
FORWARD APPROX 1 1/2"③ REC SPLIT INTO TWO, OPENING THROUGH
(LEFT PORT) WELDED INTERSECTIONNOTE: TEST LUG WAS ETCHED WITH #923 ON
TOP RAIL OF RECEIVERWILL DM
90/3/91

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10/12/91 - REL NOTES DATED 9/23/91: SINGLE PIECE CWS DESIGN

- FURTHER DEVELOPED CWS DESIGN, BEGAN
FIRST PROTOTYPE.

- CONSIDERING TWIN GCS BELLER HOLE DESIGN

- DEVELOPED POSSIBLE SHOULDER BOLT / FLAW

EXTRACTOR DESIGN.

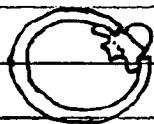
ENDS OF EXTRACTOR WOULD FIT INSIDE BOLT

SHROUD WITH EXTRACTOR PROTRUDING THROUGH

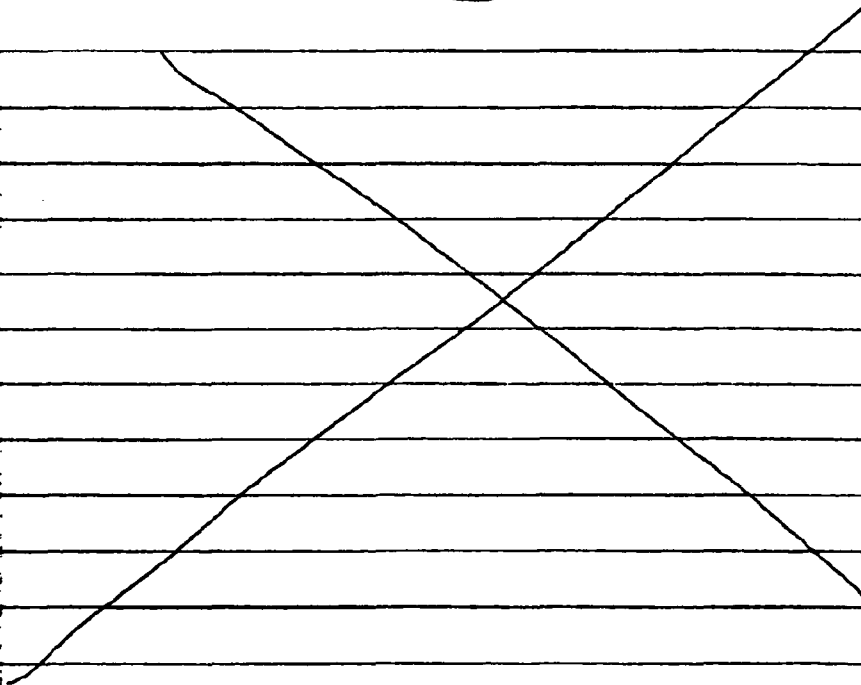
RECESS IN SHROUD. UPON CASE HEAD FAILURE,

EXTRACTOR WOULD ACT AS CONTINUATION OF

BOLT SHROUD SEALING RUPTURE OF CASE HEAD.



EXTRACTOR PLACEMENT



(10)

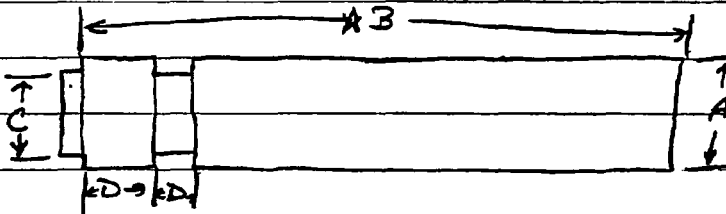
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10/6/91. DEVELOPED BOLT CONTOUR W/ SHROUD.

Bolt (TURNED) 6 BOLTS TO FOLLOWING DIM.

A. BOLT O.D. - .900 $\pm$.0015

B. BOLT LENGTH - 6.120 BOLT FACE TO END - (W/O SHROUD)

C. SHROUD DIA./LOCKING SURFACE - .645 $\pm$.0015D. LUG WIDTH - .500 $\pm$.0015

TO ENSURE GAS SEAL UPON CASE HEAD FAILURE,

A REVISED 700 SHROUD DESIGN IS DESIRED.

TO ACHIEVE SUCH A SHROUD DESIGN, BOLT LOCKING,

SURFACE AND MAINTAIN CAPABILITY, THE BOLT

O.D. HAS TO BE .900" WHICH WILL ALLOW FOR

.125" LUG WIDTH (HEIGHT OF CONTACT SURFACE) AND

A SHROUD THICKNESS OF .050 $\pm$.002. AS STATED

PREVIOUSLY, THE EXTRACTOR WILL BE OF THE CLAW

(LAUSSE) STYLE, WHICH WILL INTERSECT THE SHROUD

BUT UPON CASE HEAD FAILURE WILL NOT AS

A UNIFORM MESS OF THE SHROUD, TO CONTAIN

THE PRESSURE, PREVENTING MECHANICAL FAILURE

OF LOCKING MECHANISM AS WELL AS RECEIVER

WALLS. THE O.D. OF THE RECEIVER WILL BECOME

1.300 APPROXIMATELY .200" WALL THICKNESS AROUND THE

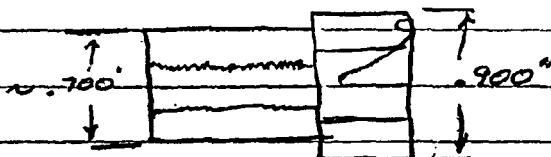
BOLT.

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10/6/91 CONT'D. BOLT CONFIGURATION

TO IMPROVE WEIGHT DISTRIBUTION AS WELL AS
 OVERALL WEIGHT, THE BOLT FIRING PIN
 CLEARANCE HOLE WILL BE BORED OUT, AS
 A WEIGHT REDUCTION PROCESS, TO ALLOW
 BOLT BODY WALL THICKNESSES TO BE IN
 THE RANGE OF .100". TO ADD USE THE M/700
 FIRING PIN ASSY, A RUSHING, WILL BE PREPARED
 INTO THE REAR OF THE BOLT. THE RUSHING
 WILL CONTAIN THE CORE'S THREADS FOR THE
 BOLT PULLER, GEAR CUT AND COCKING, NOTCH, AND
 THE ASSEMBLY CUT FOR THE BOLT HANDLE, AS
 IN DASH SKETCH BELOW.



10/11/91 - ALTERED MURKIN DIAMETER FROM ORIGINAL .700

BARREL LENGTH - NEW .600" MURKIN DIA. FIREARM

BACK TO .700 THEN TO .8147 AS STD JAP MURKIN

BARREL

DISCUSSED MURKIN BOX FEEDING - ROTARY OR STRIP

WILL REQUIRE CLEARANCE IN THE BOLT.

WILL INCREASE NON-SULPHURIZED MATERIALS

TO ALLOW FOR LARGER WEARINGS.

(12)

E-46321

10/14/91 - SENT 12 RBL TO GATION FOR ZIFLING:

BARRELS WERE DRAILED, BEAMED AND SIZED

FOR 30 CAL AFTER HT TO OUR CURRENT

BARREL SPEC THE BARRELS WILL BE BUILT

INTO 40X 2 ACTIONS AND TESTED FOR ACCURACY

10/22/91 - ON 10/21/91 FIRED 4 TEST ROUNDS THROUGH A

NBAR WITH FOLLOWING SPEC: BAR BOLT SHROUD L.D. AT .500"

BOLT SHROUD O.D. AT .645

BOLT SHROUD DEPTH AT .120"

TEST ROUNDS FIRED AT NORMAL REACTIONS, BUT

SHOWED POSSIBLE HEAD SPACE MEASURE PROBLEMS. AFTER

LYSTERING, WAS FOUND TO BE .009" DEEP.

BOLT WAS ALTERED WITH A .005" SHIM INSERTED IN

BOLT FACE ON 10/22/91 4 FIRING PIN INDICES TAKEN,

RESULTS - .019, .017, .020 & .019 - AGREED TO

FIRE HIGH PRESSURE 30:00 LEAD. LOAD: 50 GRAMS

OF 4198, 220 GRAIN BULLET. ESTIMATED PRESSURE

AT 110,000 PSI.

RESULTS: NO VISUAL METAL FAILURE, LOW TEMP

BRAZE JOINT SPLIT BUT LUL DID NOT EXIT

RELEASER.

DATE

(13)

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11/5/91 - RAN ONE BARREL/RECEIVER WITH:

RECEIVER DIA - 1.300

RECEIVER T. DIA - 906

DOUBLE PORTS

RIGHT HAND BOLT HANDLER CUT ONLY

WILL USE THIS ASSY, FOR STOCK CONSTRUCTION. (FOR SAMPLE

USE ONLY, PARTS WILL NOT BE H.T.D.)

RECEIVED ECM BARRELS ON 11/14/91, WRO BARREL

SECTIONED FOR VISUAL INSP. OF SURFACE.

SURFACE FINISH APPEARS TO BE AS REQUIRED, NO

VISUAL DISCREPANCIES. WILL BUILD 10 BARRELS

WITH: 308 CHAMBER

1/2 TWIST

Bore Dia. DRILLD, REAMED & SIZED

L7 ROBE DIA. ECM'S

IF LASER WELDING, OR ELECTRON BEAM WELDING, IS

APPLIED; MRE CHANGE LUG POSITION TO 180° NOT

140° AS IS CURRENTLY, MAY ALSO WIDEN LUGS TO

INCREASE BEARING SURFACE AREA.

WITNESSED BY

DATE

(14) E-46321

8/21/91

700 Bolt Body - 5.3575

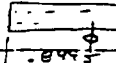
Bolt Head - 3.120 REAR OF HEAD TO Bolt Body
5.6695

700 REC. CORE DEPTH - 1.150

F.C. LENGTH + 5.970
FROM FRONT4.82 DIST BETWEEN LOCK SURFACE
TO FIRST F.C. HOLE

DIST FROM FIRST F.C. HOLE TO END OF BOLT IS

$$5.6695 - 4.82 = .8495$$

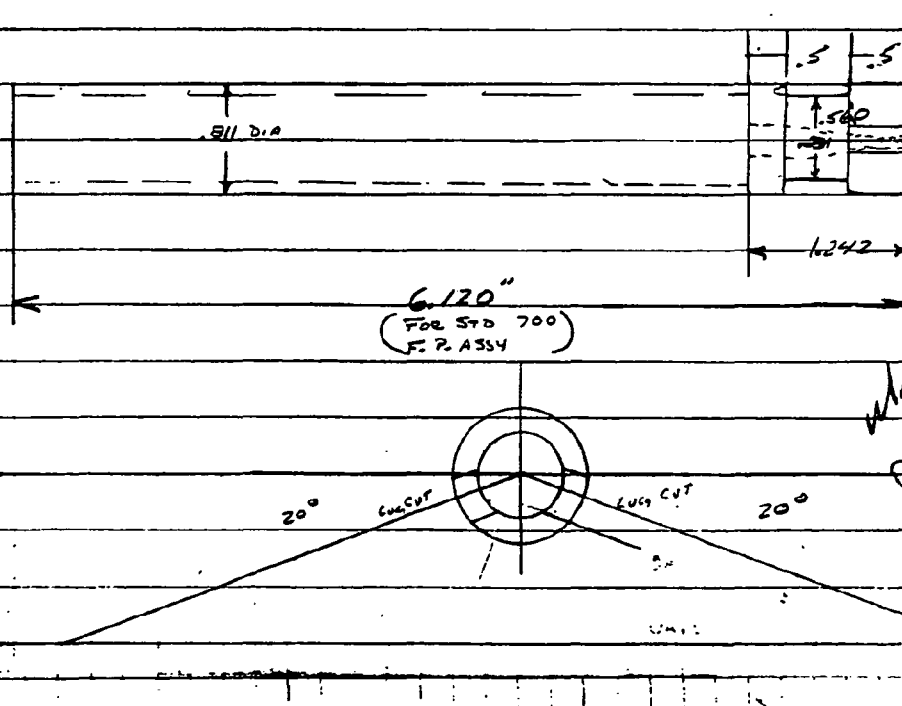
0  → FRONT SURFACE
.8495

TO PRODUCE A LONG ACTION BOLT THAT WILL

FUNCTION WITH A CURRENT F.P. ASSY. THE LENGTH

WILL HAVE TO BE 5.6695" LONG, FROM LOCK SURFACE

BACK 12/ OAL IS TO 6.120"



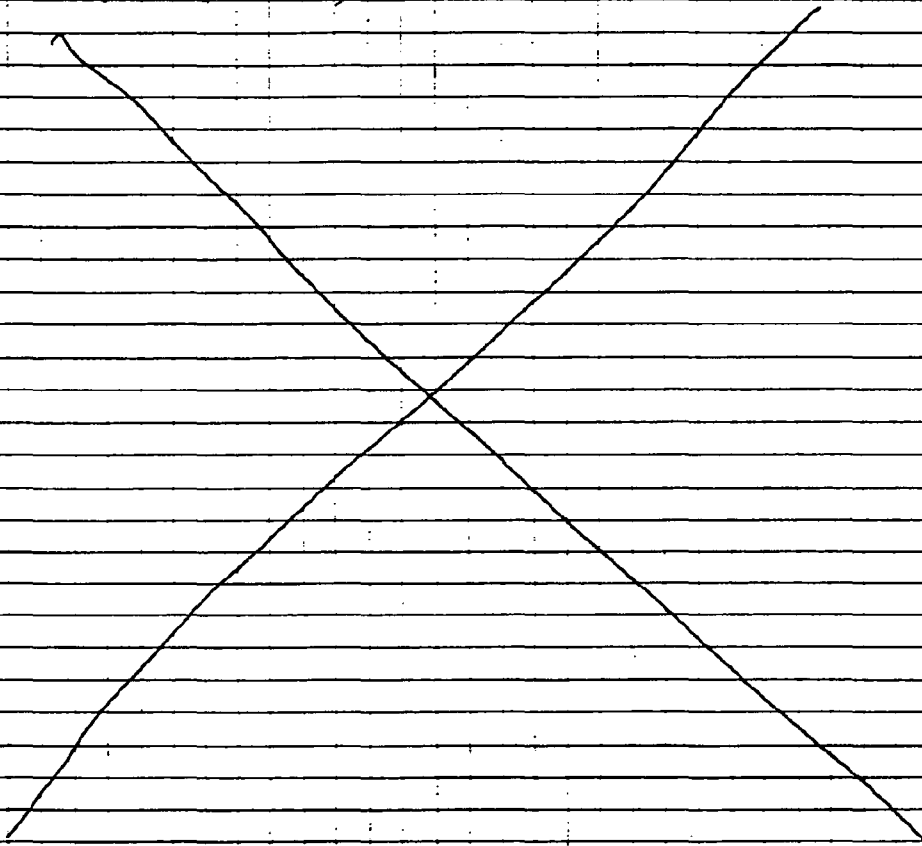
Welded 8/21/91

James Barber 8/28/91

PURPOSE EXPLANATION OF FOLLOWING, VOID PAGESBook No. E 46321

PAGES NUMBERED 1-20 INCLUDING WERE SAVED FOR
ORIGINAL EXPERIMENTAL LOOSE LEAF NOTEBOOK PAGES
THAT HAD BEEN INSERTED ON PAGES 1-14 INCLUDING,
ON 12/19/91.

