

PLAINTIFF'S
EXHIBIT

3168

AL 0129628 1083

RECEIVER DEFLECTIONS OF

4 POWER CENTER FIRE RIFLES

MODEL NO.	RECEIVER AREA IN TENSION SQ. IN.	BOLT AREA IN SHEAR SQ. IN.	BOLT AREA IN COMPRESSION SQ. IN.	EXPECTED DEFLECTION OF BOLT IN RECEIVER BY YOUNG'S MODULUS $P = 9000 \times 10^6$ $E = 3 \times 10^{10}$ INCHES	BOLT DEFLECTION STEEL AISI OR NE NO	NOMINAL YIELD POINT 1000 #/SQ. IN.	LOAD WHICH BOLT WITHOUT PERMANENT DEFORMATION ± 1.45 LBS.	BOLT		BARREL SIZE OR ATCH DIA. OF TUBES AT SHANK DIA. IN INCHES	STEEL AISI NO. YIELD POINT #/SQ. IN.	BA	EL
								MEAN PRESSURE POSSIBLE IN 30-06 IN. 376	MEAN PRESSURE POSSIBLE IN 376			MEAN PRESSURE POSSIBLE IN 30-06 IN. 376	MEAN PRESSURE POSSIBLE IN 376
720	.443	.397	.109	.0013	2340	190	20,750	82,000	64,000	1.086	X-4130 120,000	58,000	54,000
721	.480	.429	.141	.0013	1335 2340	75 190	10,600 26,800	42,000 106,000	33,000 83,000	1.071	X-4130 120,000	57,000	53,000
1X-760*	.303	.206	.114	.0014	1335 2340	75 190	8,600 21,750	34,000 86,000	27,000 68,000	.897	X-4130 120,000	49,000	44,000
2X-760	.355		.071	.0150	1315 2340	75 190	5,350 13,500	21,000 53,000	17,000 42,000	.892	X-4130 120,000	48,000	43,000
W1903A3	.470	.329	.084	.0020	8620	190	10,900	43,000	34,000	1.011	1350 75,000	34,000	32,000
M-70-W	.537	.400	.086	.0020	Rock 48	190	16,400	65,000	51,000	.959	X-4130 120,000	52,000	48,000

(*) The Barrel Extension is the Receiver in the 1X-760.

NOTE: The above Force and Pressure figures are theoretical and should be used for comparison only. According to experience actual figures would be higher.

M. H. W.
2-28-44

AL 0029604
2883

RELATIVE STRENGTHS OF HIGH POWER CENTER FIRE RIFLES

MODEL NR.	RECEIVER AREA IN TENSION SQ. IN.	BOLT AREA IN SHEAR SQ. IN.	BOLT AREA IN COMPRESSION SQ. IN.	EXPECTED DEFLECTION OF BOLT & RECEIVER BY YOUNG'S MODULUS P = 9000 C = 5X10 INCHES	BOLT				BARREL SIZE OR FIT IN DIA. IN INCHES	STEEL AISI NO.	BARREL	
					NOMINAL YIELD POINT 1000 PSI	NOMINAL TENSILE STRENGTH 1000 PSI	MEAN PRESSURE POSSIBLE IN BTU	MEAN PRESSURE POSSIBLE IN BTU			MEAN PRESSURE POSSIBLE IN BTU	MEAN PRESSURE POSSIBLE IN BTU
720	.143	.397	.109	.0015	2340	190	82,000	64,000	1.085	I-4130	58,000	54,000
721	.480	.429	.141	.0015	2340	190	106,000	83,000	1.071	I-4130	57,000	53,000
1X-760*	.303	.206	.114	.0014	2340	190	86,000	68,000	.897	I-4130	49,000	44,000
2X-760	.355		.071	.0150	2340	190	53,000	42,000	.892	I-4130	48,000	43,000
M1903A3	.470	.329	.084	.0020	8620	130	43,000	34,000	1.011	135	34,000	32,000
M-70-M	.537	.400	.086	.0020	Rock C	190	65,000	51,000	.959	I-4130	52,000	48,000

(*) The Barrel Extension is the Receiver in the 1X-760

NOTE: The above Force and Pressure figures are theoretical and should be used for comparison only. According to experience actual figures would be higher.

3083
AL 0029605

TITLE OF PROJ

PROJ. NO.

