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[signature] 8/28/91   James Rabkin 8/28/91   ①

NOTEBOOK: E-46331

8/2/91 - Bill Jackson & Myself brainstormed about a
one piece Barrel & Receiver Firearm.
One piece Bolt Body Assy.
Lugs in Rear

8/3/91 - Developed Basic Parameters - Rough Sketch
~~[struck]~~ Laser weld Lug in Receiver
60° Lock Rotation
Single feed magazines
Lips in Box not Receiver
Universal Bolt Cut - Left or Right.

8/5/91 - Reviewed Mat'l Selection w/ Glen Sietsma - (4140 mod. Poss.)
Laser weld no good on resulfurized mat'l
Copper Braze way to go
Top Tang to stop Rotation
Mirror image cam cut
Mirror ~~[struck]~~ image Ejector & Extractor

8/6/91 - Hexagon contour to points requires 1.44" of mat'l Dia.
For Radius will run possibly 1.370" Dia.
Recess Bolt Body for Bolt Handle - Flush .815 Dia.
Reviewed shear stress w/ Jim Pomeranski (General)
Lug mat'l to be 8640 - Possible two lugs?

8/7/91 - Gathered Tooling for Receivers & Bolts
Wayne Cable had trouble drilling
4140 Blanks. 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"
∴ New bolt will be 5.600 + .8495 = <u>6.4495</u>" in length
or 6.450 even

Developed spec sheets.
Trigger Assy Hole Location on Assy will have to change.

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Notebook: E-40321

8/28/91

8/28/91

8/8/91 Cont'd.

Bolt Plug O.D. to change to .810 - match Bolt O.D.
F.P. Head Dist - 4 to Engagement surface increase
to accomodate .810 Bolt Diameter

8/9/91 - Write High Spot for Lug / Barrel / Bolt
Set up Mikano - Gundrill & Ream
Reconfigured Custom Chambering opsr.
Wayne will run chamber and .660 ± Dia
Counterbore.

8/10/91 - Ran Barrel/Receiver Program on Monarch Lathe
w/ help of Jim Rabbia. Program is 0808/d. (Receiver)
Cut Receivers to 1.250 Dia. Did not leave a
step.
Proceeded with Mikano - Cut Bolt Hole & Reamed
at 200 RPM F=.020 IPR to a Depth of
8.500 from Rear Face of Receiver.
Set Monarch Tailstock to 47" - use 222 Centers

8/11/91 - Processed Receivers on Fadals w/ Indexing Unit.
Posts at 20° above horizontal
90° Lock Rotation (Trailing Out)
Top Tang
Lug .05 wide (with 5/16 Rad in all corners) By 1.0 = .375
Std. Tool Below Screen Position.

8/12/91 - C'Bore Dia" for 243 is .650" D.A
Bolt OAL - 6.456 - Drill Shoulder at 5.260" from Rear
Step O.D. at .325" from End = from .646" D.A to .812" D.A.

8/13/91 - Ran Lug Contour on Monarch - Program 8/10
Turned Bolts on Okuma - .325 at .648 Dia.
Tang cut at .690"
Wayne drilled slope holes - Front and Rear the same dist.
.650" C'Bore x .150 Deep.

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Michael Dunn 8/14/91

James Rabbitt 8/28/91

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Notebook E-46321

8/14/91

- Hand Filed Extractor - 20° Rotation w/ 180° Sep. for Ejector
- Bolt Plugs Milled
- Bolt Head Hole Location: Sketch

~~Chuta:~~

8/16/91 - Results of Presentation:

Well Received for Concept

Concerns: Recoil Lock-up - Receiver Stretch

Bearing Dia. of Bolt - Poss. 700 Bolt Shroud

Solutions: Double Lock-up in Front

90° Lock Rotation

Will test w/o Bolt Shroud - if Lugs with stand load (250,000 psi) Bolt Shroud should not be required.

Cam Cut, Threads & Bolt Handle one unit pressed into rear of Bolt Body.

8/19/91 - Glen & Pete Reviewing Heat Treatment.

8/21/91 - For Twin Locking Lugs. Position 20° Below Horizontal

Points 30° Above Horz.

Ring Bolt .5" x 360°

Lug Width .5" ?

90° Lock Rotation will be possible w/ 20° Rotation

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NOTEBOOK: E-46321

8/28/91 - DEVELOPED TWO SKETCHES :

(1) RECEIVER W/ FRONT LUGS UP

TWO LUGS AT 20° BELOW HORIZ.

OAL = 8.0"

LUG RADIUS 2 → (3/16 DIA CUTTER)

STEELTREATERS RUN SINGLE BARREL SAMPLE IN VACUM FURNACE - HARDNESS REJECTED AT RC 28. NOT HIGH ENOUG.

WILL RUN IN CONTROLLED FURNACE - RESULTS: MAY SHOW WARPAGE AND SCALE.

RUN 7 BARRELS THROUGH MITAKO - READY FOR FIRST CUTS.

Michael D. Lowe 8/28/91

James Robbins 8/28/91

9/4/91 - REVIEWED TWIN LUG IN FRONT W/ DICK JENSEN,

DICK PREFERRED 60° LUG ROTATION OVER 90°.

UPON REVIEWING, 20° LUG ORIENTATION,

70° LUG ROTATION WOULD BE [redacted] ULTIMATE SUPPORT LUG ROTATION, SO THAT $\mathcal{L}$ OF LUG IN RECEIVER MATCHES $\mathcal{L}$ OF LUG ON BOLT - PRODUCING FULL SUPPORT OF LUG SURFACES.

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9/5/91 NOTEBOOK: E-46321

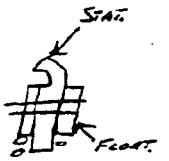
LOCATION OF TRIGGER ASSY HOLES:

CURRENT 700 LOCAT. IS .520 BELOW ℄.

DUE INCREASED BOLT DIA.'S HOLE ℄ LOCATION WILL REQUIRE LOWERING OF ~~.0625~~ .05825"

∴ ℄ OF T. A. HOLES WILL BE ~~.5175~~ .5183" BELOW ℄ OF NEW RECEIVER.

9/11/91 FOR EXTRACTION: RUN C'BORE AT ANGLE TO FORCE 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 LUGS AFTER RADIUS WITH I.D. GROOVING TOOL.

FOR BOLT STOP/GUIDE - PLUNGER FROM SIDE INTO SLOT IN BOLT (BEHIND RECESS) ANGLE

PLUNGER TO AID IN BOLT INSERTION/ALIGNMENT.

James Cobb 9/11/91

Witness 9/11/91

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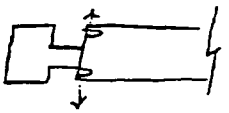
(C)

9/13/91 - IN THE CASE OF HEAD FAILURE, TO INSURE NOTCH: E-4650
THE SEAL OF GAS FROM OPERATOR A RECESS
IN SECONDARY BOLT FACE WILL SEAL RADIALLY
AGAINST RECEIVER.



9/13/91

9/19/91 - DISCUSSION ABOUT LUG ATTACHMENT,
WILL TEST HIGH TEMP. SILVER SOLDER.
LUGS HAS BEEN COMPLETED, REQUIRES
H.T. & TESTING.

9/23/91 - RESULTS OF MEETING W/ FRED SCHMIDT & DICK JACKSON,
LOCKING LUGS ~~WILL~~ NOT SHOULD NOT REQUIRE COPPER
BRAZE. SUGGESTED LOCALIZED INDUCTION BRAZING.
FRED WILL REVIEW LUGS DESIGN AND ADVISE.

PREPARING BARREL FOR TESTING. STRESS RELIEVE
AND THEN H.T. BY STEEL TREATERS. LUGS WILL
BE SILVER SOLDERED IN JACK AFTER H.T.

9/27/91

TEST TO BE PROGRESSIVE: TEST LOAD, PROOF, ULTIMATE
HIGH PRESSURE, PLUGGED BORE.

* EXPECTED MODES OF FAILURE: HIGH PRESS. LOAD WILL
SWELL/FRACTURE CASE HEAD, ALLOWING PRESSURE
INTO RECEIVER. BRASS WILL FLOW BACK INTO LOCKING
RECESS IN BOLT. GAS SHOULD PENETRATE SECONDARY
BOLT FACE AND SEAL GASSES FROM SHOOTER. SEE ABOVE SKETCH
9/13/91

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NOTEBOOK: E-46321

9/23/11 CONT'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 STRESSES.

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

REVISED CYL DESIGN W/ INTEGRAL BARREL BREECH, PRESS FIT & BRAZE INTO RECEIVER.