THEREFORE, PAGES 16-20 WILL NOT BE USED AND
MARKED ACCORDINGLY.



EXPERIMENTER

John D. KingDATE 12/19/91

WITNESSED BY

DATE

46321

Book No. PURPOSE

EXPERIMENTER

DATE

WITNESSED BY

DATE

PURPOSE REVIEW OF PROGRESS FOR WEEK OF 12/9/91 TO 12/12/91 Book No. E 46321

PRODUCED A TEST SPECIMEN (TO DETERMINE THE ULTIMATE STRENGTH OF THE LOCKING MECHANISM) WITH THE FOLLOWING SPECIFICATIONS: TEST SPECIMEN # XC-0731

BARREL/RECEIVER: 700 MAGNUM BARREL CONTING
CHAMBERED FOR 30.06 CALIBER
RECEIVER O.D. = 1.300"
RECEIVER I.D. = .9065"
HARDNESS Rc 22 (MAT'L 4137R)
TWIN EJECTION PORTS .625 WIDE

BARREL BROWNET/LUG: MAT'L 4140
HARDNESS Rc 35
WIDTH 5"
LUG SURFACE WIDTH .375"
140° L SEPARATION OF LUGS
SINGLE PIGE/ YORK DESIGN

BARREL BROWNET WAS LOW TEMP. SILVER SOLDERED INTO RECEIVER

BOLT: MAT'L 8640
HARDNESS Rc 43
BOLT O.D. .900"
BOLT SHROUD O.D. .645"
BOLT SHROUD I.D. .575"

TEST CONDITIONS: OBSTRUCTED BARR - 4 BULLETS SEATED AHEAD OF CHAMBER
30.06 LOADED WITH 55 GRAINS OF 4198 POWDER CONTAINED IN IRON CHAMBER

RESULTS: BARREL LUG, ROTATED REARWARD AND KEPT BOTTOM OF RECEIVER.

BOLT WAS FOUND AT REAR OF IRON CHAMBER.
BOLT LUGS SHROUD AT APPROX. 45 DEGREES
BOLT SHROUD SEPARATED FROM BOLT.
SHROUD

NO VISIBLE FRACTURE OF BARREL OR RECEIVER.

EXPERIMENTER Michael D. H.

DATE 12/16/91

WITNESSED BY W. J. Harrison

DATE 12/17/91

46321

Book No. PURPOSE INVESTIGATION OF ELECTRON BEAM WELDING

CONTACTED BOB SAUD AT FERRANTI - SEEMED TO DISCUSS
POSSIBILITY OF E-BEAM WELDING, BARREL BARREL/LIN, INFO
RECEIVED AFTER SENDING PRINTS AND SECTIONED RECEIVER
FOR HIS REVIEW, HIS SUGGESTIONS ARE AS FOLLOWS:

- MATERIAL CHANGE WOULD BE REQUIRED TO ELIMINATE
RESULPHURIZATION
- 4140 MUST HAVE BEEN PREHEATED AS WELL
AS POST HEAT TREAT TO REDUCE INTERNAL HEAT
CRACK PROPAGATION.
- CURRENT JOINT DESIGN WOULD NOT PERMIT PROPER
WELD, FILLER WOULD NOT BE USED, THEREFORE
"KEY HOLD" EFFECT WOULD BE PRODUCED AT
INITIAL POINT OF WELD. "KEY HOLD" EFFECT WILL
GREATLY INCREASE LIKELY HOOD OF FAILURE AT
THAT REGION.
- DUE TO VARIOUS REQUIREMENTS, LARGE BATCH PROCESSING
WOULD BE PREFERRED, BUT WOULD BE DELAYING, EFFECT
ON PRE HEATING - NON CONCENTRATING TEMPERATURES FROM
FIRST TO LAST WELD PIECE.
- MAJOR/ENTIRE COST APPROX \$100,000
- SUGGESTED INVESTIGATING A WELDING PROCESS THAT
UTILIZES FILLER MATERIAL (Eg. ARC WELDING)

EXPERIMENTER Michael D. King

DATE 12/16/91

WITNESSED BY [Signature]

DATE 12/17/91

PURPOSE INVESTIGATION OF EDM PROCESS FOR LUGS ^{INTERNAL} Book No. E 46321

CONTACTED DON KOV OF ZINGERSALL LMBH TO DISCUSS

PRODUCTION PROCESSING OF INTERNAL LUGS UTILIZING

AN EDM PROBE PROCESS SENT A COPY OF FILE

"EDMREC" (AUTOGRAPH BY M. V. KEARNEY) WHICH INDICATES

THE USE OF A EDM PROBE THAT WILL HAVE PRODUCE

A SERIES OF THREE COILING LUGS 7.5" FROM REAR

OF RECEIVER

IS CURRENTLY WAITING FOR HIS REVIEWAL

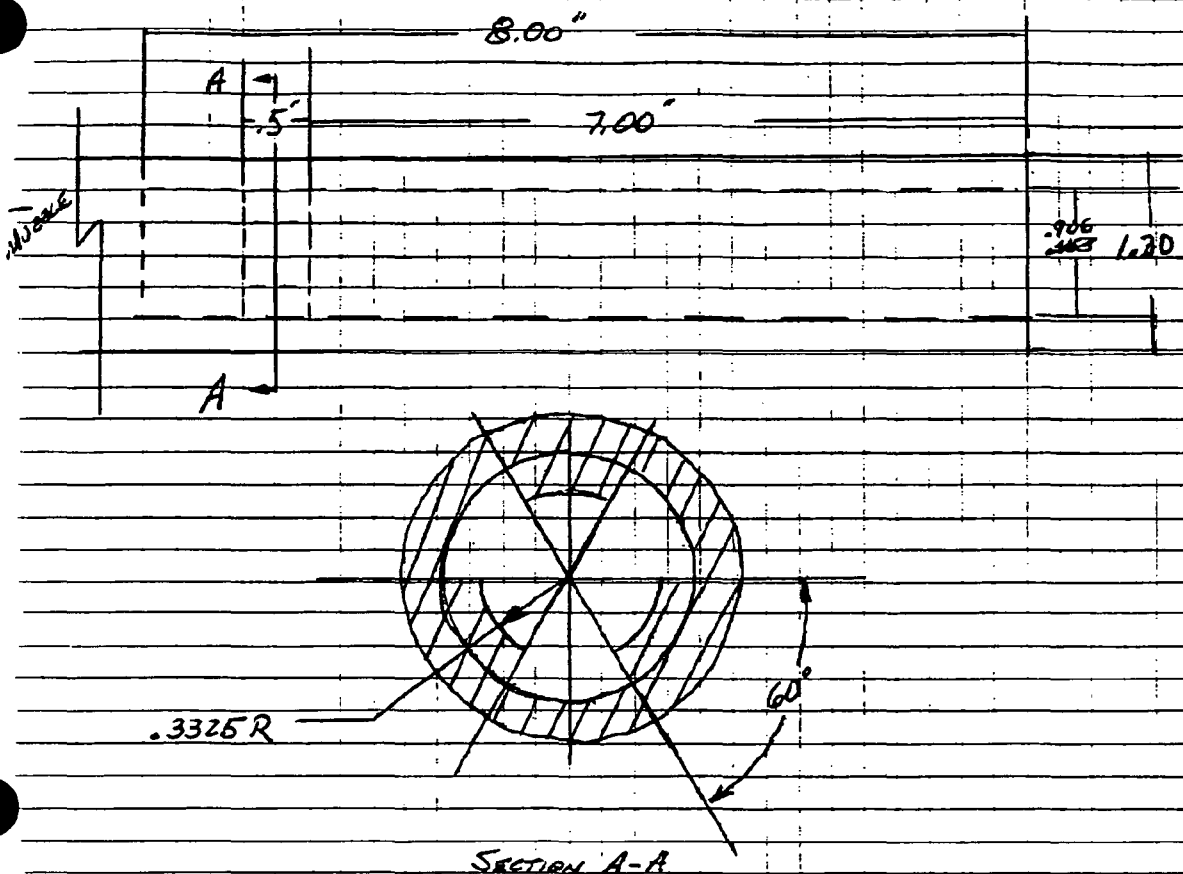
EXPERIMENTER Michael D. King

DATE 12/16/91

WITNESSED BY John J. Harrison

DATE 12/17/91

46321 Book No. PURPOSE PROCESSED EDM'S LOCKING LUG CONFIGURATION



EDM PUGH WOULD BE EXHAUSTED WITH THREE
 LOCKING LUGS, TRAVERSED AWAY TO A DEPTH OF
 8.0", THEN ROTATED 360°, PRODUCING THE .5"
 WIDTH LOCKING SURFACE AND THREE HARBOR PROJECTIONS
 FROM E.D. OF RECEIVER

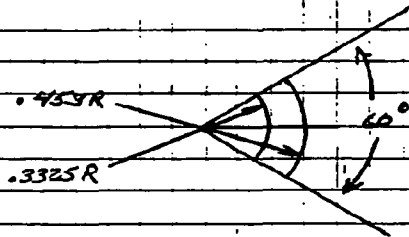
PERIMENTER W. H. D. H.

DATE 12/10/91

ITNESSED BY A. H. H.

DATE 12/13/91

SKETCH OF SINGLE LOCKING LUN:



$$A = \frac{60^\circ(\pi)}{360^\circ} (R^2 - r^2) \leftarrow \text{REF: MACHINERY'S HANDBOOK}$$

22ND EDITION
PAGE # 44 - SURFACE AREA
OF A CIRCULAR RING SECTOR

$$= \frac{60^\circ(\pi)}{360^\circ} ((.453)^2 - (.3325)^2)$$

$$A = .0496 \text{ IN}^2$$

FOR TOTAL LOCKING MECHANISM:

$$A_{\text{TOT}} = 3(A_{\text{LUN}})$$

$$= 3(.0496 \text{ IN}^2)$$

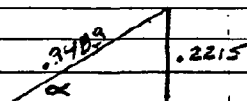
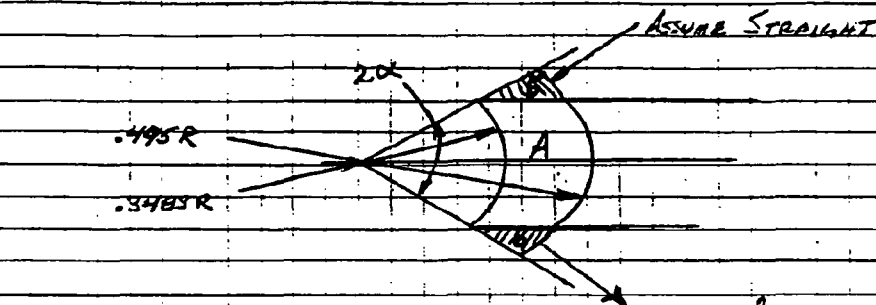
$$A_{\text{TOT}} = .1487 \text{ IN}^2$$

TOTAL BEARING SURFACE FOR
3 LUN EDM SYSTEM.

EXPERIMENTER Mable D. [Signature]DATE 12/19/91WITNESSED BY [Signature]DATE 12/20/91

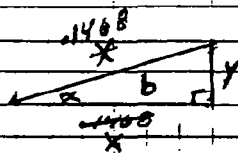
46321

Book No. PURPOSE DETERMINE BEARING SURFACE OF CURRENT M/TOD



$$\sin \alpha = \frac{2215}{2483}$$

$$\alpha = 39.5^\circ$$



$$y = .0934$$

$$CA = 59.5 = \frac{x}{146.8}$$
$$x = 8.63$$

$$b = \frac{1}{2} \times y$$

$$= (.5 \times .0434 \times .1173)$$

$$b = .0053 \text{ m}^2$$

$$A = A + 2b = \frac{2\alpha(\pi)}{360} (R^2 - r^2)$$

$$A = \frac{2\alpha(r)}{360} (R^2 - r^2) - 2b$$

$$= \frac{2(39.5)(\pi)}{360} \left((.495)^2 - (.3463)^2 \right) = 2(.8653)$$

$$A = 0.747 \text{ m}^2$$

$$A_{\text{avg}} = 2(A)$$

$$w = 2(0.0747)$$

$$A_{TOT} = 1494 \text{ in}^2$$

* SEE CORRECTION ON
PAGE # 37 ADDED 1/28/92

* SEE CORRECTION ON
PAGE # 37, DATED 1/22/12

EXPERIMENTER W. L. L.