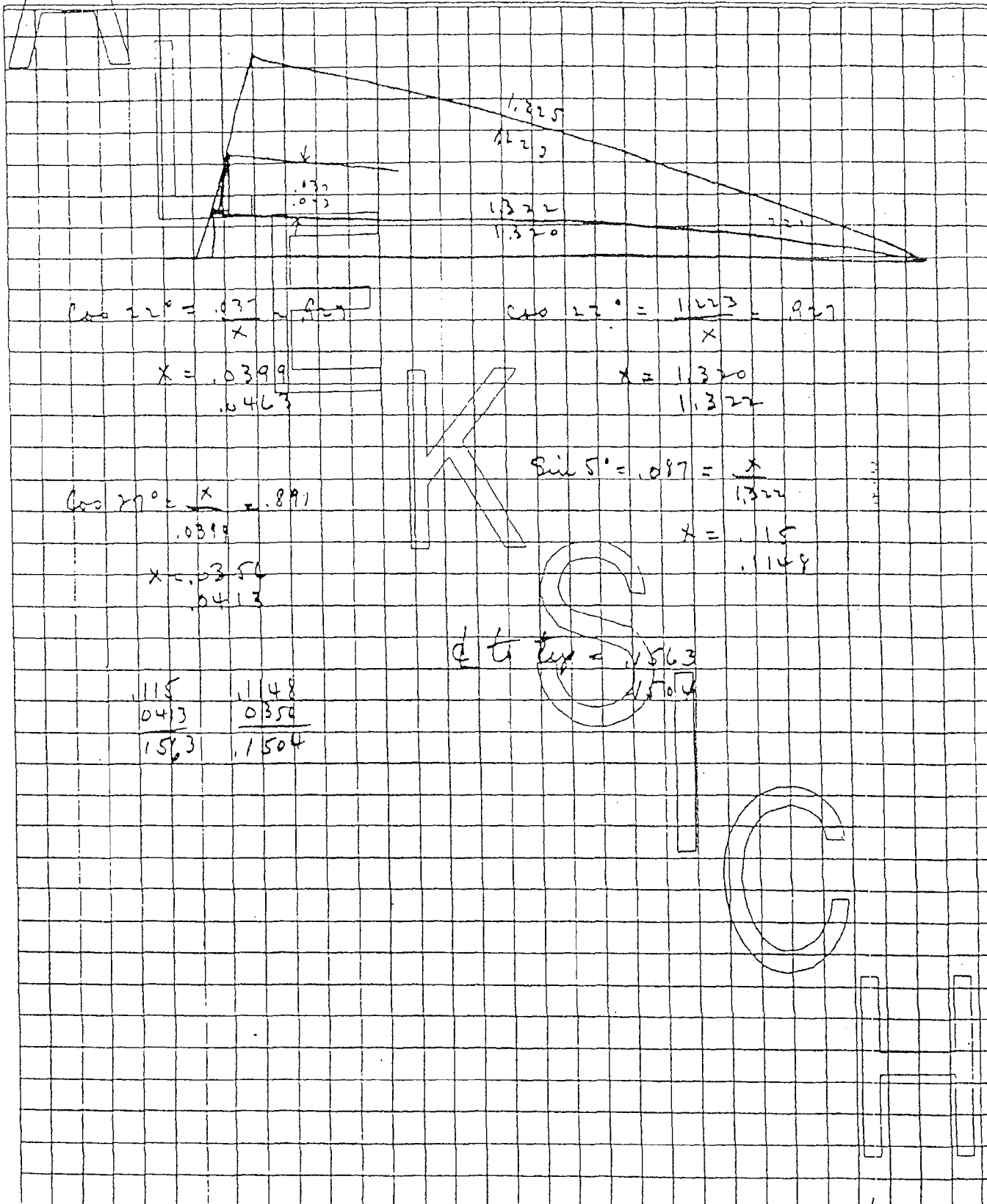
SUBJECT

WORKS

COMPUTER

DATE _____

18



4783
AL 0029606

TITLE OF PROJ. _____

PROJ. NO. _____

SUBJECT _____

WORKS _____

COMPUTER _____

DATE _____

19 _____

$\begin{array}{r} 1561 \\ 182 \\ \hline 3381 \end{array}$		$\begin{array}{r} 1502 \\ 178 \\ \hline 3282 \end{array}$	
$\begin{array}{r} 1504 \\ 3645 \\ \hline 5149 \\ 3381 \\ \hline 1768 \end{array}$		$\begin{array}{r} 1563 \\ 364 \\ \hline 5208 \\ 3282 \\ \hline 1926 \end{array}$	
$\begin{array}{r} 548 \\ 340 \\ \hline 198 \\ 0066 \\ \hline 2026 \\ 1703 \\ \hline 10323 \end{array}$	$\begin{array}{r} 540 \\ 350 \\ \hline 190 \\ 0022 \\ \hline 1878 \\ 1864 \\ \hline 10014 \end{array}$	$\begin{array}{r} 531 \\ 335 \\ \hline 196 \end{array}$	$\begin{array}{r} 528 \\ 338 \\ \hline 790 \end{array}$
<i>Property</i>		$\begin{array}{r} 350 \\ 187 \\ \hline 537 \end{array}$	$\begin{array}{r} 518 \\ 194 \\ \hline 370 \end{array}$
$\begin{array}{r} 518 \\ 160 \\ \hline 358 \end{array}$	$\begin{array}{r} 522 \\ 1150 \\ \hline 372 \end{array}$	$\begin{array}{r} 338 \\ 190 \\ \hline 148 \end{array}$	$\begin{array}{r} 335 \\ 1969 \\ \hline 1381 \end{array}$
$\begin{array}{r} 4144 \\ 384 \\ \hline 030 \end{array}$	$\begin{array}{r} 428 \\ 384 \\ \hline 158 \end{array}$	<i>engagement</i>	

$1.250 \pm .001$
 $+ .062675 \pm .000175$
 $= 1.302675 \pm .001175$
 $.06245 \pm .00005$
 $= 1.340225 \pm .001225$
 $+ .000225 \pm .000225$
 $= 1.240450 \pm .001450$
 $- .972 \pm .001$
 $= .26845 \pm .00245$
 $- .075 \pm .001$
 $= .19345 \pm .00345$

$.000,01$
 $.000,000,306$
 $.800,000,025$
 $.000,001,506$
 $.000,01$

top of trigger from
 fire control level
 E
 K
 S
 I
 C

diff. $.17835 \pm .00085$
 $= .1703$ to $.1864$

$.650 \pm .001$
 $- .280 \pm .002$
 $= .370 \pm .003$
 $+ .062675 \pm .000175$
 $= .432675 \pm .003175$
 $- .06245 \pm .00005$
 $= .370225 \pm .003225$
 $+ .062675 \pm .000175$
 $= .432900 \pm .003400$
 $- .124 \pm .001$
 $= .3089 \pm .0044$
 $+ .0629 \pm .0002$
 $= .3718 \pm .0046$
 $- .1845 \pm .0015$
 $= .1873 \pm .0061$

$.000,01$
 $.000,01$
 $.000,000,306$
 $.800,000,025$
 $.000,000,306$
 $.000,01$
 $.000,000,4$
 $.000,0225$

19345
 1873
 $.00615 \pm .00855$
 0029
 $.00905$
 $.00325$
 $.01470$
 $.00240$

$.0148$
 $.0058$
 $.0207$
 $.01910$
 $.0058$
 $.0024$
 $.0035$

top of ... fire control ...
 ...

$.000,084,374$ -2 $= \pm .0029$

$$\begin{array}{r} .503 \\ .695 \\ 2 \overline{1.005} \\ .004 \\ .4552 \\ .4448 \\ 2 \overline{1.0104} \\ .0052 \end{array}$$

$$\begin{array}{r} 700 \\ 698 \\ 2 \overline{1.002} \\ .001 \\ .4500 \\ .4500 \\ .000 \end{array}$$

$$\begin{array}{r} .001 \\ .0052 \\ .00775 \\ .00165 \\ .435 \\ \hline .44860 \\ .01360 \\ .002 \\ \hline .0156 \end{array}$$

$$\begin{array}{r} .001 \\ .000 \\ .001 \\ .000 \\ .430 \\ \hline .432 \\ .002 \end{array}$$

$$\begin{array}{r} .2555 \\ .2500 \\ 2 \overline{1.0155} \\ .0075 \end{array}$$

$$\begin{array}{r} .2835 \\ .2811 \\ 2 \overline{1.002} \\ .001 \\ .2835 \\ .2811 \\ \hline .010 \end{array}$$

$$\begin{array}{r} .2833 \\ .2800 \\ 2 \overline{1.0633} \\ .00165 \end{array}$$

$$\begin{array}{r} 430 \\ .0156 \\ \hline .4144 \\ 433 \\ 435 \\ .0156 \\ \hline .418 \end{array}$$