Michael D Hunter
9/23/11

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NOTEBOOK: E-46321

10/3/91 RESULTS OF ENTIAL TEST ON (6MM CALIBER) 9/27/91

CONDITIONS:- BARREL/REC Rc 43

- NO BOLT SHROUD/NOT FINED - TWIN LUGS Rc 43
- .650" D.A C'BORE IN REC - MIL, WELDED LUG/RECEIVER JOINT
- .810" DIA BOLT - NO GAS RELIEF HOLES
- 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 REPEATED

NO VISUAL FAILURE

3RD ROUND - HIGH PRESSURE - EST. 140,000 PSI

RESULTS: MECHANICAL FAILURE OF

RECEIVER.

(1) BOTH LUGS SEPARATED FROM RECEIVE

(2) BOLT REMAINED IN RECEIVER BUT.

REARWARD APPROX. 1 1/2"

(3) REC SPLIT INTO MAG. OPENING THROUG

(LEFT PORT) WELDED INTERSECTI

Witnessed D Law 90/3/91

NOTE: TEST GUN WAS ETCHED WITH #923 ON

TOP RAIL OF RECEIVER.

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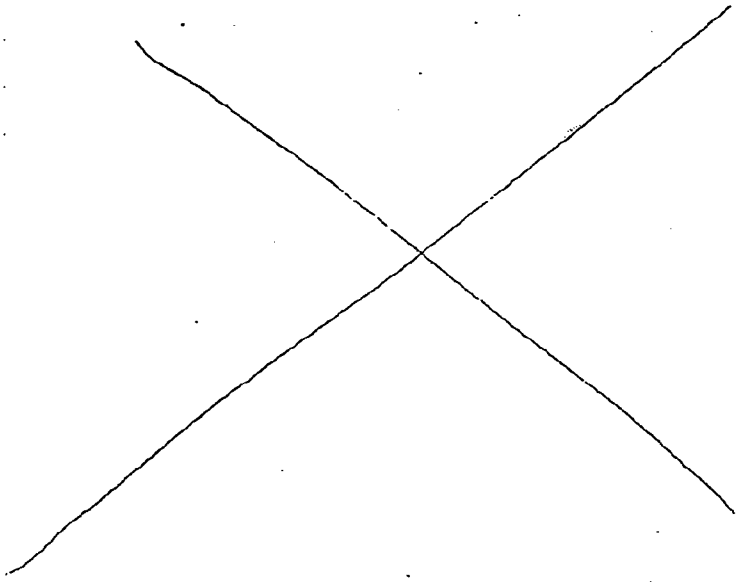
10/3/91 - RKA NOTES DATED 9/23/91: SINGLE PIECE LUG DESIGN
- FURTHER DEVELOPED LUG DESIGN, BEGAN FIRST PROTOTYPE
- CONSIDERING TWIN GAS RELIEF HOLE DESIGN
- DEVELOPED POSSIBLE SHROUDED BOLT/CLAW EXTRACTOR DESIGN.
EARS OF EXTRACTOR WILL FIT INSIDE BOLT SHROUD WITH EXTRACTOR PROTRUDING THROUGH RECESS IN SHROUD. UPON CASE HEAD FAILURE, EXTRACTOR WOULD ACT AS CONTINUATION OF BOLT SHROUD SEALING RUPTURE OF CASE HEAD.

MLH 10/3/91

= EXTRACTOR PLACEMENT



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E-46321

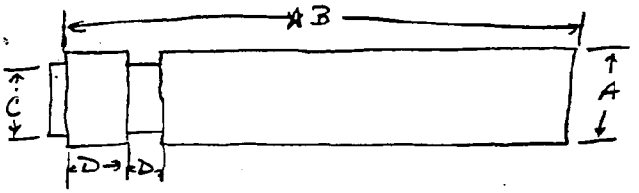
10/4/91. DEVELOPED BOLT CONTOUR W/ SHROUD. RAN (TURNED) 6 BOLTS TO FOLLOWING DIA.

A. BOLT O.D. - .900 ±.0015

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

C. SHROUD D.A / LOCKING SURFACE - .645 ±.0015"

D. LUG WIDTH - .500 ±.005



TO ENSURE GAS SEAL UPON CASE HEAD FAILURE, A REVISED W/300 SHROUD DESIGN IS DESIRED. TO ACHIEVE SUCH A SHROUD DESIGN, BOLT LOCKING SURFACE AND MAGNUM 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 ±.002. AS STATED PREVIOUSLY, THE EXTRACTOR WILL BE OF THE CLAW (PLUNGER) STYLE, WHICH WILL INTERCEPT THE SHROUD BUT UPON CASE HEAD FAILURE WILL ACT AS A UNITARY MEMBER OF THE SHROUD, TO CONTAIN THE PRESSURE, REDUCING MECHANICAL FAILURE OF LOCKING MECHANISM AS WELL AS RECEIVER WALLS. THE O.D. OF THE RECEIVER WILL BECOME 1.300 ALLOWING .200" WALL THICKNESS AROUND THE BOLT.

Hall D
10/4/91

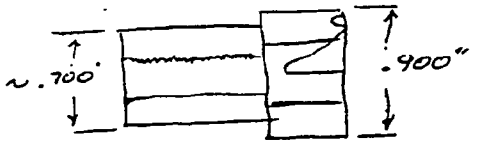
(11)

E-V6321

10/6/91 CONT'D. BOLT CONFIGURATION

TO IMPROVE WEIGHT DISTRIBUTION AS WELL AS OVERALL WEIGHT, THE ~~2nd~~ 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 BUSHING WILL BE PRESSED INTO THE REAR OF THE BOLT. THE BUSHING WILL CONTAIN THE C'BORE & THREADS FOR THE BOLT PLUG, CAM CUT AND COCKING NOTCH. AND THE AGENCY CUT FOR THE BOLT HANDLE, AS IN DRAWN SKETCH BELOW.

Michael D. 10/16/91



10/11/91 - ALTERED MUZZLE DIAMETER FROM ORIGINAL 700 BARREL CONTOUR - NOW .680" MUZZLE DIA. TAPERED BACK TO .700 THEN TO .577 OF STD 700 MAGNUM BARREL.

DESIGNED MAG BOX FEEDING - ROTARY OR STACKED WILL REQUIRE CLEARANCE IN THE BOLT.

WILL INVESTIGATE NEW - SULPHINUZED MATERIAL TO ALLOW FOR EASIER WELDING.

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10/14/91 - SENT 12 BBLS. TO CATION FOR RIFLING. BARRELS WERE DRILLED, REAMED AND SIZED FOR .30 CAL. AFTER H.T. TO OUR CURRENT BARREL SPEC. THE BARRELS WILL BE BUILT INTO 40X ACTIONS AND TESTED FOR SETBACK.

10/22/91 - ON 10/21/91 FIRED 4 TEST ROUNDS THROUGH A NBAR WITH FOLLOWING SPECS: ~~BOLT~~ BOLT SHROUD I.D. AT .562"
BOLT SHROUD O.D. AT .645"
BOLT SHROUD DEPTH AT .120"

TEST ROUNDS FIRED AT NORMAL PRESSURES, BUT SHOWED POSSIBLE HEAD SPACE ~~PROBLEMS~~ PROBLEMS. AFTER INSPECTING, WAS FOUND TO BE .809" DEEP.
BOLT WAS ALTERED WITH A .005" SHIM INSERTED IN BOLT FACE. ON 10/22/91. 4 FIRING PIN INDENTS TAKEN, RESULTS - .019, .017, .020 & .019. ~~-~~ AGREED TO FIRE HIGH PRESSURE .30:06 LOADS. LOAD: 50 GRAINS OF 4198, 220 GRAIN BULLET. ESTIMATED PRESSURE AT 140,000 PSI.
RESULTS:- NO VISUAL METAL FOLLOW, LOW TEMP BRAZE JOINT SPLIT BUT LUG DID NOT EXIT RECEIVER.

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TITLE _____

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E-46321

11/3/91 - RAN ONE BARREL/RECEIVER U.T.N.:

RECEIVER D.A. - 1.360

RECEIVER E. D.A - .906

DOUBLE PORTS

RIGHT HAND BOLT HANDLE CUT ONLY

WILL USE THIS ASSY. FOR STOCK CONSTRUCTION. (FOR SAMPLE USE ONLY, PARTS WILL NOT BE N.F.A.)

RECEIVED ECM BARRELS ON 11/7/91, HAD BARREL SECTIONED FOR VISUAL INSP. OF SURFACE. SURFACE FINISH APPEARS TO BE AS REQUIRED, NO VISUAL DISCREPANCIES. WILL BUILD 10 BARRELS WITH: .308 CHAMBER

1:12 TWIST

BORE D.A. BRIGED, REAMED & SIZED

GROOVE D.A. ECM'D

Michael P. 11/8/91

IF LASER WELDING OR ELECTRON BEAM WELDING IS APPLICABLE, MAY WISH TO LOCATE LUG POSITION TO 180° INST. 146° AS IS CURRENTLY MACHINED. WIDEN LUGS TO INCREASE BEARING SURFACE AREA.