DATE: 12/10/81

WITNESSED BY: John W. Morrison

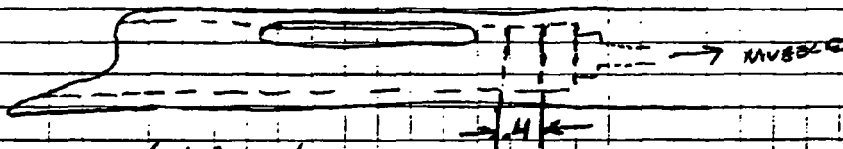
DATE 12/23/91

PURPOSE REVIEW OF MAGAZINE FEEDINGBook No. E 46321

TO MAINTAIN SYMMETRICAL PORT GEOMETRY WITH PORT OPENING, WIDTHS OF .625", THE MAGAZINE SHALL BE OF AN IN LINE STYLE WITH A CAPACITY OF THREE MAGAZINES OR FOUR REGULAR CARTRIDGES.

THE DESIGN SHALL BE ROTATED 90° FROM THE SIGHT ON PAGE 24. THIS WILL ALLOW CARTRIDGES TO BE FEED EASILY USING THE BOLT SHROUD WITH THE ROTATED GEOMETRY THE CARTRIDGE WILL NOT BE ON THE BOLT LOCKING LUGS, BUT WILL PASS BETWEEN THE TWO LOCKING LUGS, BEARING, ON THE SHROUD DIAMETER. THIS WILL ALSO ALLOW THE BOTTOM LUG, IN THE RECEIVER TO ACT AS A FEEDING, PLAMP, IMPROVING THE FEEDING ACTION OF THE FIREARM.

TO FURTHER IMPROVE THE STRENGTH OF THE RECEIVER, THE LOCKING LUG, WIDTH (PARALLEL) WITH THE CENTERLINE OF THE RECEIVER) MAY CHANGE FROM .5" TO .4". THIS WILL PROVIDE ADDITIONAL .200" SUPPORT BETWEEN THE MAGAZINE FEED SECTION PARTS AND THE LOCKING LUGS.



EXPERIMENTER

Michael D. H.

DATE

1/3/92

WITNESSED BY

R. W. [Signature]

DATE

1-10-92

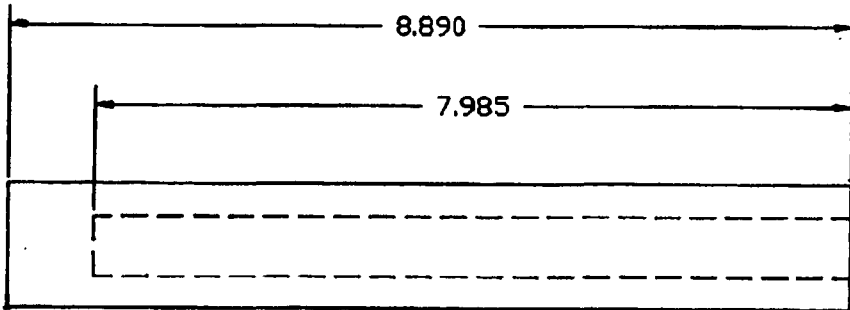
46321

Book No. PURPOSE Diskette Program Receiver Contour

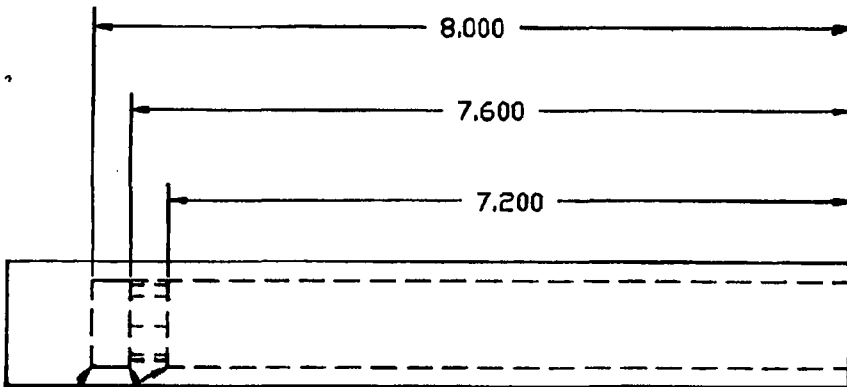
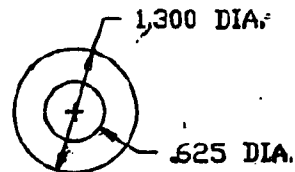
46321
28

FILE: EDMREL
DATE: 1/7/92
TOPIC: EDM RECEIVER CONTOUR
DRAWN BY: MIKE KEENEY

Mike KeeneY
1/7/92

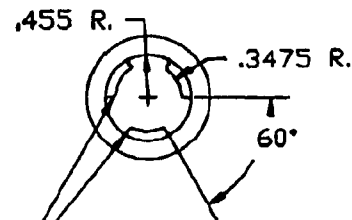


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.02 R. .015 R.

EDM CONTOUR



.03 R. TYP.

EXPERIMENTER

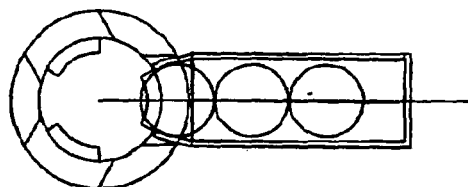
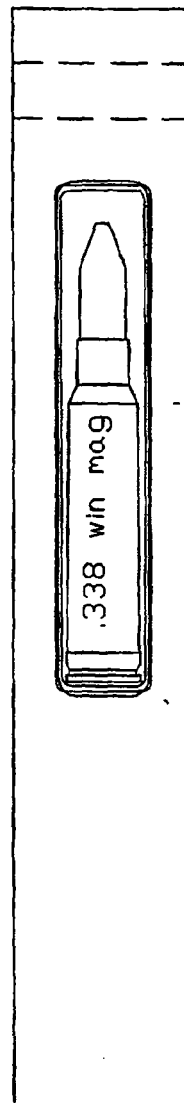
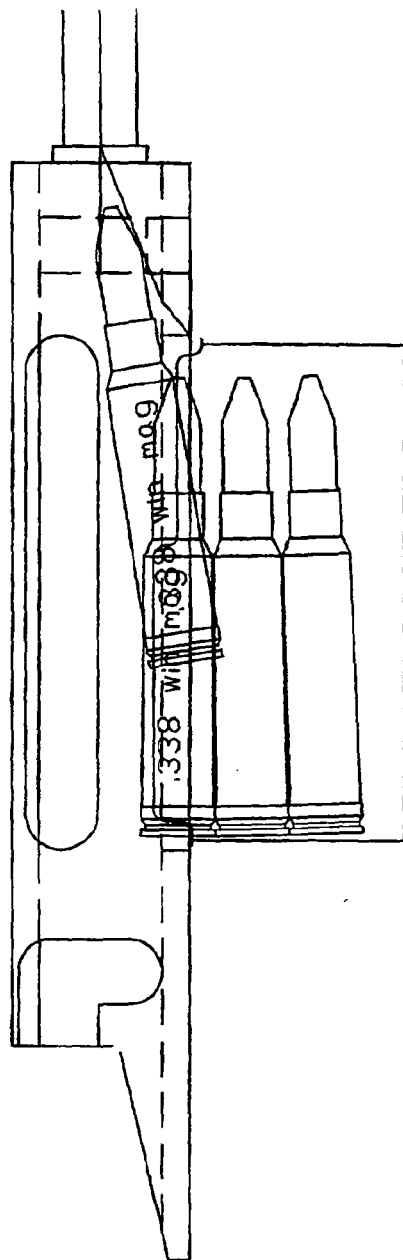
DATE 1/7/92

WITNESSED BY

DATE 1/10/92

E-46321
PAGE # 29

FILE: FEED
DATE: 1/7/92
TOPIC: NBAR MAG BOX DEVELOPMENT
DRAWN BY: MIKE KEENEY
W.H.D. 1/10/92



WITNESSED BY

R.W. [Signature]

1-10-92

46321

Book No. PURPOSE EXPLANATION OF SKETCHES ATTACHED TO PAGES 28 & 29

→ IN REFERENCE TO PRINT ATTACHED TO PAGE 28:

DEVELOPED FOR INJECTION GUNN TO REVIEW POSSIBILITY
OF PRODUCING THE RECEIVER/LOADING CH. CONTENTS DESCRIBED
BY THE PRINT. CONTACTED STEVE DALTON AND
RICHARD CARAN ABOUT APPLICATION ON 1/6/92.

PRELIMINARY REVIEW SHOWED POSITIVE. INGERSON WILL
RESEARCH FURTHER AND DEVELOPMENT DEVELOP A
(PHOTOGRAPH) QUOTE TO PIERCE PROCESS.

THE "BLANK" WILL BE PROCESSED AT REMINGTON AND
SHIPPED TO INGERSON FOR EDM PROCESSING AS PER
THE "EDM CONTOUR" PRINT.

→ IN REFERENCE TO PRINT ATTACHED TO PAGE 29:

REVIEWING EDM TOLERANCE CONTOUR WITH REGARD
TO THE LOADING AND FEEDING OF CARTRIDGES THROUGH
THE RECEIVER AND INTO THE CHAMBER. THE MAGAZINE
BOX AS DRAWN IS A SINGLE LINE TYPE. REQUIRED
TO MAINTAIN 360° STABILITY OF THE RECEIVER. A
.338 WIN MAG. CARTRIDGE WAS USED TO MODEL DUE TO
THE EXTREME SIZE OF THE CARTRIDGE.

EXPERIMENTER

Stahl D. Hany

DATE

1/6/92

APPROVED BY

K.W. Hany

DATE

1-10-92

PURPOSE DEVELOPMENT OF ALUM. BOX & RECOIL BRACKETBook No. E 46321

FURTHER INVESTIGATION SHOWED THAT .50" OF DEPTH
IS REQUIRED OVER THE PROTOTYPE STOCK MAINTAINING DEPTH
WORKED WITH JOHN REMINGTON TO PRODUCE A PLEASING
STOCK DESIGN AND PROVIDE ACCEPTABLE ALUM. BOX FIT
POSSIBLE METHOD IS TO DRIP AREA AROUND MAG BOX HOLES
".50" AND BURY THE BOTTOM OF THE BOX TO ACHIEVE THE
FULL .50" DEPTH REQUIRED. JOHN WILL ADD MATERIAL
AND REWORK THE PROTOTYPE STOCK.

RECOIL BRACKET:

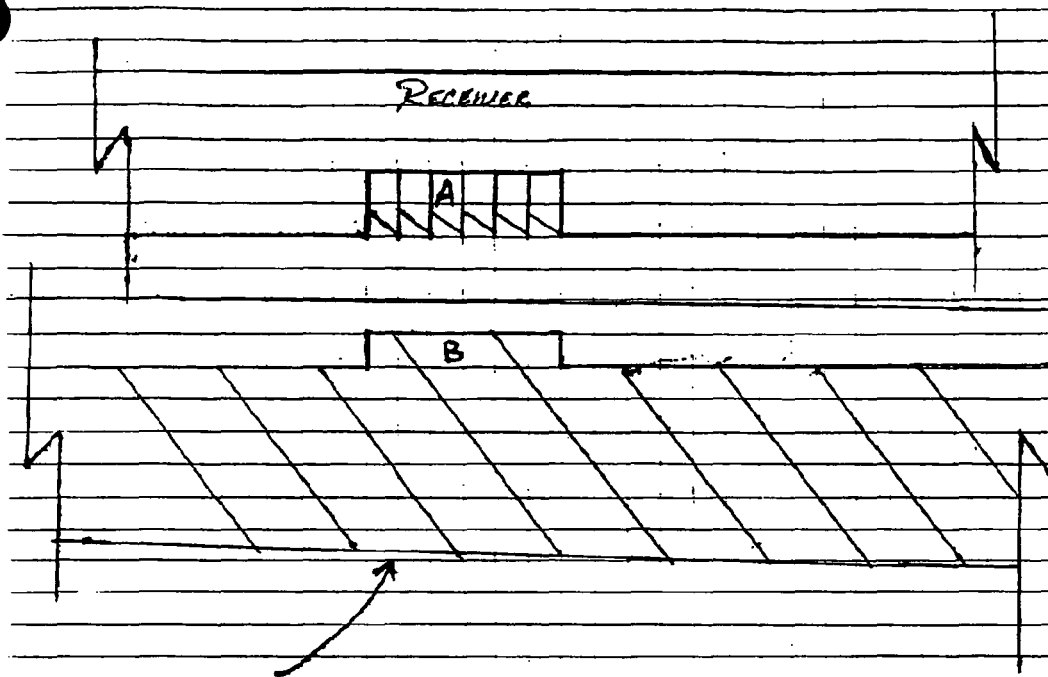
PREVIOUS CONCEPT WITH EXTERNAL LOCKING LUGS AND
THE RECOIL BRACKET FORMED WITH LOCKING LUGS.
NOW WITH CURRENT CONCEPT OF EDW LOCKING LUGS
A SEPARATE ALUM. RECOIL BRACKET (SYSTEM) WILL BE REQUIRED
REMINING, AN IDEA OF AN EXTERNAL BRACKET MOUNTED IN
A GROOVE AROUND BOTTOM OF RECEIVER WITH KEN SALLY
KEN SUGGESTED ^{A MULTI} GROOVE RECEIVER AND FORMING
A SYNTHETIC STOCK TO SUCH GROOVES TO PRODUCE A RECOIL
BEARING, AND POSSIBLE SEPARATE PROCESSES SUCH AS
ULTRASONIC OR HEAT SINKING. SEE PAGE 32 FOR
CONCEPT SKETCH.