See

$$\begin{array}{r} .1518 \\ .178 \\ \hline .3298 \\ .1969 \\ \hline .1329 \end{array} \quad \begin{array}{r} .158 \\ .182 \\ \hline .340 \\ .190 \\ \hline .150 \end{array}$$

$$\begin{array}{r} .521 \\ .1329 \\ \hline .3891 \end{array} \quad \begin{array}{r} .518 \\ .150 \\ \hline .368 \end{array}$$

$$\begin{array}{r} 432 \\ 385 \\ \hline .044 \\ .042 \end{array}$$

$$\begin{array}{r} .4144 \\ .3891 \\ \hline .0253 \end{array}$$

$$\begin{array}{r} .4486 \\ .369 \\ \hline .0796 \\ .040 \\ \hline .0356 \end{array}$$

$$\begin{array}{r} .428 \\ .368 \\ \hline .060 \end{array}$$

$$\begin{array}{r} .062675 \\ .06245 \\ \hline .000225 \end{array}$$

$$\begin{array}{r} 1250 \\ 1250 \\ \hline .000 \end{array}$$

7-183
 AL 0029610

TITLE OF PROJ.

PROJ. NO.

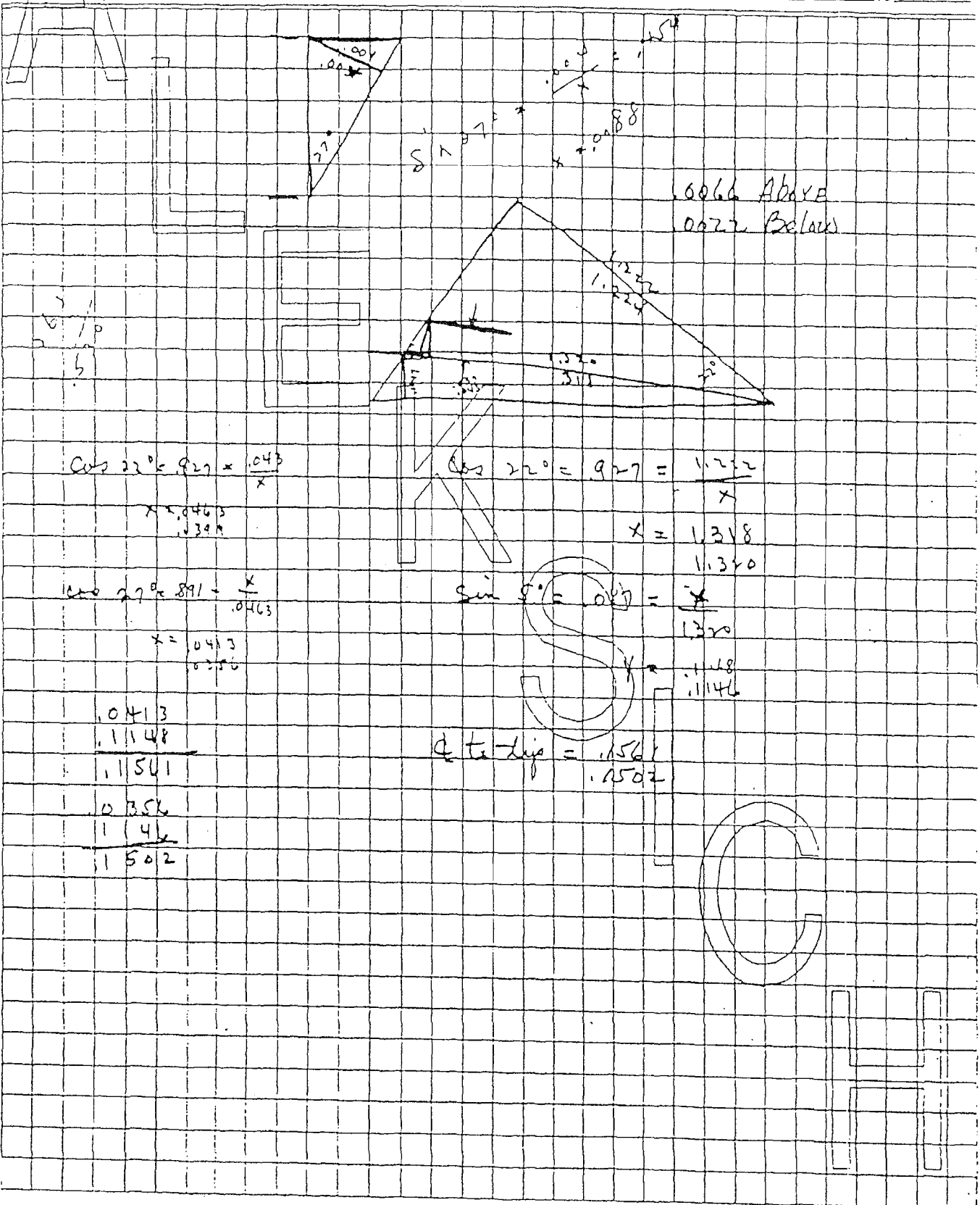
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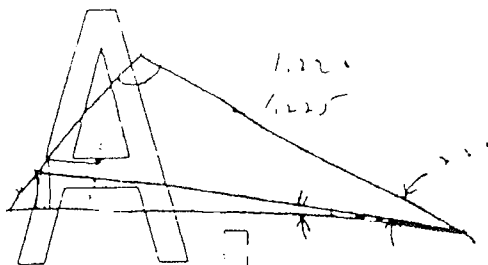
WORKS

COMPUTER

DATE

19





$$\cos 22^\circ = \frac{1.220}{x} = .9272$$

$$y = 1.316$$

$$1.376$$

$$\sin 5^\circ = \frac{y}{1.316} = .08715$$

$$= .159$$

$$1.52$$

$$\begin{array}{r} .1149 \\ .0369 \\ \hline .1518 \checkmark \\ 171 \\ \hline .3298 \\ 19 \end{array}$$

$$\begin{array}{r} .1152 \\ .0471 \\ \hline .1530 \checkmark \\ 152 \\ \hline .3400 \end{array}$$