E. I. DU PONT DE NEMOURS & CO. (INC.)

(14) E-46321

8/21/91

[illegible] BODY – 5.[illegible]75

[illegible] = .3120 REAR OF LUG TO [illegible] BODY

5.6695

[illegible] [illegible] FRONT DEPTH – 1.150

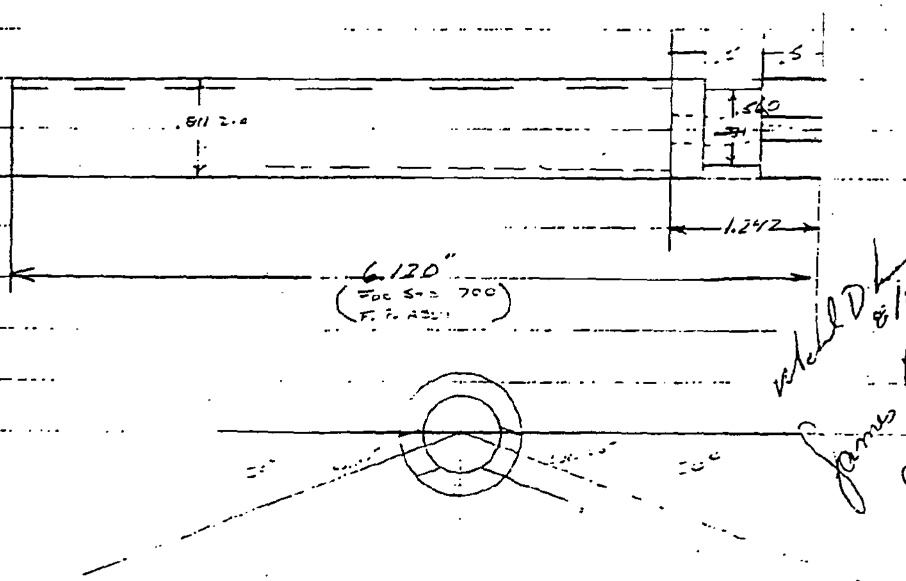
F.C. LENGTH + 5.970
FROM FRONT

4.82 DIST BETWEEN LOCK SURFACE TO FIRST F.C. HOLE

∴ DIST FROM FIRST F.C. HOLE TO END OF BOLT =

5.6695 – 4.82 = .8495

TO PRODUCE A LONG ACTION BOLT THAT WILL FUNCTION WITH A [illegible] F.P. ASSY. THE LENGTH [illegible] TO BE 5.[illegible]" LONG FROM [illegible] BACK W/ OAL. = TO 6.120"



8/30/91

8/28/91

BARBER - PRESALE R 0118817

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TITLE _____ DATE 12/19/91 Page No. 15

PURPOSE FORMATION OF EQUIVALENT VOID PAGES Book No. E 46321

PAGES NUMBERED 1-20 INCLUSIVE WERE SAVED FOR DAILY/AL DEVELOPMENTAL LAYUP LEAF NOTE BOOK PAGES. THAT HAVE BEEN INSERTED ON PAGES 1-14 INCLUSIVE, ON 12/19/91

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

EXPERIMENTER Mark D. [illegible] DATE 12/19/91

WITNESSED BY DATE

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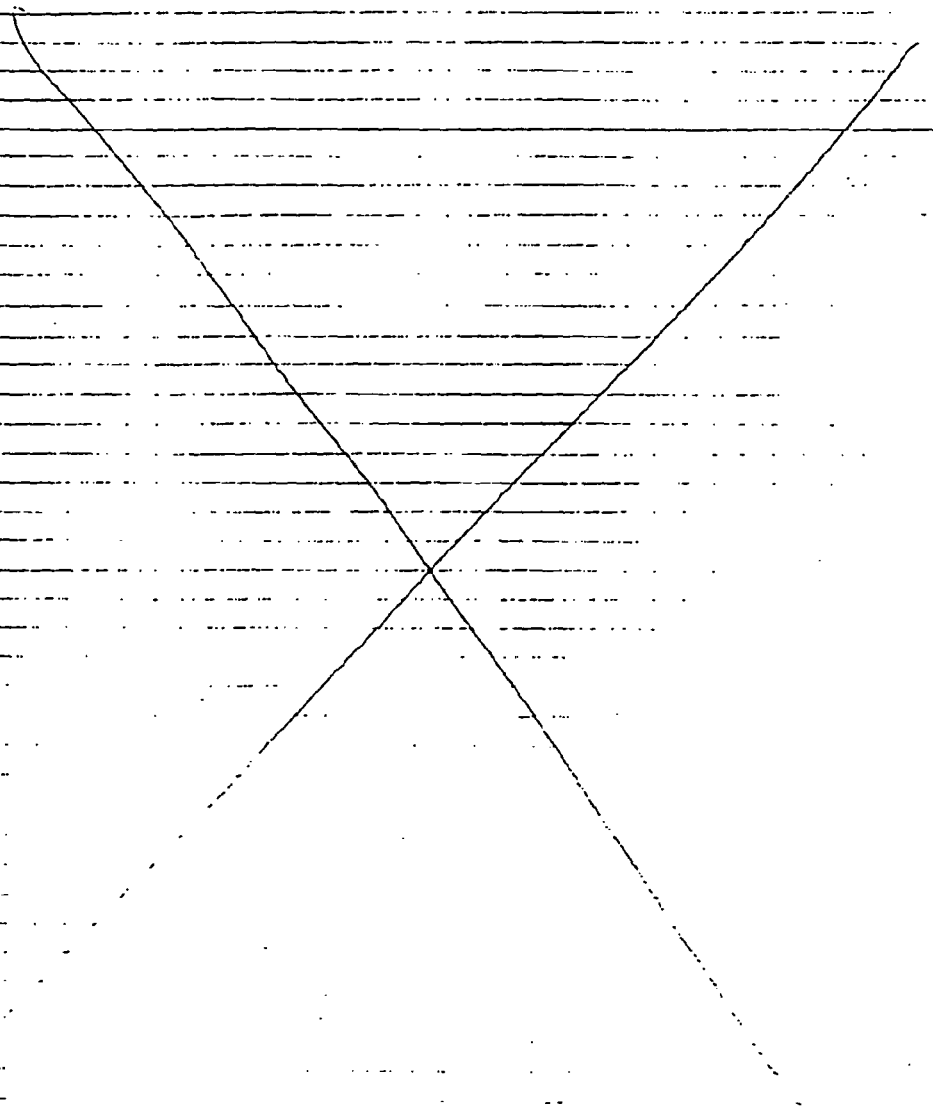
16 Page No. TITLE _____ DATE _____

E 46321 Book No. PURPOSE _____



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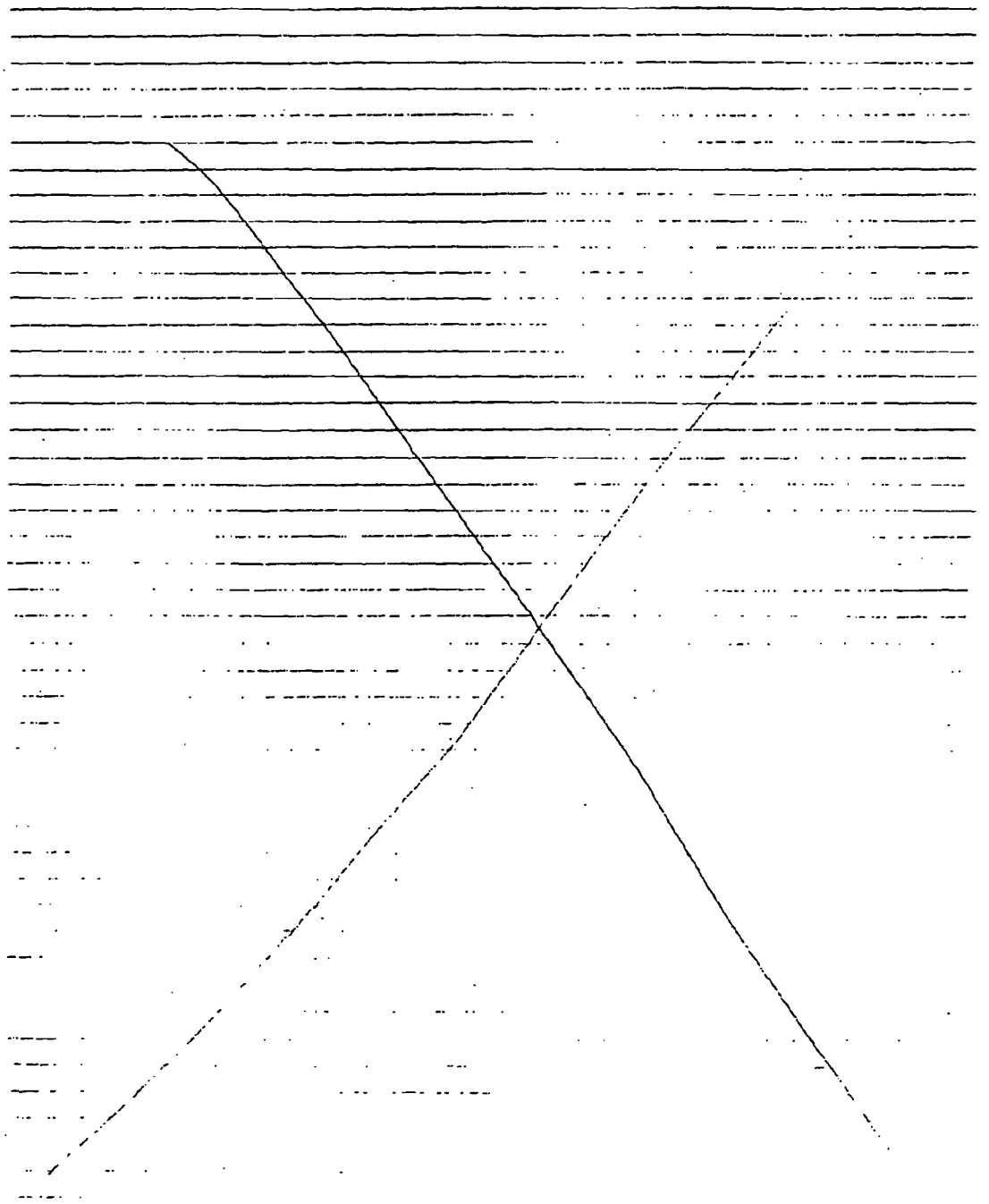
TITLE _____ DATE _____ Page No. 17