EXPERIMENTER Michael D. KinneryDATE 1/9/92WITNESSED BY K.W. SullyDATE 1-10-92

46321

Book No.

PURPOSE RECOIL BEARING SURFACE CONCEPT (KEN SOWLEY)



SYNTHETIC STOCK CROSS SECTION

EXPLANATIONS: METAL RECEIVER WOULD HAVE BOTTOM HALF

REMOVED AS SHOWN. (A) SYNTHETIC STOCK WOULD HAVE

A MALE PPD ADDED TO MATE WITH RECEIVER. (B)

UPON MATING, SECTION (B) WOULD FLOW AND FILL

SECTION (A) TO PROVIDE THE BEARING AREA REQUIRED

FOR RECOIL. ALSO AS A BENEFIT, THE PADDING

WOULD BECOME "BEDDED" TO THE STOCK ON A WOOD

STOCK A SYNTHETIC PIECE COULD BE EXPRESSED TO THE

STOCK AND THEN THE RECEIVER WOULD SINK TO THE

SYNTHETIC BLOCK.

PERFORMER

Michael D. Hines

DATE

1/9/92

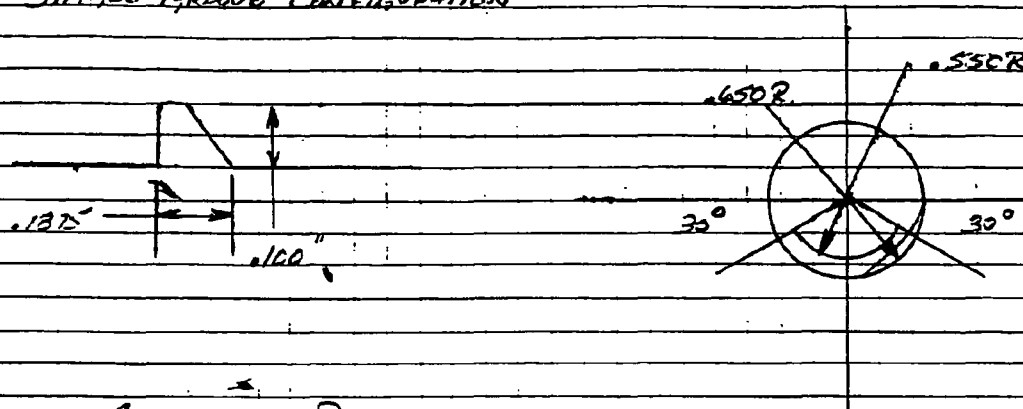
TESTED BY

K.W. Sowley

DATE

1-10-92

SINGLE GROOVE CONFIGURATION



CALCULATION PARAMETERS

$$\text{GROOVE DEPTH: } .650 - .550 = .100"$$

$$\text{GROOVE RADIAL LENGTH: } 120"$$

REF. MATHWORKS HANDBOOK: $A = \frac{(120^2) \pi}{360} ((.650)^2 - (.550)^2)$ (ONE GROOVE)

22nd EDITION

PAGE 444

SURFACE AREA OF A CIRCULAR RING-SECTION $A = .1257 \text{ IN}^2$

REFERRING TO RECIPIER SKETCH FOUND ON PAGE 29, IF GROOVES WERE TO START AT MID POINT OF LOCKING WID. WIDTH AND PROGRESS REARWARD TO MAIN BOX OPENING. THE TOTAL LENGTH AVAILABLE IS .952". THEREFORE WITH THE WIDTH OF EACH GROOVE EQUAL TO .125" WID. WE COULD ACHIEVE A SERIES OF 5 GROOVES ACROSS THIS LENGTH. THEREFORE THE TOTAL AREA WOULD BE:

$$A_{\text{TOT}} = 5A = 5(.1257 \text{ IN}^2)$$

$$A_{\text{TOT}} = .6285 \text{ IN}^2$$

EXPERIMENTER

M. L. D. L.

DATE

1/10/92

WITNESSED BY

K. W. P.

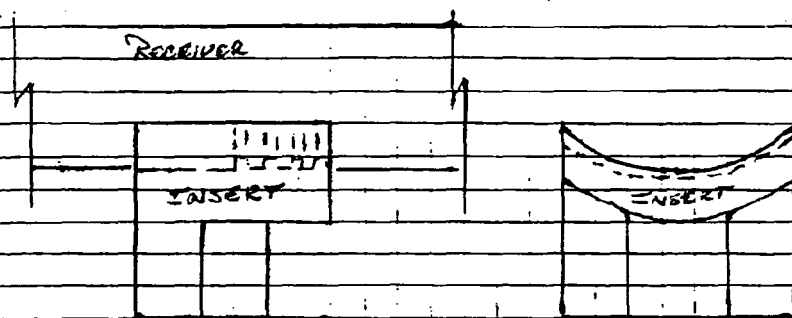
DATE

1-10-92

46321 Book No. PURPOSE RECEIVER REPAIR, SURFACE CONFORMATION

UPON FURTHER INVESTIGATION OF SYNTHETIC MATERIAL PROPERTIES RELATIVE TO ARREST SLIDING, SUCH A SYSTEM AS DESCRIBED ON PAGE 33 WOULD NOT BE AVAILABLE. SYNTHETIC STICK MATERIALS TYPICALLY HAVE A MELTING POINT AT 500°-600° F. IF RECEIVER WERE TO BE HEATED TO THIS TEMPERATURE, IT WOULD AFFECT THE RECEIVER HARDNESS IN A DETRIMENTAL WAY.

FOLLOWING THE GROOVE CONCEPT AND DISCUSSING THIS IDEA WITH THE MGR, IT BECAME APPARENT THAT A METAL INSERT COULD BE MOLDED INTO THE STAGE WHICH WOULD INTERLOCK WITH THE GROOVES IN THE RECEIVER PROVIDING THE REQUIRED BONDING SURFACE. THIS METAL INSERT COULD ALSO BE EXTENDED FORWARD TO BE USED AS A BONDING PAD FOR THE RECEIVER. SUCH A METAL INSERT COULD BE PROVIDED BY A POWDER METAL OR METAL INJECTION MOLDING PROCESS.

PERFORMER John D. KingDATE 1/10/92TESTED BY W. J. MorrisonDATE 1/15/92

TITLE PROCESS-DEVELOPMENT - NEARDATE 1/16/92

Page No.

35

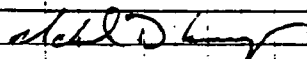
PURPOSE RECOIL BEARING INSERTBook No. E 46321

FURTHER DISCUSSION AND LOADING CALCULATIONS HAVE
LEAD TO THE PRODUCTION OF THE INSERT BY A FINISHING
PROCESS WITH SECONDARY MACHINING OPERATIONS. I
HAVE STARTED PRODUCING A PROTOTYPE INSERT, FROM
4140 MATERIAL, BY MEANS OF STANDARD MILLING,
OPERATIONS.

ALSO REVIEWING THE MAIL BOX CONFIGURATION AND
STOCK LENGTH, IT IS GENERAL CONSENSUS THAT AN
IN LINE STOCK CONFIGURATION WILL PROVIDE A "FAT" OR
BULKY "BULKY" STOCK. WILL FURTHER INVESTIGATE EFFECT
STACKING, OF ROUNDS IN MAIL BOX.

REQUESTED PURCHASING, TO SEND INGRESSOL LMBH
TO SIGN A CONFIDENTIALITY AGREEMENT, BEFORE FURTHER
DEVELOPING RECOIL EDM PROCESS

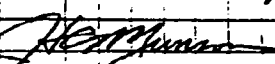
EXPERIMENTER



DATE

1/16/92

WITNESSED BY



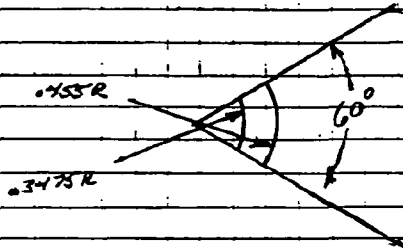
DATE

1/30/92

46321

Book No. PURPOSE LEADING IN - BEARING SURFACE AREA (EDM CONTACT)

REF. PAGE # 28, SKETCH OF EDM CONTACT LEADING IN, LW, S.



FOR PROPOSED THREE LVL. SYSTEM, BEARING SURFACE AREA CALCULATION

AS FOLLOWS:

REF. MACHINIST'S HANDBOOK: 22ND EDITION
PAGE # 44

$$A_{TOT} = 3A$$

$$A = \frac{60(N)}{360} (.453^2 - .3475^2)$$

$$A = .0452 \text{ IN}^2$$

$$\therefore A_{TOT} = 3A = 3(.0452)$$

$$A_{TOT} = .1356 \text{ IN}^2$$

PERIMENTER

Stahl D. KingDATE 1/20/92

TESTED BY

JeffersonDATE 1/30/92

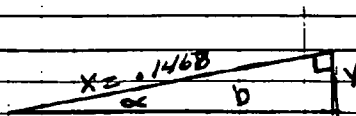
TITLE PROCESS DEVELOPMENT - NBARDATE 1/28/92

Page No.

37

PURPOSE CORRECTION FOR AREA CALCULATION PAGE # 26Book No. E 46321

REFER TO PAGE # 26 FOR SKETCH:



$$\alpha = 39.5^\circ$$

$$x = .495 - .3483$$

$$x = .1467$$

$$\tan \alpha = \frac{y}{x}$$

$$\tan(39.5) = \frac{y}{.1467}$$

$$y = .1209$$

$$\begin{aligned} \therefore A_b &= \frac{1}{2}(x)(y) \\ &= .5(.1467)(.1209) \\ A_b &= .00887 \text{ in}^2 \end{aligned}$$

FROM ATOT EQUATION PAGE # 26:

$$A_{TOT} = A_b + 2b = \frac{2\alpha(x)(R^2 - r^2)}{360}$$

$$A_{UG} = A_{TOT} - 2b$$

$$= \frac{2(39.5)\pi}{360} (.495^2 - (.3483)^2) - 2(.00887)$$

$$A_{UG} = .0675 \text{ in}^2$$

$$A_{TOT,UG} = 2(A_{UG})$$

$$= 2(.0675)$$

$$A_{TOT,UG} = .135 \text{ in}^2$$

FOR CURRENT M/100 LOCKING SYSTEM.

EXPERIMENTER

Walter D. King

DATE

1/28/92

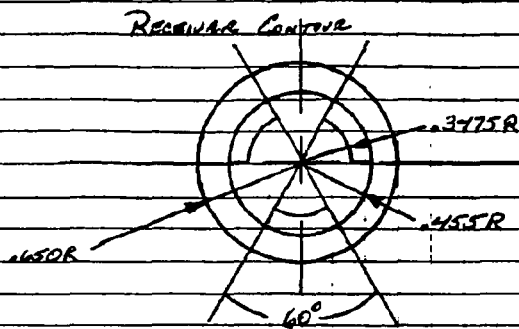
WITNESSED BY

W. D. King

DATE

1/30/92

46321

Book No. PURPOSE STRESS EVALUATION FOR THREE LUG SYSTEM

OPERATING CONDITIONS:

CASE HEAD D.O. .532"BOLT FACE DIA. .542"OPERATING PRESS. 150,000 PSI
(2X PROOF LOAD)

ASSUMPTIONS:

EQUAL LOADING OF THREE LUGS

CASE HEAD FAILURE

ARC LENGTH = $r \times \theta$ RADAWHERE: r = RADIUS θ = ANGLE

INSTANT OF IGNITION 22.0C

TO BULLET ENTRY, PEAK PRESSURE
TO BE 150,000 PSI.

$$\text{LOAD ON LUGS} = (\text{OPERATING PRESS}) \times (\text{SURFACE AREA})$$

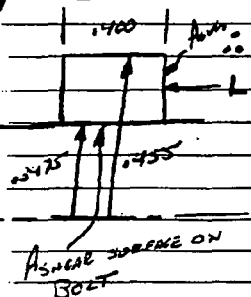
$$= (150,000 \text{ PSI}) \times \left(\frac{\pi (.542)^2}{4} \right)$$

$$L_{\text{lug}} = 34608.3 \text{ lbs.}$$

IF EQUAL LOADING APPLIES, EACH LUG, WILL SEE A LOAD EQUAL TO $\frac{1}{3} L_{\text{lug}}$.

$$\therefore L_{\text{lug}} = \frac{1}{3} (34608.3)$$

$$L_{\text{lug}} = 11536.1 \text{ lbs.}$$

REF: PAGE #36 $\rightarrow A_{\text{lug}} = .0452 \text{ in}^2$ (FRONTAL BEARING AREA)

$$\sigma_L = \frac{L_{\text{lug}}}{A_{\text{lug}}} = \frac{11536.1 \text{ lbs}}{.0452 \text{ in}^2} = \boxed{255,223.45 \text{ PSI}}$$

$$\tau_L = \frac{L_{\text{lug}}}{A_{\text{shear}}} = \frac{11536.1 \text{ lbs}}{.1456 \text{ in}^2} = \boxed{79,231.46 \text{ PSI}}$$

$$A_{\text{shear}} = (.400) \times (.3475 \text{ RAD}(60^\circ))$$

$$A_{\text{shear}} = .1456 \text{ in}^2$$

EXPERIMENTER

Will D. King

DATE

1/28/92

WITNESSED BY

W. D. King

DATE

TITLE PROLOG DEVELOPMENT - NBARDATE 1/28/92

Page No.