K

S

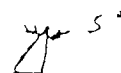
I

C

H

$$\begin{array}{r} .19345 \\ .00345 \\ \hline .190 \\ .19690 \end{array}$$

$$\begin{array}{r} 1.220 \\ 1.225 \\ \hline 1.220 \end{array}$$



$$\cos 5^\circ = \frac{x}{.043} = .9062$$

$$= .0421$$

$$= .0369$$

9083

AL 0029613

A

THIS BOOK MICROFILMED
AS COMPLETE
MAKE NO ADDITIONAL ENTRIES

L

RULES FOR RECORDING
EXPERIMENTS

1. Original records are to be in ink.
 2. Each notebook page whereon there is recorded a completed experiment should be signed and dated by the experimenter in the space provided.
 3. Each notebook page containing a completed experiment should be read and signed by a witness who will place his signature and the date in the space provided. The witness is to be one who understands the purpose of the experiment and the result obtained but who is not likely to be the inventor or a co-inventor. Preferably the witness signs on the same day as the experimenter and in any event as soon thereafter as possible.
 4. Where entries on a single experiment do not completely fill a page, the remainder of the blank page should be ruled out. Where the record of the experiment extends over several pages which are not consecutive, proper cross-references should be inserted.
 5. The bound notebook is to be preserved intact. In no case should any page or part of a page be removed.
 6. No erasures are to occur in the record. Any corrections or changes should be made by cancellation, leaving the original entry legible.
 7. The same rules as to signing, dating and witnessing are to be followed when the original data are recorded on loose sheets or forms other than the standard bound notebook.
- C
- H

11783
AL 0029616

SUBJECT FOR INDEXING THIS BOOK
MUST BE GIVEN BELOW

A

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12/83
AL 0029617

DATE
SUB

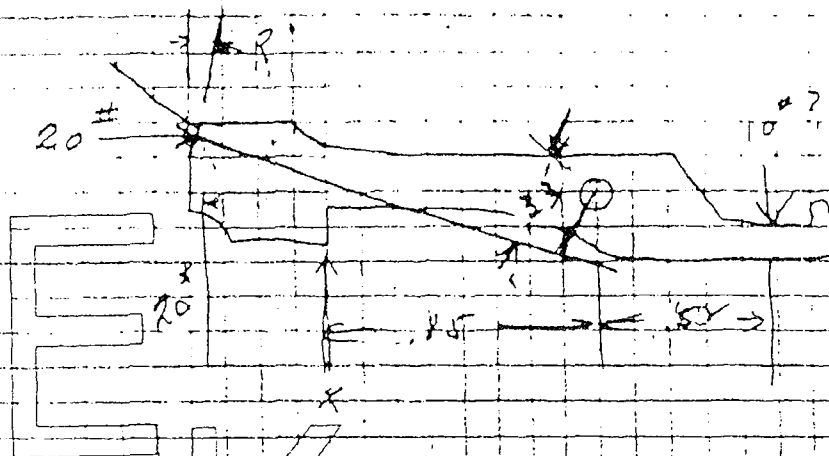
EXPE
WITH

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9-10-43

SUBJECT OF EXPT.

Blocked sem. trigon



$$(10) 52 \leftarrow 24 (33)$$

$$52 \leftarrow 8$$

$$24 (33) = 10 (52) + 8 (55)$$

$$8 = 52 + (X) (55)$$

$$2.8 = X$$

$$85 \quad X = 3.3$$

EXPERIMENTER

DATE

WITNESS

DATE

AL 0029618

13083

DATE

9-13-43

SUBJECT OF EXPT.

Dimensions - Reservoir

BR
Thurs

OAL - 8.85

M. 7.20

1.27

.700

.592

1.1 Center
box

.577

.164

1.67

1.13

Springfield

1.178

OAL - 8.59

.82

.132

1.55

16.84

Length
52

M 7.0

1.21

OAL + 8.15

1.375

.135

1.59

1.125

72" 4.59

EXPERIMENTER

WITNESS

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14/12/83
AL 0029619

DATE

9-15-43

SUBJECT OF EXPT.

3.0.6 Magazine

M720

Rec.

1.216

9.17

3.39

1.197

.800

R503

Rec.

1.300

1.350

9.30

3.4

1.122

1.122

8.10

M720

1.275

9.00

1.08

7.40

width of loading point

720 - 5.30"

RS. - 5.30"

70 - 5.41"

EXPERIMENTER

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AL 0029620

DATE

SUBJECT OF EXPT

9-15-43

Dimension - Magnifying

Leaves Rail to bottom of May.

1.720

Rear
1.74

Front
1.52

RS03

1.75

1.58

M 20

1.72"

1.54"

17760

1.60

1.48

top width
7.50

Bottom rear
9.50

Bottom Front
8.50

Nr
2
10

EXPERIMENTER

WITNESS

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DATE

16/8/85
AL 0129621

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6

DATE

SUBJECT OF EXPT.

A-17-43

Receiver Calculations

Strength of receiver Ring

$$\text{Min O.D.} = 1.370"$$

$$\text{Max I.D.} = 1.130"$$

$$\text{AREA O.D.} = \left(\frac{1.370}{2} \right)^2 \pi = 1.475 \text{ sq in.}$$

$$\text{AREA I.D.} = \left(\frac{1.130}{2} \right)^2 \pi = 1.024 \text{ sq in.}$$

$$\text{Cross Section Area} = .471 \text{ sq in.}$$

yield strength of X131 heat treated =

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9-28-43

SUBJECT: OF EXPT.

Stock dimension 721

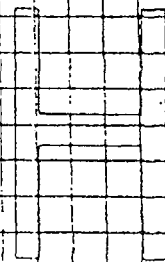
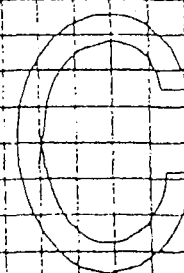
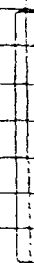
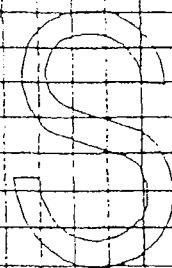
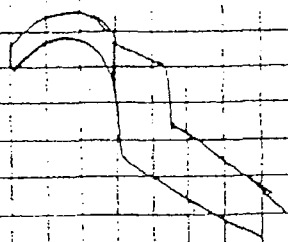
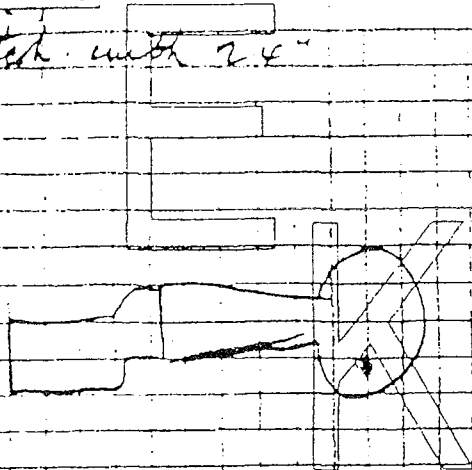
Drop at corner $1 \frac{11}{16}$ "