PURPOSE _____ Book No. E 46321



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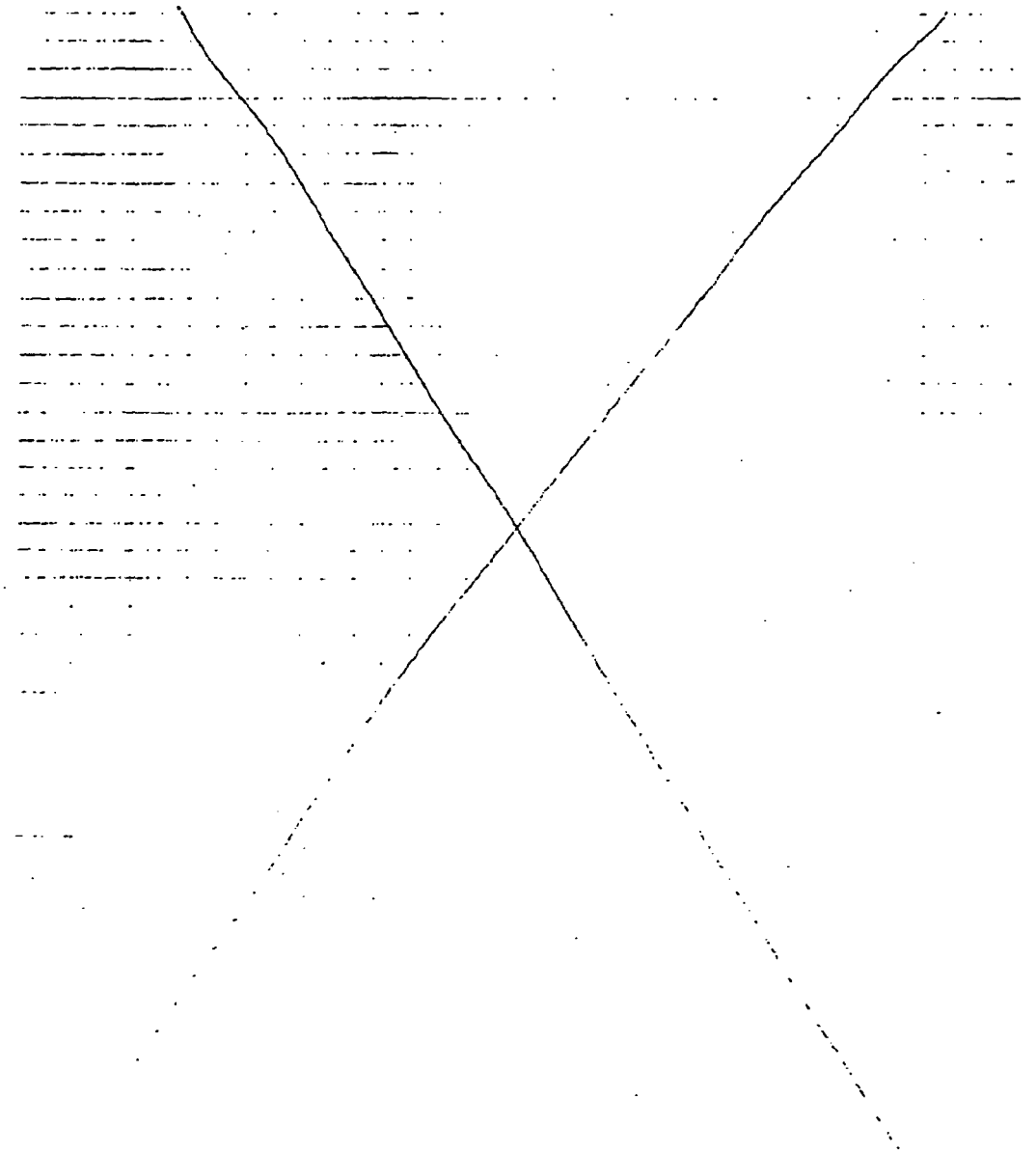
18 Page No. TITLE _____ DATE _____

E 46321 Book No. PURPOSE _____



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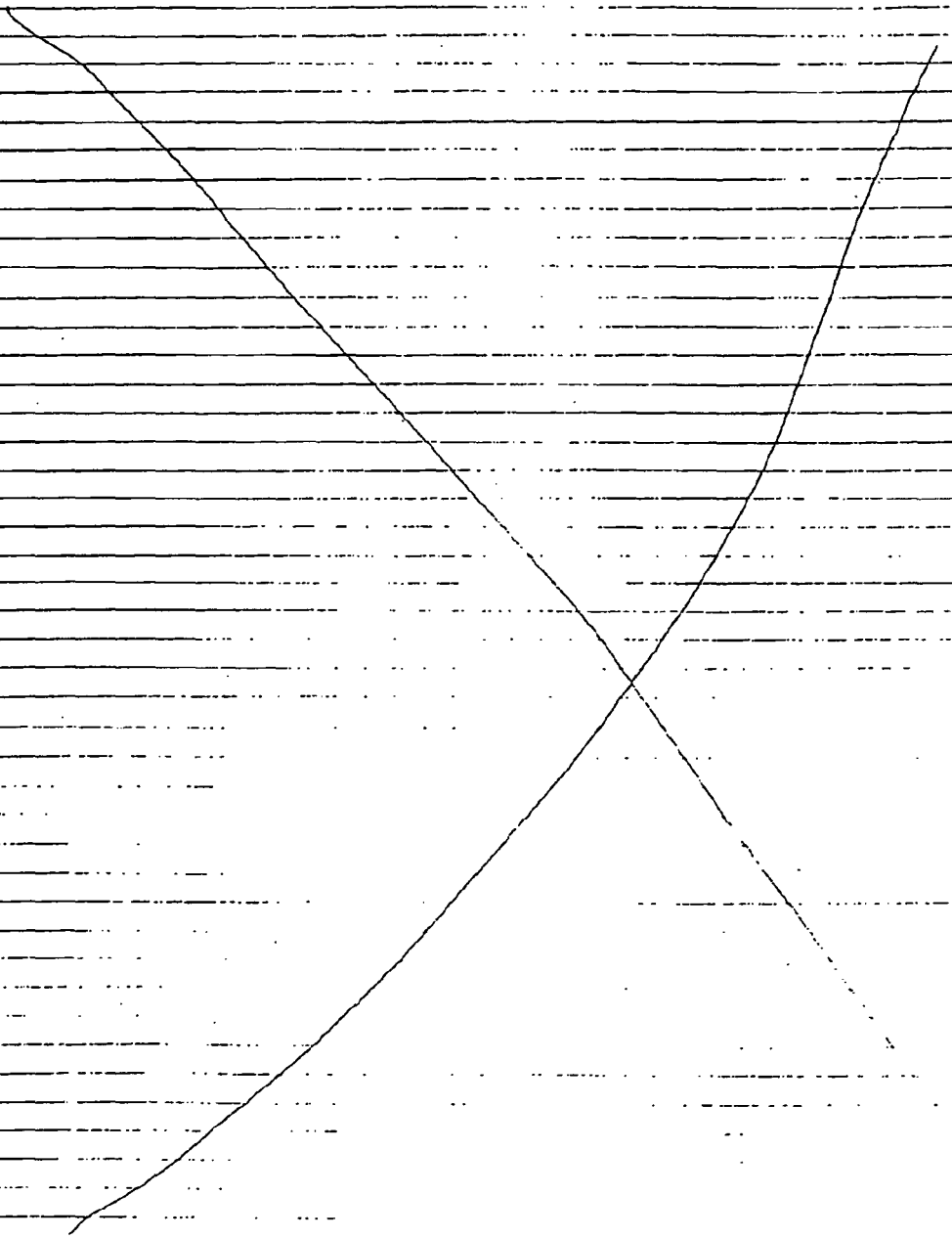
TITLE _____ DATE _____ Page No. 19