39

PURPOSE STRESS EVALUATION FOR THREE LVL SYSTEM (CONT'D)Book No. E 46321

CONT'D FROM PAGE #38:

UTILIZING MOHR'S CIRCLE:

STRESS STATE OF LVL ELEMENT 2



$$\sigma_1 = \frac{\sigma_x}{2} + \sqrt{\left(\frac{\sigma_x}{2}\right)^2 + \tau_{xy}^2} = \frac{255223.45}{2} + \sqrt{\left(\frac{255223.45}{2}\right)^2 + (79231.46)^2}$$

$$\sigma_1 = 277819.5 \text{ (COMPRESSION)}$$

$$\sigma_2 = \frac{\sigma_x}{2} - \sqrt{\left(\frac{\sigma_x}{2}\right)^2 + \tau_{xy}^2}$$

$$\sigma_2 = -22596.06 \text{ (TENSION)}$$

$$2\theta_p = \tan^{-1}\left(\frac{2\tau_{xy}}{\sigma_x}\right)$$

$$2\theta_p = \tan^{-1}\left(\frac{2(79231.46)}{255223.45}\right)$$

$$2\theta_p = 31.84^\circ$$

$$\theta_p = 15.92^\circ$$

$$\tau_{max} = \sqrt{\left(\frac{\sigma_x}{2}\right)^2 + \tau_{xy}^2}$$

$$= \sqrt{\left(\frac{255223.45}{2}\right)^2 + (79231.46)^2}$$

$$\tau_{max} = 150207.78 \text{ PSI}$$

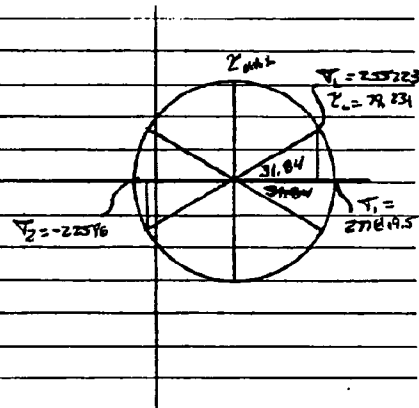
AT ANGLE OF θ

FOR MAX SHEAR STRESS

$$\theta_s = \left(\tan^{-1}\left(\frac{\tau_{xy}}{\sigma_x/2}\right)\right) \times \frac{1}{2}$$

$$\theta_{smax} = \left(\tan^{-1}\left(\frac{79231.46}{255223.45/2}\right)\right) \times \frac{1}{2}$$

$$\theta_{smax} = 29.08^\circ$$



NOTES

YIELD STRENGTH OF 4137 AT Rc = 42

IS $\approx 180,000$ PSI.EXPERIMENTER Michael D. [Signature]DATE 1/28/92WITNESSED BY [Signature]DATE 1/28/92

E 46321 Book No. PURPOSE SHAPE STRENGTH OF INSERT EVALUATION

AN INSERT WAS MACHINED FROM 4140 MAT'L TO THE FOLLOWING SPECS:

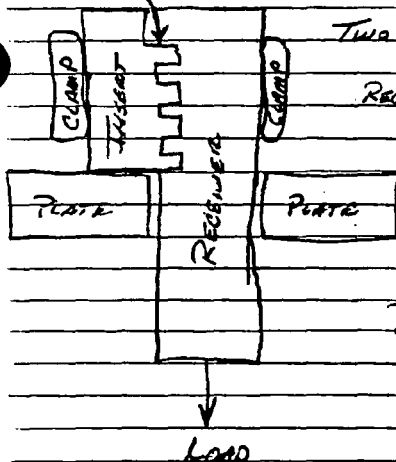
TOOTH MAJOR DIA. - .650"
 TOOTH MINOR DIA. - .550"
 TOOTH ANG - 120°
 FRONTAL SURFACE AREA - .1257 IN²
 TOTAL # OF TEETH - 4
 WIDTH OF TEETH - .060"
 HEAT TREAT/HARDNESS - R_c 40

A MATING, RECEIVER WAS MACHINED TO THE FOLLOWING SPECS:

TOOTH MAJOR DIA. - .650"
 TOOTH MINOR DIA. - .550"
 TOOTH ANG - 120°
 FRONTAL SURFACE AREA - .1257 IN²
 TOTAL # OF TEETH - 4
 WIDTH OF TEETH - .100"
 HEAT TREAT/HARDNESS - R_c 40

SURFACE "A"

TEST CONDITIONS:



TWO MATING, PARTS PARALLEL CLAMPED TOGETHER

RECEIVER WAS INSERTED THROUGH A PLATE THAT SUPPORTED THE INSERT ONLY A LOAD WAS APPLIED TO THE RECEIVER

RESULTS: AT 24,500 LBS ALL TEETH OF RECEIVER SHEARED, LOAD WAS BEING SUPPORTED BY SURFACE MARKED "A" IN SKETCH.

INSERT TOOTH OF SURFACE "A" SHOWED EXCESSIVE DEFORMATION AND A CRACK ORIGINATING AT INTERSECTION OF .450" R.

EXPERIMENTER *Robert D. Long*

DATE 1/28/92

WITNESSED BY *W. K. Harrison*

DATE 1/30/92

PURPOSE

SHEAR STRENGTH OF INSERT EVALUATION (CONT'D)Book No. E 46321

A LOAD OF 24,500 LBS CORRELATES TO AN OPERATING
PRESSURE OF 2

$$Op = \frac{24,500}{\pi (6.542)^2}$$

WHERE: 6.542 IS BOLT
FACE DIA.

$$Op = 106,188.5 \text{ PSI}$$

NOTE: EVALUATION AND CALCULATIONS THAT FOLLOWED, WERE
BASED ON THE ASSUMPTION THAT NO RECOIL WAS
ABSORBED BY SHOOTER RIF. STOCK. ALL LOAD FROM
CHAMBER WAS DIRECTLY TRANSMITTED TO INSERT
AND RECEIVER JOINT PRODUCING COMPRESSIVE AND
SHEAR STRESSES IN THE TWO COMPONENTS.

EXPERIMENTER

John D. King

DATE

1/29/92

WITNESSED BY

W. C. [Signature]

DATE

1/29/92

46321

Book No. PURPOSE IMPACT ENERGY WRT FIRING PIN PROJECTIONS

HAVE BEEN REVIEWING "THE BOLT ACTION" VOLUME NO. 1 & 2

WRITTEN BY STUART OTTERSON. AS RECOMMENDED BY

OTTERSON: IMPACT VELOCITY TO INSURE PRIMER DETONATION
SHOULD BE APPROXIMATELY $\approx 20 \text{ FT/SEC}$.IMPACT ENERGY $\approx 60 \text{ IN-02}$ FIRING PIN PROJECTIONS $\approx .055-.085$ PRIMER INSTANT $\approx .018-.026$ MAINSPRING ENERGY $\approx 81 \text{ IN-02}$

EQUATIONS USED BY OTTERSON IN VOLUME 1 TO DEVELOP

LOAD TIME AND ENERGY AS FOLLOWS:

$$E = \bar{E} \times S$$

$$E = \frac{1}{2} MV^2$$

$$F_0 - F = KS$$

$$\frac{T}{\sqrt{M}} = \frac{\cos^{-1}(F/F_0)}{\sqrt{K}}$$

$$I = MV$$

$$M = \frac{W}{g}$$

$$E = \text{IMPACT ENERGY}$$

$$F_0 = \text{INITIAL SPRING LOAD}$$

$$F = \text{FINAL SPRING LOAD}$$

$$K = \text{SPRING RATE}$$

$$T = \text{LOCK TIME}$$

$$I = \text{IMPACT/IMPULSE ENERGY}$$

INFORMATION ABOVE RECORDED FOR FUTURE REFERENCE

WHEN FIRING PIN ASSY. DEVELOPMENT BEGINS.

EXPERIMENTER

Michael D. Luning

DATE

2/5/92

WITNESSED BY

K.W. Luning

DATE

3-7-92

TITLE PROCESS DEVELOPMENT - NBARDATE 2/5/92

Page No.

43

PURPOSE REVISING RECEIVER CONSTRUCTION

Book No.

E 46321

UP TO CURRENT DATE, RECEIVER LENGTH/DESIGN HAS
BEEN REGULATED BY ASSUMPTION OF ADD USING M/700
LONG, ACTION FIRING, PIN ASSEMBLIES.

BEGAN REVIEWING, RECEIVER WEIGHT AND LENGTH
WITHOUT ANY RESTRICTIONS PERTAINING TO M/700

FIRING, PIN ASSEMBLY RESULTS AS FOLLOWS:

LUG WIDTH = .400"
DISTANCE FROM REAR OF LUG TO MAGAZINE BOX OPENING = 1.05"
DISTANCE FROM REAR OF LUG TO EJECTION PORT = 1.250"
EJECTION PORT LENGTH = 3.1"
MAGAZINE BOX OPENING LENGTH = 3.75"
REAR INSERT CONSTRUCTION:

LUG GROOVE WIDTH = .200"
NUMBER OF INTERLOCKING TEETH = 2
RADIAL LENGTH = 120°
REAR TEETH SLOTTED FOR MAGAZINE BOX
OPENING.

CURRENT M/700 TRIGGER ASSEMBLY REQUIRES APPROXIMATELY
1.5" OF RECEIVER TOTAL LENGTH FOR PROPER ASSEMBLY.
IF ALL RESTRICTIONS WERE REMOVED, AS FARWARD USING ANY
M/700 COMPONENTS, THIS AREA MAY PROVIDE FOR A LARGE
REDUCTION IN RECEIVER LENGTH AND WEIGHT. CURRENTLY
ALL PROTOTYPES AND PARTS REQUIRE LENGTH ALLOWANCE FOR
THE M/700 TRIGGER ASSEMBLY. POSSIBLE AREA TO INVESTIGATE
TO IMPROVE THE HANDLING, IF REQUIRED.

EXPERIMENTER

Michael D. KingDATE 2/5/92

WITNESSED BY

R.W. LoweryDATE 3-3-92

46321

Book No. PURPOSE RELIN BRACKET / STOCK INSERT

REVIEWING PREVIOUS TEST DATA AND STANDARD
OPERATING CONDITIONS PERTAINING TO FIREARM RECON,
IT IS APPARENT THAT IMPACT RECOIL FORCE DISTRIBUTED
ACROSS A RECOIL BRACKET IS APPROX. $\approx$ TO 1000 LBS MAXIMUM.
WORKING WITH THIS VALUE, A SINGLE TOOTH WITH
.100" FRONTAL BEARING, SURFACE AND .250" SWEAP
SURFACE WIDTH ROTATED 120° SHOULD BE SUFFICIENT
TO INTERLOCK THE STOCK AND RECOIL BR. SEE
PAGE #45 FOR DETAILED SKETCH OF INSERT
CONFIGURATION.

EXPERIMENTER

Stahl D. Long

DATE

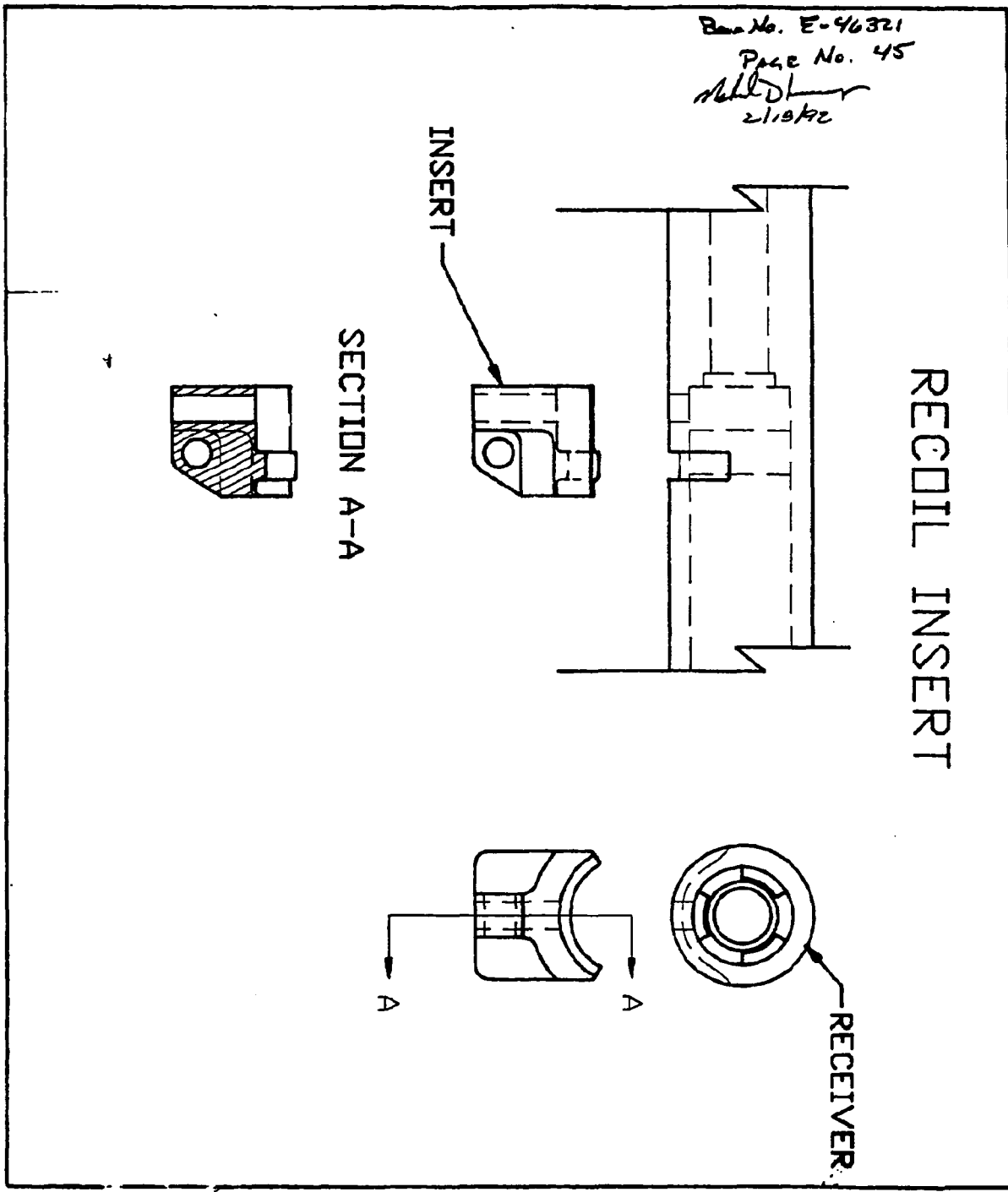
2/18/92

WITNESSED BY

K.W. Long

DATE

3-3-92



EXPERIMENTER W. D. L.