Drop at heel $2 \frac{5}{8}$ "

Length $13 \frac{1}{2}$ "

Pitch with 24" $25 \frac{1}{2}$ "

not used



EXPERIMENTER:

WITNESS:

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19-283

AL 0029624

8

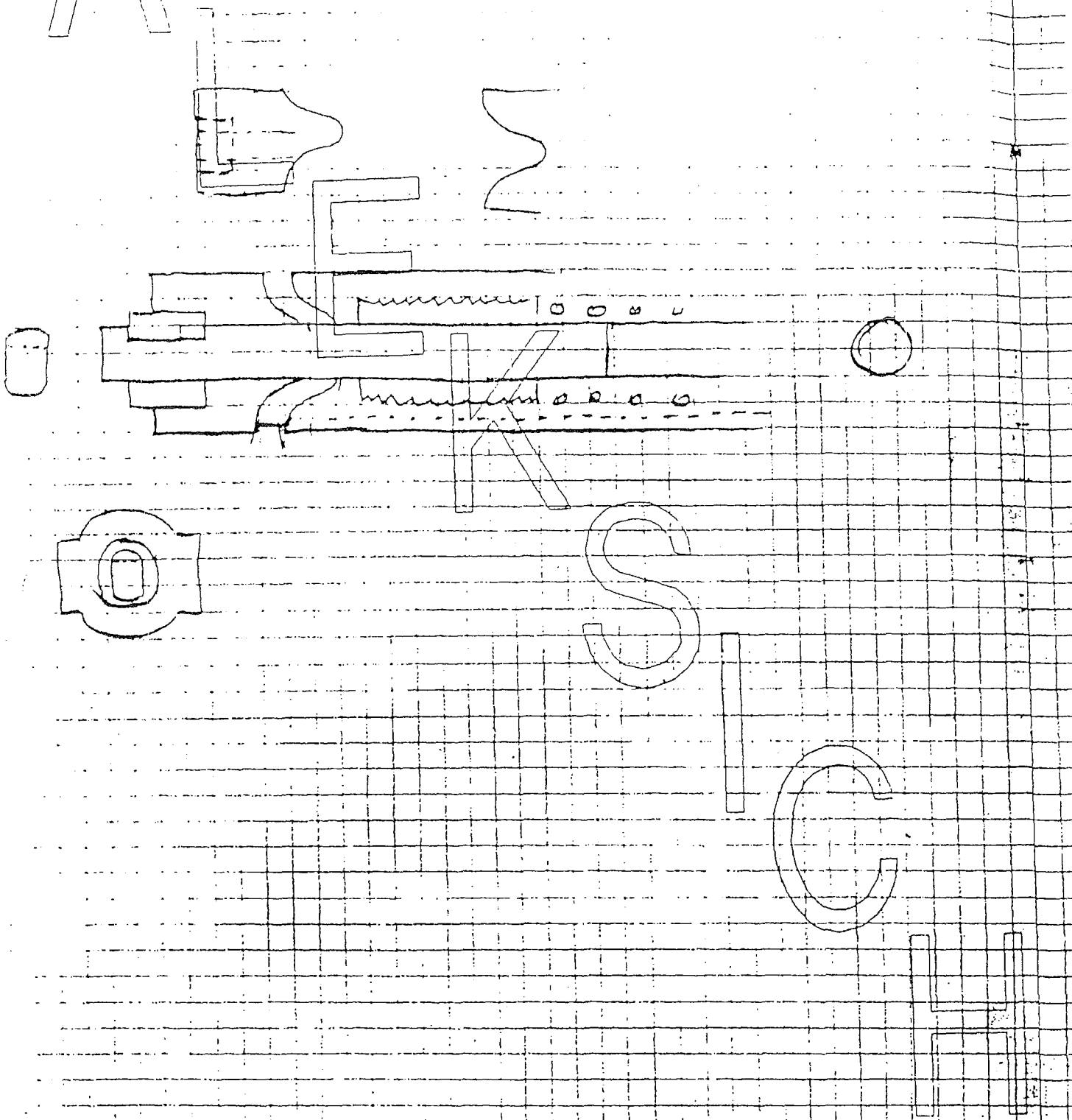
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SUBJECT OF EXPT.

A

9-30-43

Belt



EXPERIMENTER

WITNESS

DATE

DATE

20983
AL 0029625

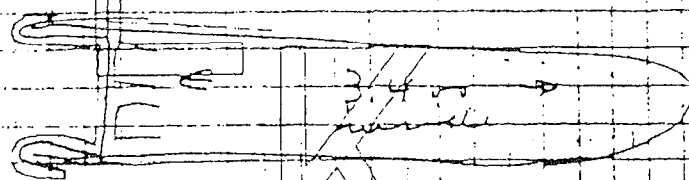
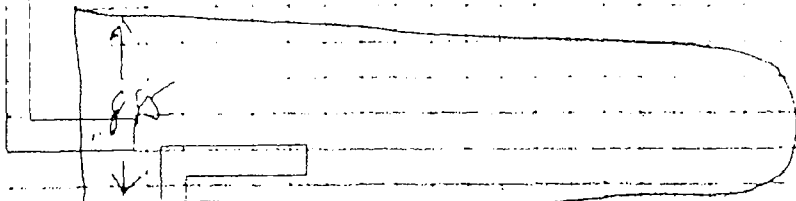
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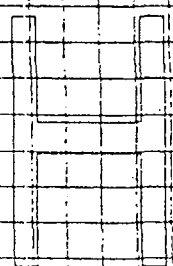
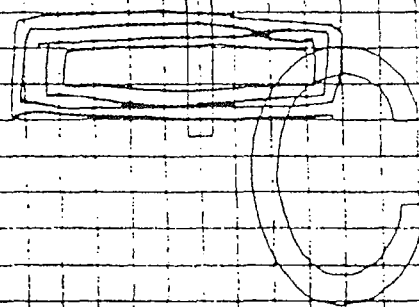
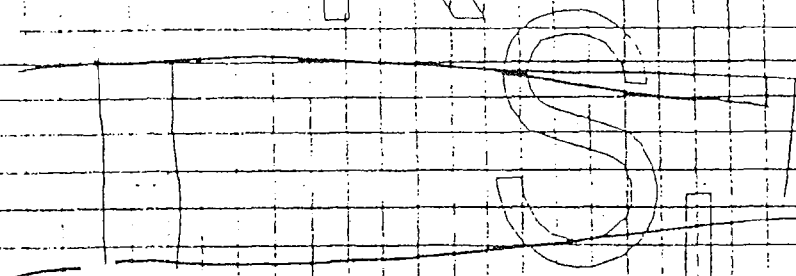
6-1-43

SUBJECT OF EXPT.