PURPOSE _____ Book No. E 46321



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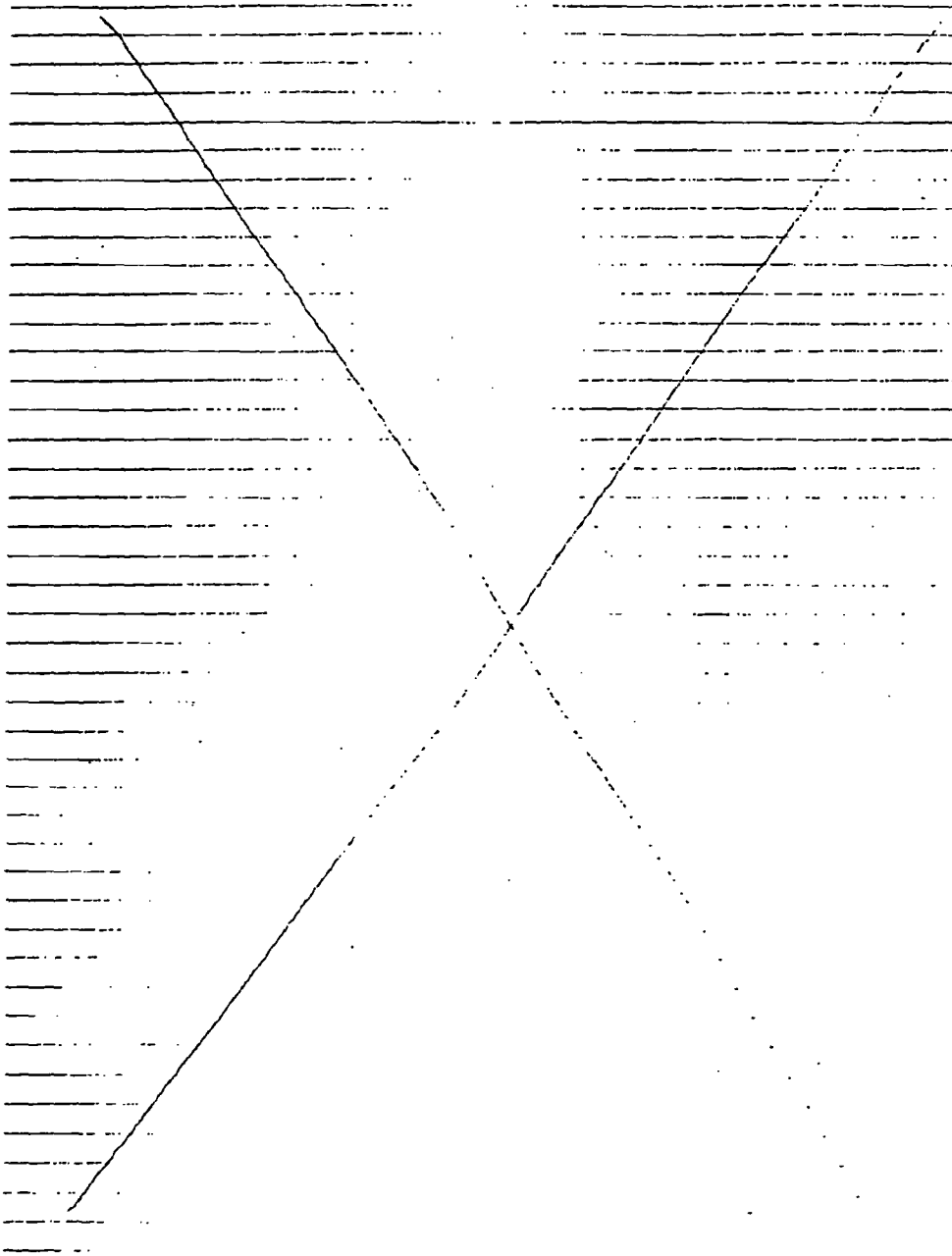
20 Page No. TITLE _____ DATE _____

E 46321 Book No. PURPOSE _____



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TITLE NBAR - PROCESS DEVELOPMENT DATE 12/16/91 Page No. 21

PURPOSE REVIEW OF PROGRESS FOR WEEK OF 12/9/91 TO 12/13/91 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 CONTOUR
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 BRAILET/LUG: MAT'L 4140
HARDNESS Rc 35
WIDTH .5"
LUG SURFACE WIDTH .375"
140° C SEPERATION OF LUGS.
SINGLE PIECE/YOKE DESIGN

BARREL BRAILET 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 BORE — 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 KNITED BOTTOM OF RECEIVER.

BOLT WAS FOUND AT REAR OF IRON CHAMBER.
BOLT LUGS SHEARED AT APPROX. 45 DEGREES
BOLT ~~SHROUD~~ SHROUD SEPERATED FROM BOLT.

NO USABLE FIXATIVE OF BARREL OR RECEIVER.

EXPERIMENTER [signature] DATE 12/16/91

WITNESSED BY [signature] DATE 12/17/91

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22 Page No. TITLE NBAR - PROCESS DEVELOPMENT DATE 12/10/91

E46321 Book No. PURPOSE INVESTIGATION OF ELECTRON BEAM WELDING

CONTACTED BOB SELL AT FERRANTI - SCIAKY TO DISCUSS POSSIBILITY OF E-BEAM WELDING BARREL BRACKET/LUG INTO RECEIVER. AFTER SENDING PRINTS AND SECTIONED RECEIVER FOR HIS REVIEW, HIS SUGGESTIONS ARE AS FOLLOWS:

- MATERIAL CHANGE WOULD BE REQUIRED TO ELIMINATE RESULPHURIZATION.

- 4140 MAT'L WOULD REQUIRE PRE HEATING AS WELL AS POST HEAT TREAT TO REDUCE INTERNAL HEAT ZONE PROPAGATION.

- CURRENT JOINT DESIGN WOULD NOT PERMIT PROPER WELD, FILLER WOULD NOT BE USED, THEREFORE "KEY HOLE" EFFECT WOULD BE PRODUCED AT INITIALIZATION OF WELD. "KEY HOLE" EFFECT WILL GREATLY INCREASE LIKELY HOOD OF FAILURE AT THAT REGION.

- DUE TO VACUUM REQUIREMENTS, LARGE BATCH PROCESSING WOULD BE BENEFICIAL, BUT WOULD HAVE DEGRADING EFFECT ON PRE HEATING, - NON CONFORMING TEMPERATURES FROM FIRST TO LAST WORK PIECE.

- MACHINE/FIXTURE COST APPROX. $600,000

- SUGGESTED INVESTIGATING A WELDING PROCESS THAT UTILIZES FILLER MATERIAL (E.g. ARC WELDING)

EXPERIMENTER [signature] DATE 12/10/91

WITNESSED BY [signature] DATE 12/12/91

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TITLE NBAR - Process Development DATE 12/12/91 Page No. 23

PURPOSE Investigation of EDM Process for Internal Lugs Book No. E 46321

Contacted Don. Kay of Ingersoll GmbH to discuss production processing of internal lugs utilizing an EDM probe process. Sent a copy of file EDMREC (Autocad by McKenney) which incorporates the use of a EDM probe that will probe a series of three locating lugs 7.5" from rear of receiver.

Currently waiting for his reviewal.

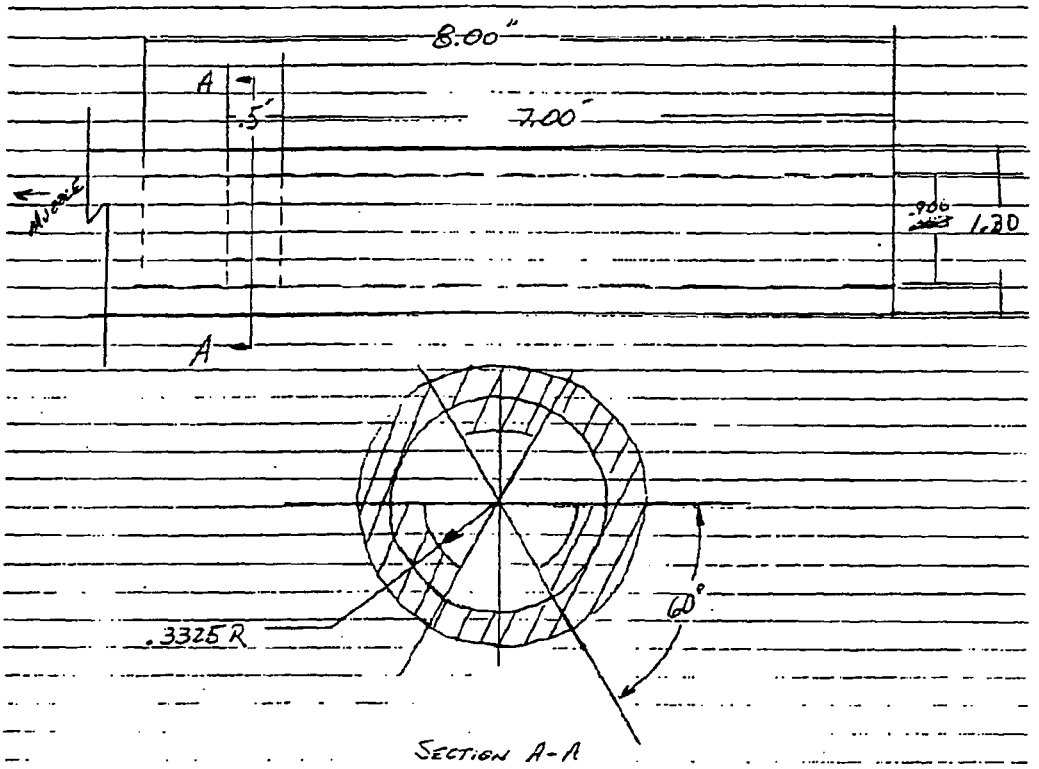
EXPERIMENTER Michael D Kenney DATE 12/12/91