DATE 2/18/92

WITNESSED BY K. W. R.

DATE K. W. R.
3-3-92

46321

Book No. PURPOSE UPDATE FROM 2/24/92 - 2/27/92

2/24/92 - REVISED STOCK INSERT (RECON), MOVED CORE HOLE FROM CENTER RIB (1 TO BORE) TO EITHER SIDE OF RIB (11 TO BORE). DIMENSIONED PRINT (FIXE INSERT) AND SUBMITTED FOR QUOTE BY FOREIGN AND INVESTMENT CASTING OPERATIONS.

2/25/92 - FINALIZED EDM RECEIVER PRINTS AND GATHERED INFORMATION AROUND PRODUCTION REQUIREMENTS FOR THE EDM APPLICATION.

2/26/92 - MET WITH STEVE DRYDEN AND RICH CARAN TO DISCUSS EDM OPERATION. FINALIZED WHAT WOULD BE REQUIRED OF THE PROTOTYPE EDM RECEIVERS AS WELL AS LONG TERM. REQUESTED A CYCLE TIME OF UNDER 8 MIN. TO MACHINE UNDERCUT AND PROFILE. EXPEDITED SHIPMENT OF PROTOTYPE PLATES TO INGERSON BY 3/12/92.

HAVE BEEN INVESTIGATING BORACH, BAR'S TO SINGLE POINT MACHINE UNDERCUT. VENDOR TO QUOTE ON TOOLING.

EXPERIMENTER

Michael D. Long

DATE

2/27/92

WITNESSED BY

R.W. Long

DATE

3-5-92

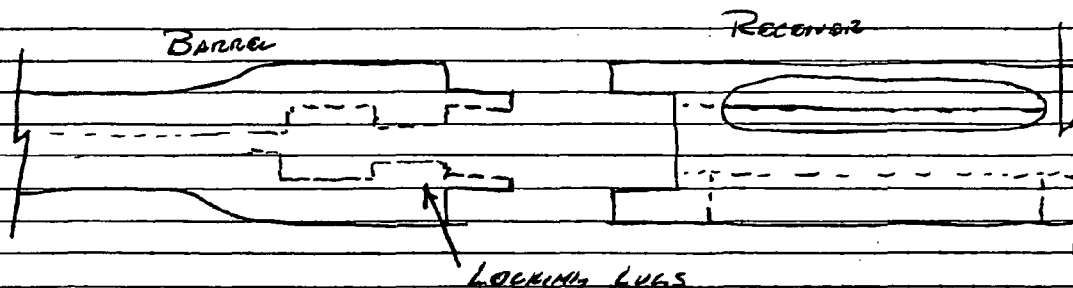
TITLE PROCESS DEVELOPMENT - NBARDATE 2/27/92

Page No.

47

PURPOSE ALTERNATIVE TO EDM LUG PROCESS. WIT UNDERCUT.Book No. E 46321

TO REDUCE THE CYCLE TIME OF THE EDM PROCESS,
THOMPSON SUGGESTED MECHANICALLY REMOVING MATERIAL
IN THE UNDERCUT REGION. AS STATED ON PREVIOUS PAGE (^a/₄₆)
A VENDOR IS RESEARCHING THIS APPLICATION.
BUT IF THERE IS NOT TOOLING AVAILABLE TO UNDERCUT THE
RECEIVER 8.0" FROM THE END, AN ALTERNATIVE MAY BE
TO SPLIT THE SINGLE PIECE INTO TWO COMPONENTS.
THIS WOULD DEPART FROM THE CURRENT ACTION RIFLES
DUE TO THE FACT THAT THE LUGS WOULD STILL BE
INCORPORATED IN THE BARREL SECTION AND A "TUBE"
THREADED BEHIND THE LOCKING LUGS. THIS WOULD ALLOW
FOR THE MECHANICALLY PROCESSED UNDERCUTTING AND
EDM PROFILE OF THE LUGS.



THIS MAY BE BENEFICIAL DUE TO THE LOCKING LUGS AND
BARREL WILL STILL BE PROCESSED FROM ONE PIECE OF STEEL.

EXPERIMENTER

Michael D. [Signature]

DATE

2/27/92

WITNESSED BY

R.W. [Signature]

DATE

3-3-92

46321

Book No. PURPOSE TEST ASSEMBLY DEVELOPMENT

TO REDUCE DEVELOPMENTAL TIME OF TEST PIECES,
THE CONCEPT OF TWO PIECES WILL BE UTILIZED
(AS ON PAGE 42) TO TEST THE STRENGTH OF
THE COILING MECHANISMS. THIS WILL ALLOW FOR
THE MAKING, BY STANDARD PRACTICES, OF THE
COMPONENTS AND ASSEMBLY PRIOR TO TESTING.
COMPONENT SKETCHES HAVE BEEN COMPLETED AND
TOOLING, ORDERED TO PRODUCE THE PROPER GEOMETRY.

~~CONFIDENTIAL~~

PERFORMER

Michael D. KingDATE 3/2/92

WITNESSED BY

K.W. LowreyDATE 3-3-92

HAVE BEEN DEVELOPING PRINTS FOR ROUGH CHAMBER

DIMENSIONS FOR THE FOUR SERIES OF CARTRIDGES:

- ① .222/223
- ② SHORT (.308) CLASS
- ③ (30-06) LONG CLASS
- ④ MAGNUM

IF ECONOMICALLY POSSIBLE, WE WOULD LIKE TO ROUGH

CHAMBER EACH UNIT USING AN EDM OR ECM APPROACH.

THIS WOULD ALLOW FOR A SINGLE STEP FINISH OPERATION

OF THE CHAMBER, USING STANDARD CHAMBER TOOLING.

THE CURRENT APPROACH IS TO LEAVE APPROX. .010" PER

SIDE TO CLEAN-UP WITH THE FINISH PLAMER. A

PRINT OF A ROUGH 30-06 CHAMBER HAS BEEN COMPLETED

AND WILL BE SENT TO VENDORS FOR REVIEW.

WE ARE CURRENTLY PROPOSING FOUR DIFFERENT ROUGH

CHAMBERS, BUT MAY COMBINE THE 30-06 AND MAGNUM

CLASSES DEPENDING ON FINISH TOOLING CAPABILITIES.

EXPERIMENTER

W. D. L.

DATE 3/12/92

WITNESSED BY:

K. W. L.

DATE 3-26-92

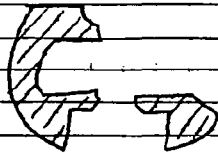
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Page No. TITLE PROJECT DEVELOPMENT - NBARDATE 3/20/92

46321

Book No. PURPOSE RESERVE RIGIDITY / CROSS SECTIONAL AREA

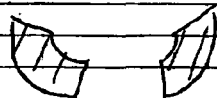
RAN A COMPUTER AIDED COMPARISON OF THE
 M/700 RECEIVER AND THE PROPOSED NBAR RECEIVER.
 THE AREA IN QUESTION WAS THE CROSS SECTIONAL SURFACE
 AREA (IF THE RECEIVERS WERE CUT PERP. TO BORE
 THROUGH MAGAZINE / EJECTION PORT SECTION) OF THE
 TWO RECEIVERS. THE RESULTS ^{ARE} ~~ARE~~ AS FOLLOWS:

M/700:

$$A_{TOT} = .2478 \text{ in}^2$$

NBAR:

$$A_{TOT} = .2754 \text{ in}^2$$

EXPERIMENTER Robert D. LoneyDATE 3/20/92WITNESSED BY R.W. LoneyDATE 3-26-92

TITLE PROCESS DEVELOPMENT - NBARDATE 4/29/92

Page No.

51

PURPOSE SUMMARY OF PROGRESS FOR 3/21/92 - 4/28/92Book No. E 46321

FOUR TEST RECEIVERS ARE CURRENTLY IN MANUFACTURE.

THREE ARE OF THE TYPE DESCRIBED ON PAGE #47, TWO
PIECE ASSEMBLIES.

REFINED INGRESSOLL'S QUOTE FOR PROCESS DEVELOPMENT OF
EDM OPERATION ON 3/23/92. SUBMITTED ²⁵⁰ BLANK PRINTS
TO CMCI TOOL SHOP FOR QUOTING. EXPERIMENTAL BLANKS
ARE TO BE SHIPPED TO INGRESSOLL BY MAY 15, 1992.

DEVELOPED A POSSIBLE HAMMER FORGED ONE PIECE UNIT.
WILL INCLUDE A SMOOTH UNDERSIZED BORE, EXTERNAL BARREL
AND RECEIVER CONTOUR AND INTERNAL LOCKING LUG GEOMETRY.
THE BOLT LOCKING LUG, UNDERCUT IN THE RECEIVER WILL REQUIRE
AN EDM OPERATION. BEGIN DEVELOPMENT OF FORGING MANDREL.

EXPERIMENTER

Robert D. HuntDATE 4/28/92

WITNESSED BY

Tom PowersDATE 7/27/92

46321

Book No. PURPOSE SUMMARY OF PROGRESS FROM 4/29/92 TO 5/15/92

WROTE REQ. FOR EDM PROCESS DEVELOPMENT. PLANS WILL BE
SHIPPED TO INGERSON ON 5/15/92. PLANS ARE 13" LONG &
1.320" DIA. WITH STEPPED I.D. OF .685/.910. EDM WILL
BURN THREE END PROFILE, UNDERCUT AND A ROUGH CHAMFER.

TWO BULK TEST COMPONENTS ARE IN TOOL ROOM, SHOULD BE
COMPLETED BY 5/22/92.

DEVELOPED GEM MANDREL FOR HOT FORMING, OPERATION, AS
STATED ON BOTTOM OF 51. PRINTS TO BE COMPLETED BY
5/22/92 AND SUBMITTED FOR QUOTING.

DEVELOPED A SOLID MODEL REPRESENTATION OF THE PROPOSED
NBAR CONFIGURATION. FILE: RES. NBAR. BARREL-ASSEMBLY.MDK ON
CV HOST.

EXPERIMENTER

Michael D. LongDATE 5/15/92

WITNESSED BY

John G. LewisDATE 7/27/92

TITLE PROCESS DEVELOPMENTDATE 6/18/92

Page No.

53

PURPOSE SUMMARY OF PROGRESS THRU 5/15/92 TO 6/18/92Book No. E 46321

LEAD MANUFACTURE PRINTS HAVE BEEN COMPLETED AND ARE

CURRENTLY OUT FOR GRATING.

TWENTY BARREL/RECEIVER BLANKS HAVE BEEN TURNED ON

A WAGON LAKE, CYCLE TIME OPTIMIZATION SHOULD PRODUCE

RESULTS IN THE AREA 3-4 MIN.

TWENTY RECEIVER BLANKS WERE SHIPPED TO INHERSALL.

TEST RESULTS AND SAMPLES ARE EXPECTED BY JULY 10

DISCUSSION WITH JANA FINDLEY & JIM ROKKAINEN ABOUT

LOW END RANT ACTION TIER PROGRAM PROPOSED

THAT WE LOOK AT A TWO PIECE ASSY SUCH AS THE

TEST PIECES AS DETAIL ON PAGE 42. THIS WOULD

SHORTEN THE LEAD TIME TO MARKET, THEN FOLLOW

WITH A SINGLE PIECE UNIT. DISCUSSION WITH

MARKETING, TO FOLLOW.

EXPERIMENTER

DATE 6/18/92

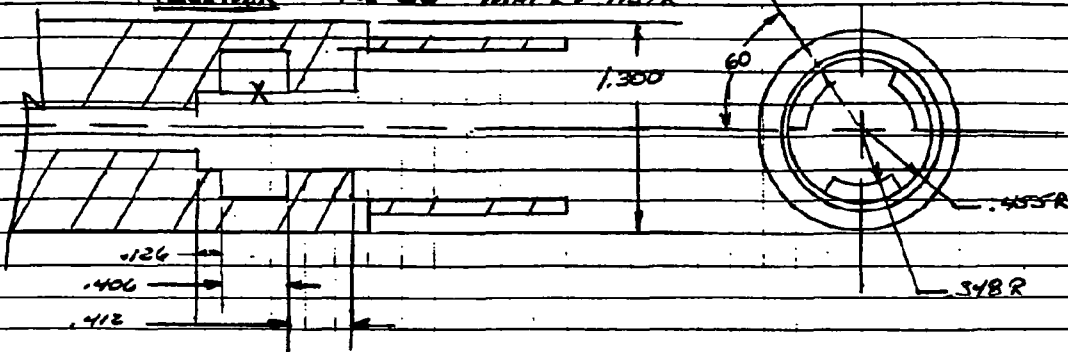
WITNESSED BY

DATE 7/27/92

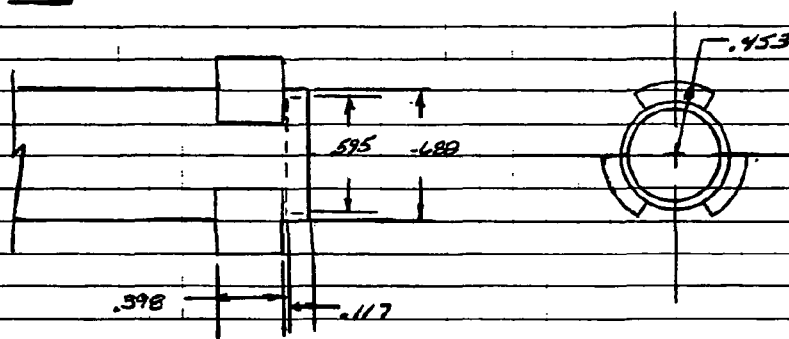
46321

Book No. PURPOSE EXPERIMENTAL TEST ACTION - LOCKING SYSTEM EVAL

RECEIVER R-38 MAT'L: 4137R



BOLT R-41 MAT'L: 8640



ASSEMBLED TEST ACTION AS DESCRIBED ON PAGE #47, WITH THE ABOVE

DIMENSIONS AND MATERIAL SPECIFICATIONS. CHAMBERED FOR 30-06.