Magnus



0.60



EXPERIMENTER

DATE

WITNESS

DATE

AL 0029626
21283

10

DATE

SUBJECT OF EXPT.

11-16-43

Magazine dimensions

30.00

30,000

\$75

1 man 30

\$25

1 man 50

Win 70

Rem 70

Depth Front to belt

1.424"

1.450"

" Rear "

1.606"

1.682"

Width Rear

9 1/2"

9 1/2"

Width Front

7 1/2"

7 1/2"

Girth - receiver ring

7 1/8"

7 1/8"

Girth back of "

6 7/8"

7"

Girth front of the budge

7 1/8"

7 1/8"

Stock thickness

1.817

1.825

Grip circumference

5 1/8"

4 1/8"

270

5.56

5.56

5.56

5.56

5.56

5.56

5.56

5.56

5.56

5.56

5.56

5.56

5.56

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EXPERIMENTER

DATE

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AL 0029627

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SUBJECT OF EXPT.

1-23-44

7xL main Spring

FIRED LENGTH 3.375

COCKED LENGTH 3.030

 $d = .055$ $D = 3.95 - .055 = 3.895$ $n = 38$ ACTIVE

19# at 3.375 = 6.0 ENERGY

$$P = \frac{f \cdot 16}{8 \pi D^3} = \frac{f \left(\frac{9.15 \times 10^{-6} \text{ in} \times 10^6}{8 \times 38 \times .0593} \right)}$$

$$= 8.8$$

Set from
7.8 to
6.0

$$8.8 (L - 3.375) = 19$$

$$L = \frac{19}{8.8} + 3.375$$

$$L = 5.485 + 3.50$$

$$\text{FIRED } P = 19$$

$$\text{COCKED } P = 8.8 (5.50 - 3.03) = 21.7$$

$$\text{STACKED } P = 8.8 (5.50 - 2.10) = 29.6$$

$$S = \frac{8 P D}{\pi d^3} = \frac{8 \times 29.6}{\pi (1.46 \times 10^{-4})^3}$$

$$S = 157,000$$

$$\text{FIRED } S = 19 (1700) = 32,300 \text{ PSI}$$

$$\text{COCKED } S = 21.7 (1700) = 36,890 \text{ PSI}$$

$$\text{STACKED } S = 29.6 (1700) = 50,320 \text{ PSI}$$

EXPERIMENTER

WITNESS

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AL 0029628

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12

DATE

SUBJECT OF EXPT.

A

I - 23 - 44

Short on 721, Train Spring

1" shorter

FIRED LENGTH = 2.375

CHECKED LENGTH = 2.030

 $d = .055$ $D = .395 - .055 = .340$

19" at 2.375 = 6" ENERGY

STACKED L = 2.030 - .600 = 1.430 = 25 Active Coils

P = 13.4 F

 $13.4 (L - 2.375) = 2.0$ $L = 3.66$

FIRED P =

CHECKED P = $(3.66 - 2.030) 13.4 = 21.8$ STACKED P = $(3.66 - 1.43) 13.4 = 30.0$ $S = P(5200)$ FIRED S = $5200 \times 16 = 83.501$ CHECKED S = $21.8 \times 5200 = 113.401$ STACKED S = $30.0 \times 5200 = 156.001$ $5200 \times 32 =$

set from to

EXPERIMENTER

WITNESS

DATE

DATE

24283

AL 0029629

DATE

3-29-44

SUBJECT OF EXPT.

FIRING PIN PROTRUSION

MAX BOLT LENGTH

.451
 .315
 .433
 .064
 1.263

MIN PIN LENGTH

1.810
 - .500
 1.310

MIN PROTRUSION = $1.310 - 1.263 = .047$

MIN BOLT LENGTH

.449
 .309
 .427
 .060
 1.245

MAX PIN LENGTH

1.813
 - .498
 1.315

MAX PROTRUSION = $1.315 - 1.245 = .070$

EXPERIMENTER

DATE

WITNESS

DATE

25883
 AL 0029630

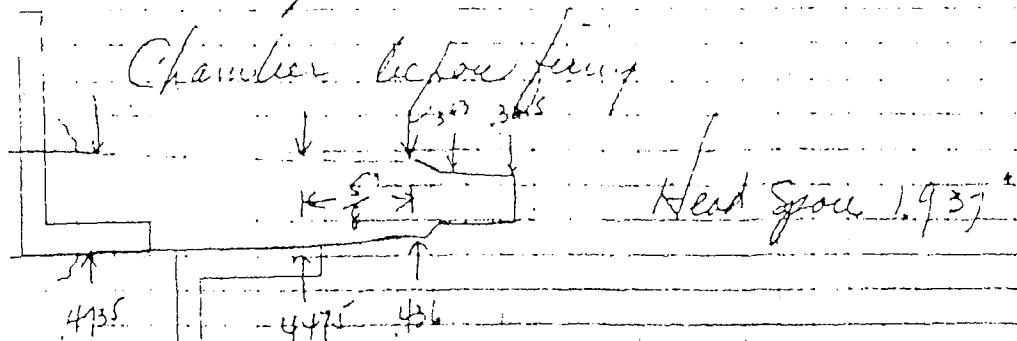
14

DATE

OBJECT OF EXPT.