WITNESSED BY J. C. Allmon DATE 12/17/91

E. I. DU PONT DE NEMOURS & CO. (INC.)

24 Page No. TITLE N88R - Process Development DATE 12/19/91

E46321 Book No. PURPOSE Proposed EDM's Locking Lug Configuration



SECTION A-A

EDM PROBE WOULD BE CONSTRUCTED WITH THREE LOCKING LUGS, TRAVERSED AXIALLY TO A DEPTH OF 8.0", THEN ROTATED 360°, PRODUCING THE .5" WIDTH LOCKING SURFACE AND THREE MACH RECESSIONS FROM I. D. OF RECEIVER.

EXPERIMENTER [signature] DATE 12/19/91

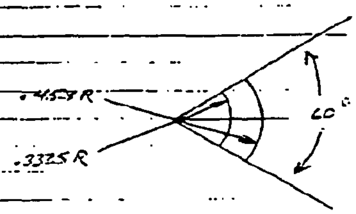
WITNESSED BY [signature] DATE 12/23/91

E. I. DU PONT DE NEMOURS & CO. (INC.)

TITLE NBAC- Process Development DATE 12/9/91 Page No. 25

PURPOSE Determine bearing surface of locking mechanism Book No. E 46321

Sketch of single locking lug:



$A_{lug} = \frac{60^\circ (\pi)}{360^\circ} (R^2 - r^2)$ ← REF: Machinery's Handbook 22ND Edition Page 44 - Surface Area of a Circular Ring Sector

$= \frac{60^\circ (\pi)}{360^\circ} ((.459)^2 - (.3325)^2)$

$A_{lug} = .0496 \text{ in}^2$

For total locking mechanism:

$A_{TOT} = 3(A_{lug})$

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

$A_{TOT} = .1487 \text{ in}^2$ Total bearing surface for 3 lug EDM system

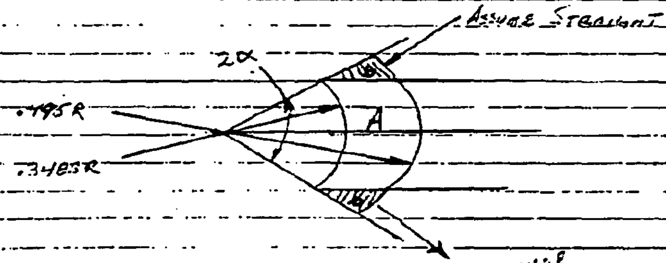
EXPERIMENTER [signature] DATE 12/9/91

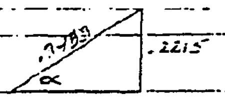
WITNESSED BY [signature] DATE 12/25/91

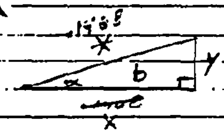
E. I. DU PONT DE NEMOURS & CO. (INC.)

26 Page No. TITLE NBAR - Process Development DATE 12/19/91

E46321 Book No. PURPOSE Determine bearing surface of insert [illegible]







$\sin \alpha = \frac{.2215}{.3483}$

$\underline{\alpha = 39.5^\circ}$

$\sin 34.5 = \frac{Y}{.1468}$ $\cos 34.5 = \frac{X}{.1468}$

$\underline{Y = .0834}$ $\underline{X = .1133}$

$b = \frac{1}{2} XY$

$= (.5)(.0834)(.1133)$

$\underline{b = .0053 \text{ in}^2}$

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

$A_{\text{in}} = \frac{2\alpha(\pi)}{360}(R^2 - r^2) - 2b$

$= \frac{2(39.5)(\pi)}{360}\left((.495)^2 - (.3483)^2\right) - 2(.0053)$

$A = .0747 \text{ in}^2$

$A_{TOT} = 2(A)$

$= 2(.0747)$

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

EXPERIMENTER [illegible signature] DATE 12/19/91

WITNESSED BY [illegible signature] DATE 12/23/91

BARBER - PRESALE R 0118829

E. I. DU PONT DE NEMOURS & CO. (INC.)

TITLE [illegible] - Project Development DATE 1/3/92 Page No. 27

PURPOSE Review of magazine feeding Book No. E 46321

To maintain [illegible] cylindrical port geometry with port opening width of .625", the magazine [illegible] is of an in-line style with a capacity of three [illegible] or four regular cartridges.

The design shall be rotated 60° from the sketch on page 24. The [illegible] cartridges to be fed easily with the bolt shown. With the rotated geometry the cartridge will not ride on the bolt locking lugs, but will pass between the two locking lugs (depending on the [illegible] diameter. This will also [illegible] the bottom lug in the receiver to act as a [illegible] [illegible], improving the feeding action of the [illegible].

To further improve the strength of the receiver, the locking lug length (parallel with the centerline of the barrel) may change from .5" to .4". This will provide additional .100" support between the [illegible] & ejection port and the locking lugs.