EXPERIMENTER

DATE

7/24/92

WITNESSED BY

DATE

7/27/92

PURPOSE EXPERIMENTAL TEST ACTED - LOOKING INTO SYSTEM EVAL Book No. E 46321

DELIVERED TEST RECEIVER/ASSY TO TEST LAB.

REQUESTED A "STRESS LOAD" EVALUATION OF A 2000

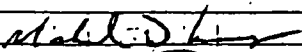
LOAD FIRING, FOLLOWED WITH A HIGH PRESSURE LOAD

OF 125,000 PSI. W/ A NON-RESTRICTED BORE

MEASURED FIRING, PIN INDENT USING COPPER CRUSHERS,

RESULTS RANGED FROM .015" TO .017"

EXPERIMENTER



DATE

7/27/92

WITNESSED BY



DATE

7/27/92

46321 Book No. PURPOSE EVALUATION OF TOL-LUG SYSTEM - LUG BEARING / SHEAR AREAS

RESULTS OF CY MODELING OF TOL-LUG SYSTEM GEOMETRY AND RECEIVER

LUG GEOMETRY:

BOLT LUG:

ARC LENGTH AT SHEAR SURFACE = .361 IN.

BOLT LUG SHEAR AREA = .1444 IN² (ASSUME LUG WIDTH = .400 IN.)

BOLT LUG BEARING AREA = .0444 IN²

→ TOTAL LUG SYSTEM SHEAR AREA = 3 x .1444 = .4332 IN²

→ TOTAL LUG SYSTEM BEARING AREA = 3 x .0444 = .1332 IN²

RECEIVER LUG:

ARC LENGTH AT SHEAR SURFACE = .468 IN.

RECEIVER LUG SHEAR AREA = .1872 IN² (ASSUME LUG WIDTH = .400 IN.)

RECEIVER LUG BEARING AREA = .0440 IN²

→ TOTAL REC. LUG SYSTEM SHEAR AREA = 3 x .1872 = .5616 IN²

→ TOTAL REC. LUG BEARING AREA = 3 x .0440 = .132 IN²

EXPERIMENTER *John D. L.*

DATE 7/21/92

WITNESSED BY *Tom Powers*

DATE 8-3-92

PURPOSE RESULTS OF INTENTIONAL ABUSE TESTING ON 7/21/92Book No. E 46321

REFERRING TO TEST ASSEMBLY OF PAGES 54 & 55.

TEST SEQUENCE:

① FIRE .30-06 PROOF LOAD

② FIRE .30-06 HIGH PRESSURE (EST. 120,000 PSI)

TEST CONDITIONS: ENCLOSED IN IRON CHAMBER

NON-OBSTRUCTED BORE

HIGH PRESSURE WAS EXTRAPOLATED FROM (RANGE OF
LESS PRESSURE) PRESSURE VS LOAD DATA

TEST RESULTS: PROOF LOAD → EASY BOLT LIFT

NO VISUAL FAILURE

AS EXPECTED, SAME RESULTS AS
CURRENT M/TOD RESULTSHIGH PRESSURE LOAD → NO VISUAL EXTERIOR FAILURE
UPON OPENING CHAMBERBOLT ROTATION IMPROVED,
TOP OF HAMMER, BOLT
ROTATION PERMITTED.NO VISUAL FAILURE OF INTERNAL
LOCKING SYSTEM.

CASE HEAD FAILURE.

NOTE: ALL COMPONENTS TO BE MAGNETIZED AND REUSED.

NEXT TEST WILL BE HIGH PRESSURE LOAD WITH OBSTRUCTION
IN BORE.EXPERIMENTER StahlDATE 8/1/92WITNESSED BY Tom PowersDATE 8-3-92

58

Page No.

TITLE

PROCESS DEVELOPMENT - NBAR

DATE

8/6/92

46321

Book No.

PURPOSE

TENTATIVE RANGE TESTING OF TEST ARTICLE

TEST DATE - 8/4/92

CONDITIONS: SOME COMPONENTS AS STATED ON PAGE 54 AND USED
IN TEST DESCRIBED ON PAGE 57ALL COMPONENTS MAINTAINED PRIOR TO TEST,
NO INDICATIONS- OBTAINED ROPE - 2 1/2 BULLETS SEATED
AHEAD OF CHAMBER- HIGH PRESSURE ROUND - SAME AS HIGH PRESSURE
LOAD USED BY PAGE 57.

- FIRED IN IRON CHAMBER w/ LANYARD.

RESULTS: NO USUAL EXTERIOR FAILURE UPON OPENING
IRON CHAMBER

ROPE LOCKED UP - WOULD NOT ROTATE

EDM WIPED SECTION THROUGH LOCKING AREA.

ROPE LOCKS IN RECEIVER SET BACK $\approx .015"$

CASE HEAD FAILURE

SHROUD FAILURE IN TENSION AT $\approx 60^\circ$ RADIALYCONCLUSION: ACTION CONTAINED ALL COMPONENTS, NO
CATASTROPHIC FAILURE OCCURRED.

EXPERIMENTER

Robert J. King

DATE

8/6/92

WITNESSED BY

Tom C. C. C.

DATE

9-18-92

TITLE PROJECT DEVELOPMENT - NBARDATE 8/18/92

Page No.

59

PURPOSE Progress Update From 8/1/92 to PresentBook No. E 46321

REQUEST FOR ARTIST CONCEPTUAL DRAWINGS OF NBAR, FOR
BY ADJUSTING CONT'D LUN CORRIDOR TO DO GET WORK
MAIN EMPHASIS ON STOCK COMPLETION DRAWINGS
ARE DUE BY 8/24/92.

DEVELOPED HIGH SPOT ECONOMICS FOR DAN SHUMWAY.

INVESTIGATION OF EXTRACTOR DESIGN THAT WILL
INCORPORATE THE M100 EXTRACTOR AND A "CAN"
STYLE EXTRACTOR. ALTHOUGH A CUT THROUGH THE
SHROUD IS REQUIRED, EXTRACTOR WILL ACT AS INTEGRAL
PART OF SHROUD UPON CASE HEAD FAILURE.

DEVELOPED CV MODEL: RES. NBAR, CXP 2444, EXTRACTOR, M100.
HAND SKETCHED TRIAL COMPONENTS TO INSTALL IN A
M100 FOR EXPERIMENTAL PURPOSES.

REVIEWED AREA OF JOINTING BETWEEN FORWARD FACE OF
MAGAZINE OPENING TO BOLT FACE. SKETCHED MOVED BOLT FACE
.030" FORWARD INTO BARREL C'FACE. ALTERED DISTANCE FROM
M100 OPENING TO BOLT FACE WAS 1.05" TO .850" W/
FEED RAMP OF 20°

EXPERIMENTER

DATE 8/18/92

WITNESSED BY

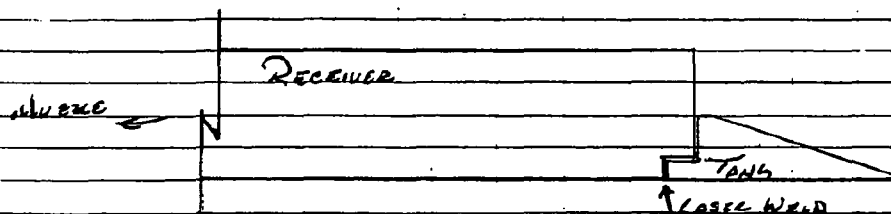
DATE 9-18-92

E 46321

Book No. PURPOSE Process Update from 8/19/92 to Present

5 Paintings were received and delivered to Marketing.
Current proposal includes a "Satin" finish wood storage
offering and a stainless steel synthetic offering.

To reduce machine tool complications with
1/4" learning, ease of chamber depth in receiver,
the receiver (Receiver/Barrel) unit will consist
of a 5.50" receiver section and up to a 24"
barrel. This will enhance the machining operations
required to provide the bolt gun clearance in the
receiver. Following, all machine cuts on the receiver,
the tank section will be laser welded to
the back of the receiver. The tank could possibly
consist of a fine blanking. See sketch below.



EXPERIMENTER

ALHDL

DATE

9/18/92

WITNESSED BY

Tom Bowers

DATE

9-18-92

TITLE Project DevelopmentDATE 9/18/92

Page No.

61

PURPOSE Cont'd Update From Page #60Book No. E 46321

CURRENTLY DEVELOPING TWO FOCUS PANEL SAMPLE LUNGS.

THE SAMPLES WILL BE OF THE TWO PIECE VERSION.

DESCRIBED ON PAGE #47, DUE TO CURRENT MANUFACTURING

CAPABILITIES. THE SAMPLES WILL NOT HAVE FUNCTIONAL

COMPONENTS.

CONTINUING TO DEVELOP COMPONENTS ON LV. AS

OF NEW: REBAR, EXTENDER, REBAR/REPAIR, INSERTS HAVE

BEEN MODELED.

HAVE DEVELOPED A SCOR MOUNTING SYSTEM THAT WOULD

BE INCLUDED ^{WITH} IN EACH FIREARM. DETAIL, A CURRENT RECEIVER

CONSTRUCTION AND MANUFACTURING PROCESS WOULD NOT PERMIT

EASY DEVELOPMENT OF INTEGRAL MOUNTS, THE PROPOSED SYSTEM

MAY BE EASILY DERIVABLE. THE SYSTEM MOUNTS RADICALLY

PERPENDICULAR TO C_L OF BORE. THE MOUNT AND BASE PLATE

WOULD BE AN INTEGRAL COMPONENT, FIXED TO THE RECEIVER

BY 3 ALLEN HEAD CAP SCREWS. PROTOTYPES WILL BE INCLUDED

ON FOCUS PANEL LUNGS.

EXPERIMENTER

Michael D. Henry

DATE

9/18/92

WITNESSED BY

Tom Powers

DATE

9-18-92

MEETING TIME: 4:30 PM ON 9/23/92

PRESENT: BILL WARDEN, ALICE KERNET, JOHN BAIRD, JAY BOWING

① RECORD/REDDING INSERT WERE RECEIVED WELL, MAY NEED TO INSTALL AN INSERT IN 2000 & 2500 TO INSURE A CORRECT CENTERLINE BETWEEN LOCATING SURFACES OF THE RECEIVER.

② IF PROPOSED Z-TARGET (AS DESCRIBED ON PAGE 59) WILL CONTAIN PRESSURE COMPARABLE TO M/200, WOULD BE DESIRABLE TO HAVE AN N300.

③ SCORE MOUNTING SYSTEM (AS DESCRIBED ON PAGE 61) WOULD BE DESIRABLE. NEED TO STUDY SCORE CL HEIGHTS TO MAKE SURE SCORE MOUNT WOULD ACCOMMODATE 85-90 ° OF ALL SLOPES.

④ NEED TO PROVIDE CAPABILITY TO PROVIDE A 26" BARRELED VERSION, (K) THROUGH OUT ALL MAXIMUMS OPER.

EXPERIMENTER

DATE 9/24/92

WITNESSED BY

DATE 9-24-92

TITLE PROCESS DEVELOPMENT - NBAR DATE 9/24/92 Page No. 63PURPOSE CONT'D FROM PAGE *62 - MEETING DISCUSSIONS Book No. E 46321DISCUSSION ABOUT FOCUS PANEL GUNS & ISSUES:NEED TO HAVE TWO VERSIONS:

- ① W/ PROPOSED FLARING/BLANDERED CONTOUR
- ② W/ CONVENTIONAL STEP BETWEEN RECENTER AND BARREL
- ③ W/ .1650" WIDE EJECTION PORT
- ④ W/ MORE CONVENTIONAL OPEN TOP PORT

GUNS NEED NOT TO BE FUNCTIONAL - BOLT DOES NOT NEEDTO OPERATE OPERATIONAL - (Y.E.) DOES NOT NEED TOTRAVERSE THROUGH RECEIVERTRIGGER COULD BE PRIMER IN STOCK - NON FUNCTIONALEXPERIMENTER Michael D. L...DATE 9/24/92WITNESSED BY Tom P. ...DATE 9-24-92

64

Page No. TITLE PROCESS DEVELOPMENT - NBAR DATE 10/29/92E 46321 Book No. PURPOSE DEVELOPMENTAL UPDATE FROM 9/24/92 TO PRESENT

FOCUS PANEL GUNS ARE CURRENTLY BEING
PRODUCED. BARRELS ARE COMPLETE, WAITING FOR
RECEIVER TUBES. VARIOUS SMALLER COMPONENTS SUCH
AS SCOPE MOUNTS, ROPE HANDLES, ARE ALSO BEING
PRODUCED BY THE TOOL ROOM.

REVIEWED THE RECIP/REDDING INSERTS, COMBINED THE
SEPARATE (PARAPSED) UNITS INTO A SINGLE PART TO BE
USED IN BOTH THE WOOD AND SYNTHETIC STACKS.

REVIEWING CURRENT OPEN RIGID DESIGNS. INVESTIGATING
THE POSSIBILITY OF UTILIZING A BALL / PINION SYSTEM TO
ADDRESS THE ADJUSTMENT ASPECT.