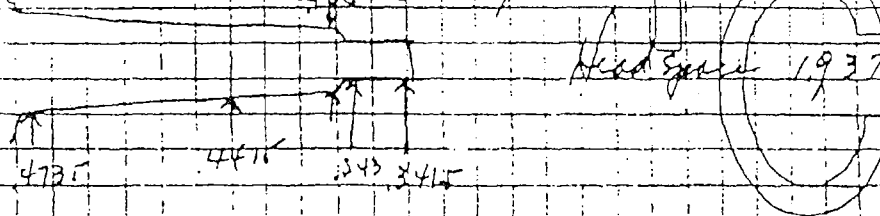
First cartridge Fired on 12/7/71



A standard 30.06 Rem. U.S. S.P. was fired after some trouble getting the product up to 0.18. The case stretched in front of the solid head and ruptured enough to let out some gas. The primer was deformed to more than $\frac{1}{4}$ " diameter.

It is fairly evident that the leading plug took up on the body instead of the shoulder of the chamber causing excessive head space.

Chamber after firing



No Swell is evident.

Ejected from

0.76
1.37
0.01

EXPERIMENTER

WITNESS

DATE

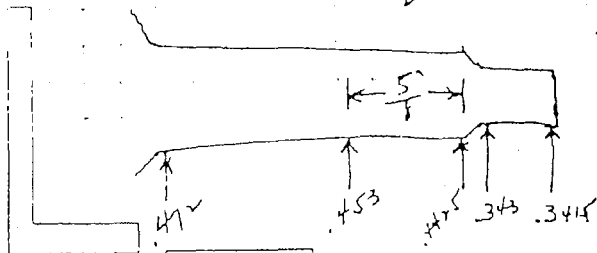
DATE

26-283
AL 0029631

DATE

4-10-44

SUBJECT OF EXPT.

First Cartridge in 721 after reheading
Before FiringHead Space
1.957

No change in case content after 10 periods

K

S

I

C

H

EXPERIMENTER.

DATE

WITNESS

DATE

27-283

AL 0029632

16

DATE

SUBJECT OF EXPT.

New basic steel column

$$S = \frac{P(K_1^2 + K_2^2)}{(K_1^2 - K_2^2)}$$

$$P = 510.57 \quad 1.067 \quad P = 290 \text{ Max.} \quad \text{PRESSURE} = 84,000 \text{ PSI}$$

$$r_1^2 = (474 - 2)^2 = 237^2 = .0567$$

$$1/8 = 1.067 \quad r_2^2 = (1067 - 2)^2 = 534^2 = .795$$

$$1/16 = 1.011 \quad r_2^2 = (1011 - 2)^2 = 509^2 = .259$$

$$1/8 S = \frac{84,000 (.3412)}{.2788} = 125,200 \text{ PSI} \quad (270 \text{ Win})$$

$$1/16 S = \frac{84,000 (.3137)}{.2051} = 130,000 \text{ PSI} \quad (270 \text{ Win})$$

$$290 \text{ Max.} \quad \text{PRESSURE} = 84,000 \text{ PSI}$$

$$r_1^2 = (514 - 2)^2 = .257^2 = .066$$

$$1/8 = 1.067 \quad r_2^2 = (1067 - 2)^2 = 534^2 = .785$$

$$1/16 = 1.018 \quad r_2^2 = (1018 - 2)^2 = 509^2 = .259$$

$$1/8 S = \frac{84,000 (.351)}{.219} = 135,000 \text{ PSI} \quad (284 \text{ Max})$$

$$1/16 S = \frac{84,000 (.325)}{.193} = 144,000 \text{ PSI} \quad (284 \text{ Max})$$

DATE ENTER:

DATE

WITNESS

DATE

28283-
AL 0029633E
W

DATE
SUBJECT OF EXPT.

June 5 1940
721 Lock Time

721 Spring Pin = 61.5 grms.

721 Spring = 12.8 grms.

722 Spring Pin = 52.4 grms.

722 Spring = 9.1 grms.

721 Lock Time = $\sqrt{\frac{2 \times 67.9 \times 300 \times .002}{21 \times 32 \times 12}} = 3.33 \text{ sec}$

722 Lock Time = $\sqrt{\frac{2 \times 56.9 \times 300 \times .002}{21 \times 32 \times 12}} = 3.02 \text{ sec}$

$\sqrt{2.195}$

Handwritten notes and symbols including numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

Large handwritten letter 'C'.

Large handwritten letter 'H'.

EXPERIMENTER:
WITNESS

DATE
DATE

29783
AL 0029634

18

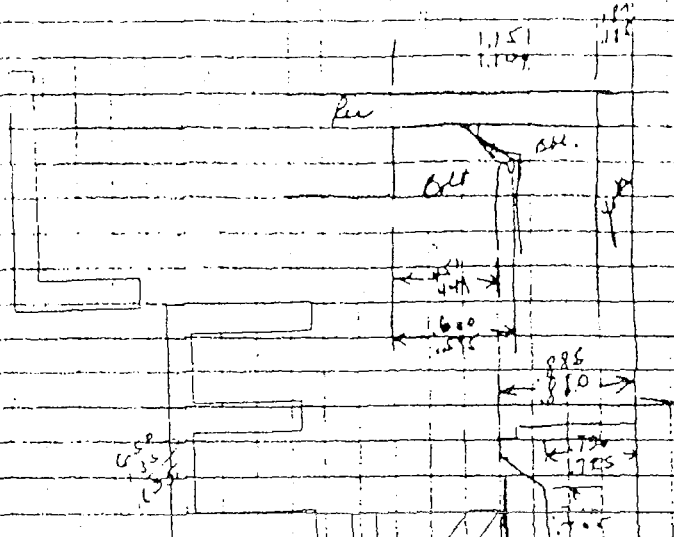
DATE

SUBJECT OF EXP

July 7, 1944

Boice, Bolt & Reimer Tolman

A



1.151

1.87

1.338

1.49

8.89

1.149

1.85

1.334

4.51

8.83

1.334

6.00

7.34

1.151

1.109

1.149

1.85

1.334

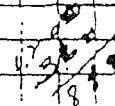
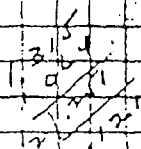
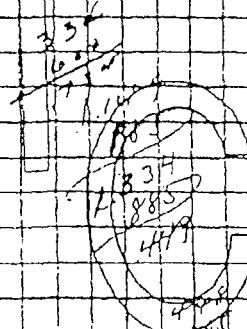
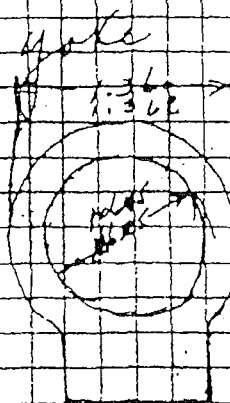
4.51