EXPERIMENTER [signature] DATE 1/3/92

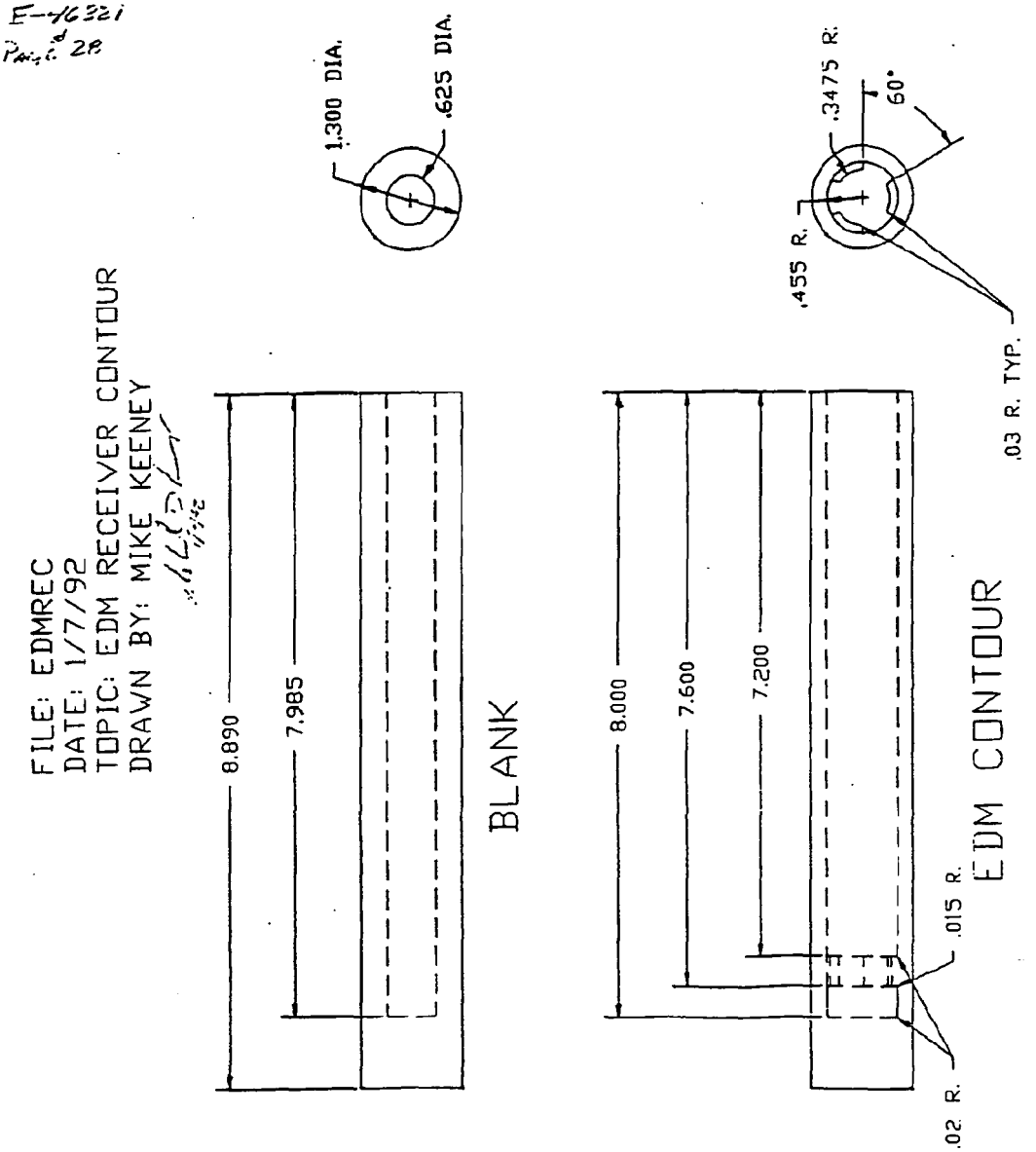
WITNESSED BY [signature] DATE 1-10-92

E. I. DU PONT DE NEMOURS & CO. (INC.)

28 Page No. TITLE Era Receiver Contour as NEAR DATE 1/7/92

E 46321 Book No. PURPOSE Develop Improved Receiver Contour

E-46321
Page 28



EXPERIMENTER Michael D Keeney DATE 1/7/92

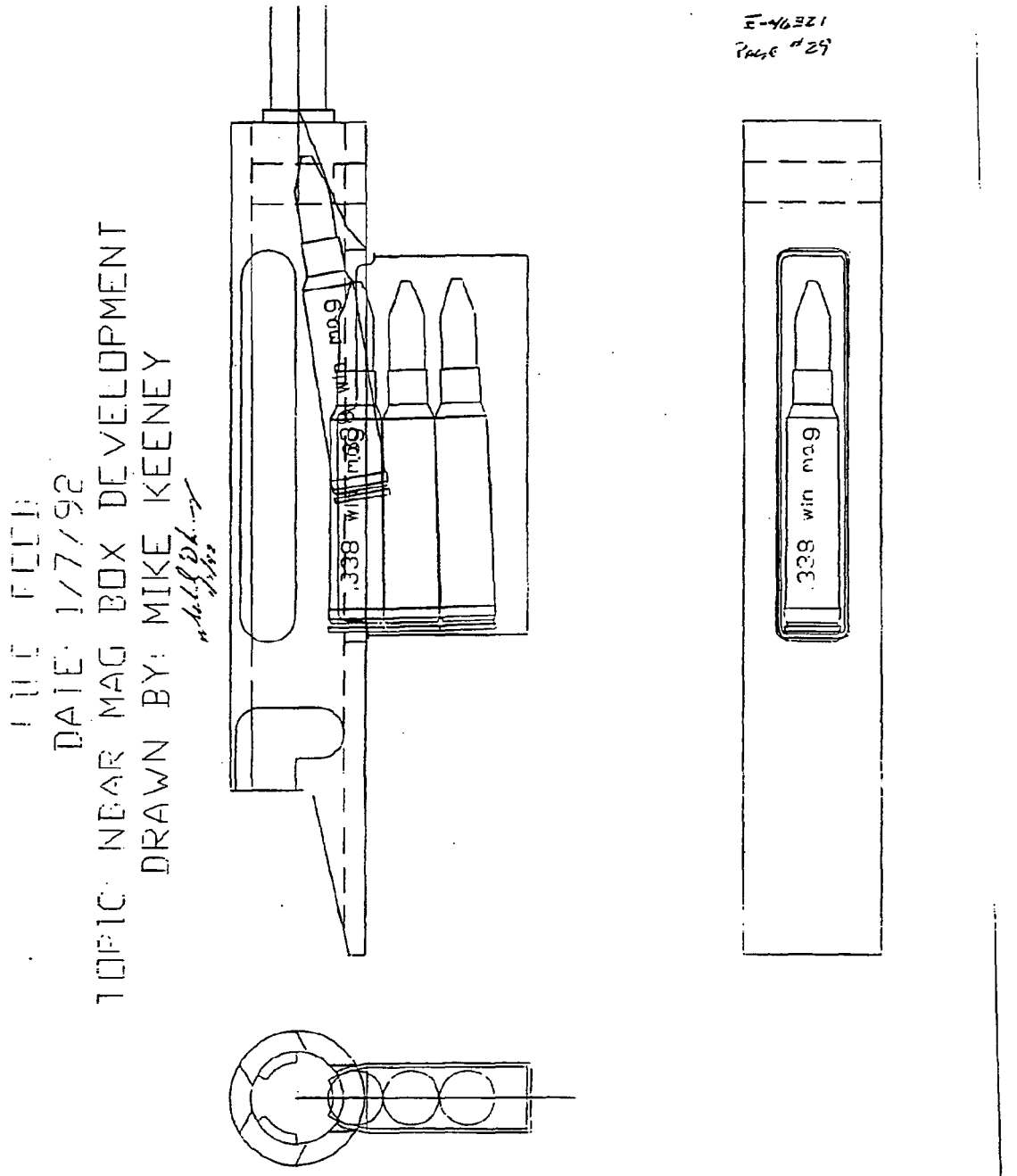
WITNESSED BY K. W. Lowery DATE 1-16-92

E. I. DU PONT DE NEMOURS & CO. (INC.)

TITLE Ballistics Development - NEAR DATE 1/17/92 Page No. 29

PURPOSE Mag Box Development with respect to Feeding Book No. E 46321

E-46321
Page #29



WITNESSED BY R.W. Lowry 1-16-92

E. I. DU PONT DE NEMOURS & CO. (INC.)

30 Page No. TITLE Process Development - NBAR [illegible] DATE 1/7/92

E 46321 Book No. PURPOSE Evaluation of sketches attached to pages 28 & 29

→ In reference to print attached to page 28: [illegible]

Developed for [illegible] [illegible] to review possibility

of producing the [illegible] [illegible] control described

by the print [illegible] Steve Dalton and

Richard Carson [illegible] [illegible] on 1/6/92.

Preliminary review [illegible] [illegible] Ingersoll will

research further and ~~development~~ develop a

([illegible]) [illegible] [illegible] process.

The "[illegible]" will be processed at Remington and

shipped to Ingersoll [illegible] EDM processing as per

the "EDM Centers" print.

→ In reference to print attached to page 29:

Reviewing EDM [illegible] centers with respect

to the [illegible] and [illegible] of [illegible] through

the receiver and [illegible] the [illegible]. The magazine

[illegible] as drawn is a [illegible] [illegible] [illegible]. Required

to [illegible] 360° symmetry of the receiver. A

.335 [illegible] [illegible] [illegible] [illegible] [illegible] to [illegible]. [illegible]

the [illegible] size of the cartridge.

EXPERIMENTER [signature] DATE 1/7/92

WITNESSED BY [signature] DATE 1-10-92

E. I. DU PONT DE NEMOURS & CO. (INC.)

TITLE Recess Development - NZAR DATE 1/9/92 Page No. 31

PURPOSE Development of Mag. Box & Recoil Bracket Book No. E 46321

Further investigation showed that .500" of depth is required with the prototype steel magazine depth. Working with John Remington to produce a pressing steel [illegible] and provide acceptable mag. box fit. Possible [illegible] is to [illegible] area around mag box [illegible] .050" and [illegible] the bottom of the box to achieve the full .500" depth required. John will get material and rework the prototype steel.

Recoil Bracket:

Previous concept with [illegible] locking lugs and the recoil bracket [illegible] with locking lugs.

[illegible] with current concept of FDM locking lugs a separate ~~[illegible]~~ recoil bracket (system) will be required. Reviewing an idea of an external bracket [illegible] in a groove around bottom of receiver with Ken [illegible]. Ken suggested ~~[illegible]~~ a multi-groove receiver and [illegible] a synthetic [illegible] to such grooves to provide a recoil bearing area. Possible [illegible] processes such as ultrasonic or heat sinking. See page 30 for concept sketch.