CONTACTED AMERICAN (FBI) TO DISCUSS READING, PROGRESS
DEVELOPMENT FOR THE RECEIVER SECTION. NO TECHNICAL
ADVISORS ARE PRESENT IN THE U.S. - MUST CONTACT
AUSTRIA TO DISCUSS PROPOSED OPERATION. WILL
REVIEW OPTIONS WITH SIM RABBIT & GARY BARNES.

EXPERIMENTER Michael D. LongDATE 10/22/92WITNESSED BY Edward J. FordDATE 1/13/93

TITLE PROCESS DEVELOPMENT OF NBAR DATE 11/6/92 Page No. 65PURPOSE UPDATE FROM 10/23/92 TO PRESENT Book No. E 46321

DUE TO LOW VALUE OF OPEN RIGHTS THAT WOULD BE USED ON THE NBAR, FURTHER DESIGN OF NEW SIGHTING SYSTEM IS NOT JUSTIFIABLE. WORKING TO FINISH CURRENT DESIGN SO THAT IT COULD BE A ADD USE PART.

HAVE DEVELOPED A CONCEPTUAL DESIGN TO HAMMER FORGE THE INTERNAL COILING GEOMETRY.

TWO POSSIBLE APPROACHES: ① TWO PASSES - 1 FOR BARREL RIFLING, 1 FOR RECEIVER GEOM.

THE BARREL WOULD BE HAMMER FORGED AS CURRENT PRODUCT. THEN THE RECEIVER WOULD BE DRILLED AND REAMED ON A SECOND LGF, A MANDREL WOULD BE INSERTED INTO THE RECEIVER, THE ENTIRE RECEIVER LENGTH WOULD BE FORGED.

② ONE PASS -

THE RIFLING MANDREL WOULD BE FED THROUGH THE RECEIVER MANDREL.

COMPONENTS FOR THE TWO PASS OPERATION HAVE BEEN DESIGNED

AND DELIVERED TO THE TOOL ROOM, ONCE COMPONENTS ARE

COMPLETED, TRIAL FORGING WILL BE SCHEDULED.

EXPERIMENTER	<u>Walter D. King</u>	DATE	<u>11/6/92</u>
WITNESSED BY	<u>Edward J. Ford</u>	DATE	<u>1/13/93</u>

66

Page No. TITLE PROCESS DEVELOPMENT - NBARDATE 12/14/92

E 46321

Book No. PURPOSE UPDATE FOR 1/6/92 TO 12/14/92

HAVE CONTINUED NIAGRA CUTTERS AND HORN BORING SYSTEMS
PERTAINING TO THE UNDERSTANDING, FACILITY, OR THE GREENING,
LAYS IN THE RECEIVER AFTER THE FORGING OPERATION HAVE
RECEIVED EXPERIMENTAL T-CUTTERS FROM NIAGRA. HORN
TO BE SUBMITTING QUOTES FOR A STD. SINGLE POINT BORING,
BAR AND A T-CUTTER.

THE PROTOTYPE GPM HANDLES ARE EXPECTED BY 12/16/92. HOWEVER
THEY WILL NOT BE TO THE EXACT MODEL DRAWING DIMENSIONS, THEY
WILL PROVIDE INSIGHT ON THE FORGING CAPABILITIES.

FOCUS PANEL ACTIONS ARE STILL IN THE TOOL ROOM. NO

EXPECTED COMPLETION DATE AVAILABLE.

EXPERIMENTER

Michael D. L...

DATE

12/14/92

WITNESSED BY

Edward J. Goid

DATE

1/13/93

TITLE PROCESS DEVELOPMENT - NBAR DATE 12/23/92 Page No. 67PURPOSE DEVELOPMENT OF ALTERNATIVE TO FRONT LOG CONCEPT. Book No. E 46321

THE CURRENT CONCEPT CONTAINS THE FORWARDING OF LOCKING LUGS AT THE FRONT OF THE RECEIVER ONLY. THE BOLT BODY DIA. WOULD BE EQUAL TO THE BOLT LENGTH LUGS MAJOR DIA. THIS IS ONE OF DESIGN CONCEPT OF A SINGLE POINT BORING BAR USED TO PRODUCE THE UNDERCUT, TO ALLOW FOR MAXIMUM BORING BAR STAKE DIA.

INVESTIGATING THE POSSIBILITIES OF UTILIZING A "NOBURR" S-SERIES TOOL TO PRODUCE THE LOCKING LUGS FULL IN THE RECEIVER. THE TOOL CONVEYS TRANSLATION PARALLEL TO RECEIVER CENTER LINE INTO RADIAL TRANSLATION WHILE PISTONING OFF OF INTERNAL RECEIVER DIA. IF THE TOOL IS AVAILABLE, IT WOULD ALLOW US TO FORM RECEIVER LUGS THE FULL LENGTH OF THE RECEIVER, THIS PISTONING WOULD BE OFF OF THE MINOR DIA. OF THE LOCKING LUGS.

REVIEWED INTERNAL LUG GEOMETRY AS WELL AS RADIAL LOCATION OF LUGS IN THE FULL LENGTH STATE APPEARS TO BE MORE BENEFICIAL TO HAVE THE RECEIVER LUGS IN A 12, 4 & 8 O'CLOCK POSITION RATHER THAN A 2, 6, & 10 O'CLOCK POSITION.

— CONTINUED ON PAGE 68

EXPERIMENTER Michael D. [Signature]DATE 12/23/92WITNESSED BY Edward J. [Signature]DATE 1/13/93

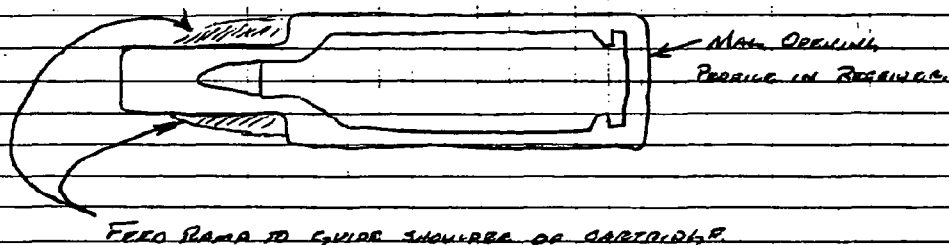
68

Page No. TITLE PROCESS DEVELOPMENT - NBOB DATE 12/23/92

E 46321

Book No. PURPOSE CONTINUED FROM PAGE #67

At a 12, 4:30 O'clock LUG LOCATION, THERE IS NO LUG
 AT THE 4 O'CLOCK POSITION TO FEED OVER THEREFORE,
 TO IMPROVE AND DECREASE THE PROBABILITIES OF FEED CHAMBER
 MALFUNCTIONS, DEVELOPING A CONCEPT TO MOVE THE FRONT
 OF THE MAGAZINE OPENING IN LINE WITH THE LOGGING, LUG
 FACE. THE AMOUNT OF TRAVEL FOR THE BULLET NOSE TO
 REACH THE CHAMBER WOULD BE MINIMIZED. SINCE THERE
 WOULD BE NO LOGGING LUG, TO FEED OVER, AND ASSUMING
 THE MAGAZINE WILL REMAIN IN LINE FEEDING, DEVELOPED A MAGAZINE
 OPENING IN THE RECEIVER THAT WOULD FEED THE ROUND BY
 CONTACTING THE SHOULDER NOT THE BULLET AS IN CONVENTIONAL
 FEEDING SYSTEMS.



EXPERIMENTER

Michael D. [Signature]

DATE

12/22/92

WITNESSED BY

Edward J. [Signature]

DATE

1/13/93

TITLE PROCESS DEVELOPMENT - NBAR DATE 1/13/93 Page No. 69PURPOSE RECORDING OF DIMENSIONS FOR FULL LENGTH LUG RECEIVERS Book No. E 46321
AS DESCRIBED ON PAGE # 67

TO DATE, THE FOLLOWING ARE CRITICAL DIMENSIONS (PROPOSED)

FOR THE CONVENTIONAL STYLE FULL LENGTH RECEIVER GEOMETRY.

BOLT BODY DIA: $.692 \pm .001$ BOLT LUG DIA: $.934 \pm .002$ BOLT SHOULDER DIA: $.6915 \pm .0015$ REC MINOR T.D.: $.701 \pm .001$ REC MAJOR T.D.: $.940 \pm .002$ REC SHOULDER T.D.: $.695-.698$ REC OUTSIDE DIA: 1.340

LUG GEOMETRY:

RECEIVER LUG RADIAL - 53° BOLT LUG RADIAL - 67° OPTIMIZED BEARING W/ $.025"$ WIDE LEAD ANGLE CUT

ON BOLT LUG, WHICH WILL ALLOW FOR FULL COVERAGE OF

THE RECEIVER LUG IN THE LOADED POSITION.

NOTE: RECEIVED FORGING MANDRILLS FOR TWO PASS FORGING,
OPERATION AS DESCRIBED ON PAGE # 65. CURRENTLY
WAITING FOR BLANKS.

EXPERIMENTER Michael D. KingDATE 1/13/93WITNESSED BY Edward J. GmelDATE 1/13/93

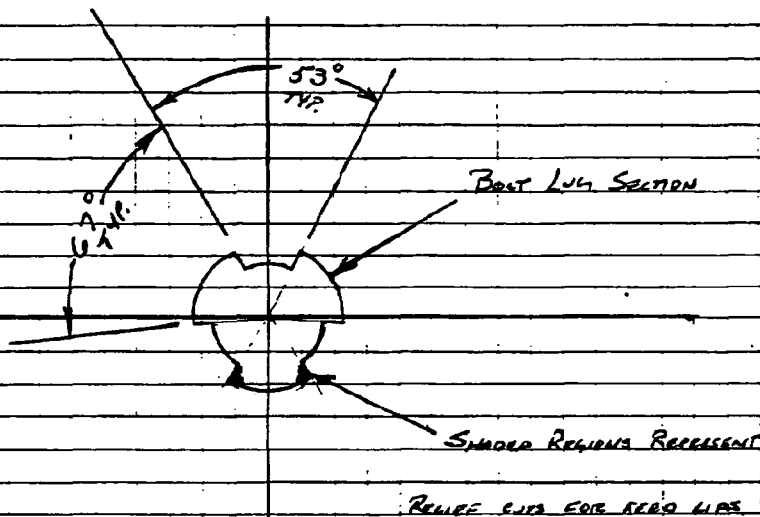
70

Page No. TITLE PROCESS DEVELOPMENT - NBAR DATE 1/25/93

E 46321

Book No. PURPOSE UPDATE FROM 1/12/93 TO 1/25/93

REVIEWING THE LOCKING SYSTEM (62°/53°) AS STATED
ON PAGE #69, WITH THE REARER LUGS ORIENTED AT
THE 12, 4 & 8 O'CLOCK POSITIONS, THE RINGS WILL BE
FEED THROUGH THE 4 & 8 O'CLOCK LUGS. ON THE ASSUMPTION
OF IN LINE FEEDING, A BOLT AND, IN THE 6 O'CLOCK
POSITION MUST PASS THROUGH THE FEED LIPS TO INSURE
PROPER ENGAGEMENT OF THE SHELL RIM AND THE BOLT SHOULD
THEREFORE, THE 6 O'CLOCK BOLT LUG, WILL HAVE TO BE REINFORCED
ON EACH SIDE TO CLEAR THE FEED LIPS. SEE SKETCH BELOW:



EXPERIMENTER

Michael J. Long

DATE

1/25/93

WITNESSED BY

DATE

TITLE Process Development - NBACDATE 2/16/93

Page No.

71

PURPOSE Forming UpdateBook No. E 46321

RECEIVED ALL COMPONENTS TO FORM TRIAL SAMPLES BY
2/11/93. FORMED SEVEN PIECES ON 2/16/93

RESULTS:

AREA REDUCTION: FROM 1.365" TO 1.240" DIA.

Visual - APPEARS TO HAVE FILLED 50% OF CUP DEPTH

PIES TO BE SECTIONS AND MEASUREMENTS MADE ON ALL

DIMENSIONS. FLOW CHARACTERISTICS TO BE STUDIED AND
REVIEWED.

NEXT STEP: BEGIN W/ BLANKS AT 1.50" DIA OR LARGER
AND BRIDGE TO 1.350" DIA, REVIEW FLOW.

EXPERIMENTER

Michael D. KingDATE 2/16/93

WITNESSED BY

JFAC

DATE

46321

Book No. PURPOSE INTERNAL GEOMETRY OF REAR ALTERATIONDIMENSIONAL ALTERATIONS TO PAGE # 692DUE TO INCREASE IN BOLT SHOULDER WALL THICKNESS TOIMPROVE EXTRACTOR & BOLT SHOULDER INTEGRITYREDUCE OVERALL HEIGHT OF LOCKING LUGS &BEARING LUGS ALLOWED TO FAIL, W/ A BEARINGBEARING AREA BEYOND SPEC LIMIT. SEE CALC. BELOWDIMENSIONS:BOLTS: BOLT SHOULDER D.I.A. - .710-.713BOLT BODY D.I.A. - .717-.720BOLT LUG D.I.A. - .930-.941RECEIVERS: REC. SHOULDER D.I.A. - .716-.720REC. BOLT BODY CLEAR - .723-.725REC. BOLT LUG CLEAR - .944-.946REC. OUTSIDE D.I.A. - 1.340-1.345

$$\text{BEARING AREA} = \frac{(3.53(14))}{360} ((.4690)^2 - (.362)^2)$$

$$A_B = .1244 \text{ in}^2$$

EXPERIMENTER StallinDATE 2/16/98

WITNESSED BY

DATE

TITLE

DATE

Page No.

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PURPOSE

Book No. E 46321

EXPERIMENTER

DATE

WITNESSED BY

DATE