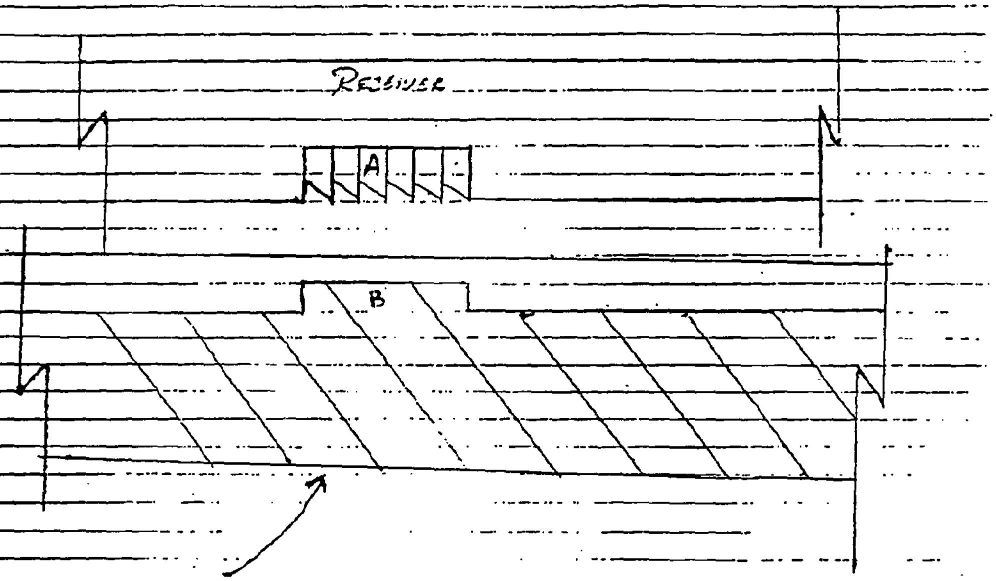
EXPERIMENTER [signature] DATE 1/9/92

WITNESSED BY [signature] DATE 1-10-92

E. I. DU PONT DE NEMOURS & CO. (INC.)

32 Page No. TITLE Process Development – NBUR [illegible] DATE 1/9/92

E 46321 Book No. PURPOSE Recoil Bedding Scheme Concept ([illegible])



Synthetic Stock Cross Section

Explanation: Metal receiver would have bottom half machined as shown (A). Synthetic stock would have a thick pad molded to mate with receiver. (B) Upon heating, section (B) would melt and fill section (A) to produce the bearing area needed for recoil. [illegible], the receiver would become "bedded" to the stock. On a wood stock a synthetic piece could be epoxied to the stock and then the receiver heat [illegible] to the synthetic [illegible]

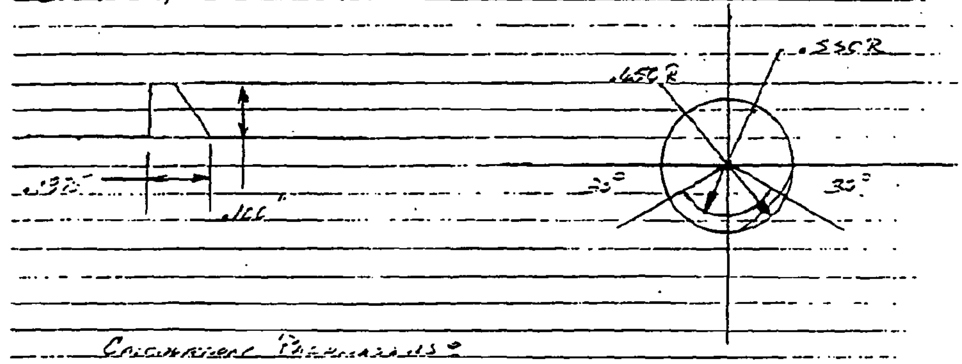
EXPERIMENTER [signature] DATE 1/9/92

WITNESSED BY [signature] DATE 1-10-92

TITLE Process Development - NBAR DATE 1/10/92 Page No. 33

PURPOSE Recoil Bearing Surface Calculation Book No. E 46321

Single Groove Configuration



Calculation Parameters:

Groove Depth: .656 - .556 = .100"

Groove Radial Length: 120°

Ref: Machinery's Handbook [illegible] Edition Page [illegible] — $A = \frac{(120°)}{360}\pi\left((.656)^2 - (.556)^2\right)$ (One Groove)

Surface Area of a Circular Ring Sector: $A = .1257\ in^2$

Referring to Receiver Sketch shown on page 29, if grooves were to start at midpoint of locking lug width and progress rearward to mag bay opening. The total length available is .950". Therefore with the width of each groove equal to .1875" we could achieve a series of 5 grooves across this length. Therefore the total area would be:

$A_T = 5A = 5(.1257\ in^2)$

$A_T = .6285\ in^2$

EXPERIMENTER [signature] DATE 1/10/92

WITNESSED BY K.W. [signature] DATE 1-10-92

E. I. DU PONT DE NEMOURS & CO. (INC.)

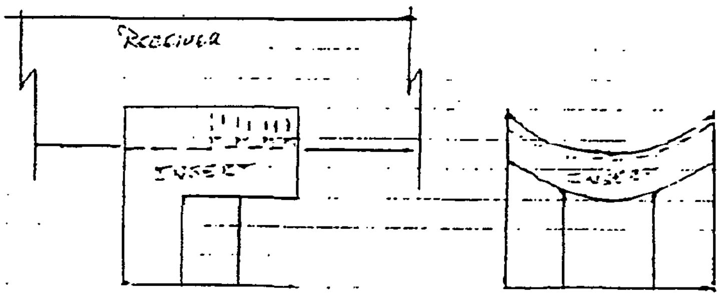
34 Page No. TITLE Process Development — NBAR DATE 1/16/92

E 46321 Book No. PURPOSE Recoil Bearing Surface Considerations

Upon further investigation of synthetic material properties relating to heat shrinking, such a system as described on page 33 would not be applicable. Synthetic stock materials typically have a melting point at 500°-550° F. If receiver were to be heated to this temperature, it would affect the receiver hardness in a [illegible] way.

Following the groove concept and discussing this idea with Joe Mead, it became apparent that a metal insert could be molded into the stock which would interface with the grooves in the receiver providing the required bearing surface. This metal insert could also be extended forward to be used as a bedding pad for the receiver.

Such a metal insert could be produced by a powder metal or metal injection molding process.



EXPERIMENTER [illegible signature] DATE 1/13/92

WITNESSED BY [illegible signature] DATE 1/15/92

E. I. DU PONT DE NEMOURS & CO. (INC.)

TITLE PROCESS DEVELOPMENT - [illegible] DATE 1/[illegible]/92 Page No. 35

PURPOSE RECOIL REDUCING INSERT Book No. E 46321

FURTHER DISCUSSION AND [illegible] [illegible] HAS LEAD TO THE DEVELOPMENT OF THE INSERT BY A [illegible] PROCESS WITH SECONDARY MACHINING OPERATIONS. I HAVE STARTED [illegible] A PROTOTYPE INSERT, [illegible] [illegible] MACHINING BY MEANS OF STANDARD MILLING OPERATIONS

ALSO [illegible], THE MAG BOX [illegible] AND STOCK [illegible], IT IS [illegible] CONSENSUS THAT AN IN LINE STOCK CONFIGURATION WILL PRODUCE A "[illegible]" OR "[illegible] BULKY" STOCK. WILL FURTHER INVESTIGATE OFFSET STACKING OF [illegible] [illegible] MAG. BOX.

REQUESTED PURCHASING TO SEND INGERSOLL [illegible] TO SIGN A CONFIDENTIALITY AGREEMENT, BEFORE FURTHER DISCUSSING [illegible] EDM PROCESS

EXPERIMENTER [signature] DATE 1/16/92

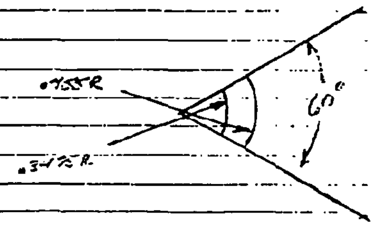
WITNESSED BY DATE

E. I. DU PONT DE NEMOURS & CO. (INC.)

36 Page No. TITLE Process Development - NEAR DATE 1/20/92

E 46321 Book No. PURPOSE Leading Line - [illegible] [illegible] [illegible] (EDM Concave)

See page #28, system of EDM [illegible] [illegible] line:



For proposed three line system, [illegible] [illegible] area calculation as follows:

See Machinery Handbook 22nd Edition Page #44

$A_{tot} = 3A$

$A = \frac{60(\pi)}{360}(.455^2 - .3475^2)$

$A = .0452\ in^2$

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

$\boxed{A_{tot} = .1356\ in^2}$

EXPERIMENTER [signature] DATE 1/20/92

WITNESSED BY DATE

REMINGTON ARMS COMPANY, INC.

ENGINEERING DEPARTMENT (DUPONT) COMPUTATION SHEET Sheet No.

TITLE OF PROJ. PROJ. NO.

SUBJECT WORK

COMPUTER DATE 19

Prototype #'s

XC 0726 - VBAR Prototypes With Black Stock Wooden Bolt Handles Non Functioning

XC 0727 - Original Sectioned Rear Lock-up Proto: Non Functioning With Bolt

XC 0728 - High Pressure Test #1: Separate Lugs No Bolt Shroud Est. 150-180 KSI

XC-0729 - High Pressure Test #2: Single Lug Bracket Bolt Shroud Est. 180-200 KSI

XC-0730 - Ambidextrous Rec/Barrel Unit: No Lugs No Bolt