8.83

1.334

6.00

7.34



1.151

1.109

1.149

1.85

1.334

4.51

8.83

1.334

6.00

7.34

OPERATOR

WITNESS

DATE

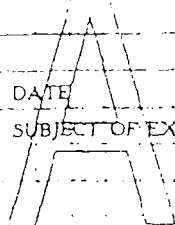
DATE

30/83

AL 0029635

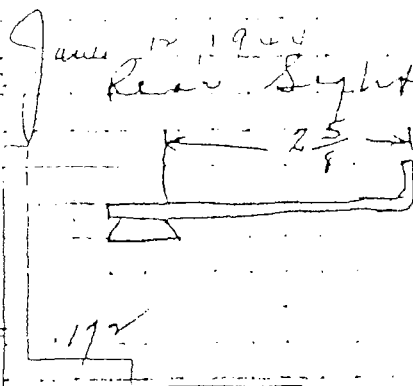
DATE
SUBJECT OF EXPT.

Jan 12, 1944
Rear Sight



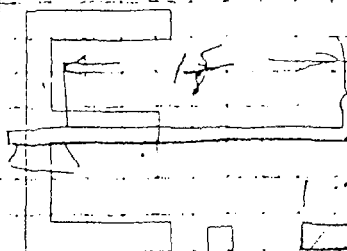
1 1/2

Def. loc = 1 1/2



$$\frac{7}{64} - \frac{18}{64}$$

1 1/2



Assume S of 150,000

$$F = \frac{2SL^2}{3EH} \quad H = \frac{252}{3EE}$$

$$H = \frac{2(150,000)(1.675)^2}{3(3 \times 10^7)(1.675)} = 0.044$$

$$P = \frac{5.64 \times 10^4}{64} = \frac{130,000(375)(0.017)}{6(1.675)} = 9.6$$

EXPERIMENTER

WITNESS

DATE

DATE

31283
AL 0029636

20

DATE

SUBJECT OF EXPERIMENT

June 13, 1944

721 & 722 Calibers

M 721

284 Rem Mag.

30-06

284 Rem

M 722

224 Rem (25-3000)

220 Rem (25-2050)

M 710 (Single Shot)

220 Rem (25-2050)

M 514 (Single Shot)

22 L.R. Target Model

EXPERIMENTER

WITNESS

DATE

DATE

32883
AL 002963

22

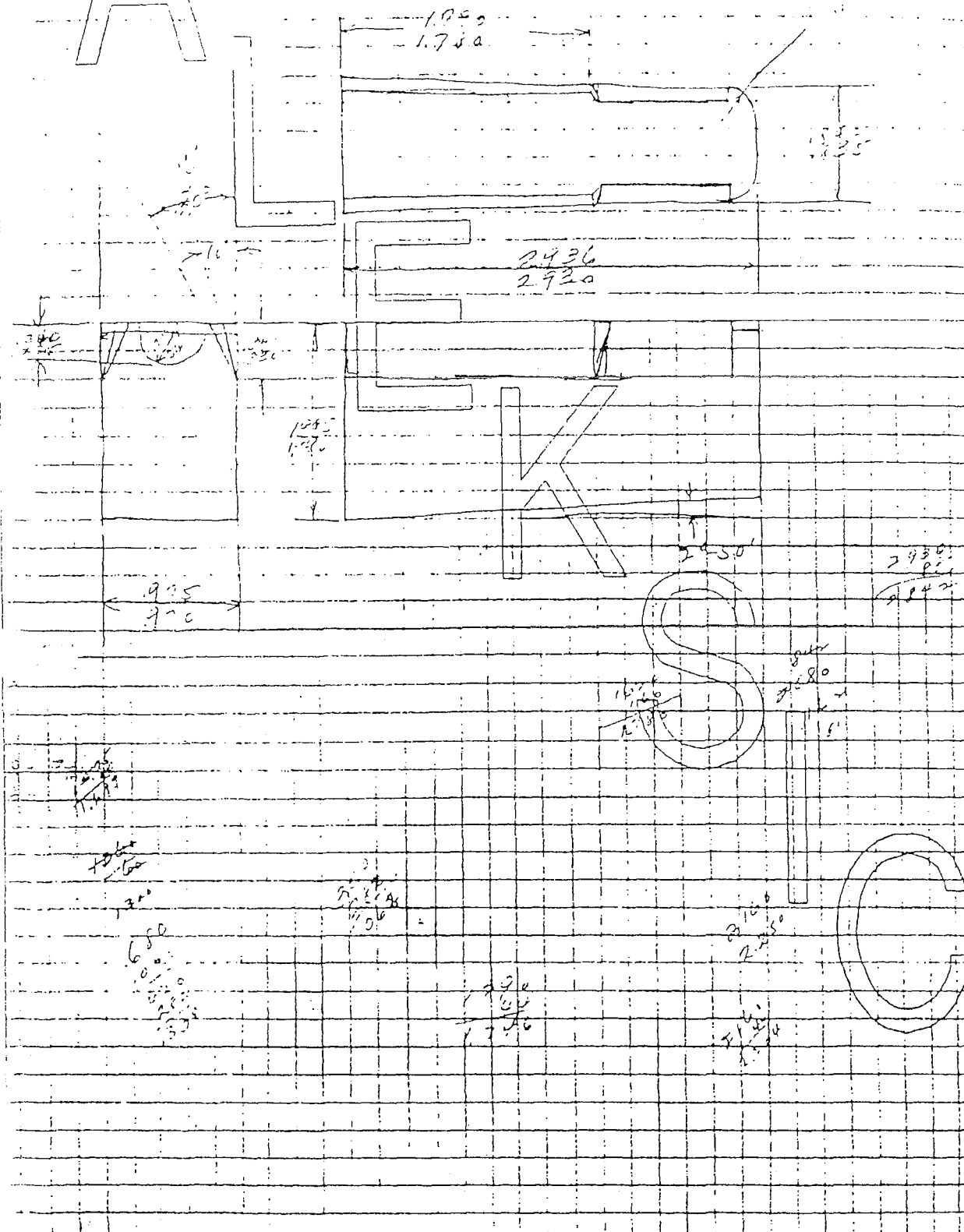
DATE

6-30-11

SUBJECT OF EXPT.

300 SAYAGE MAGNIE

26 R.



EXPERIMENTER

WITNESS

DATE

DATE

34283
AL 0029639

24

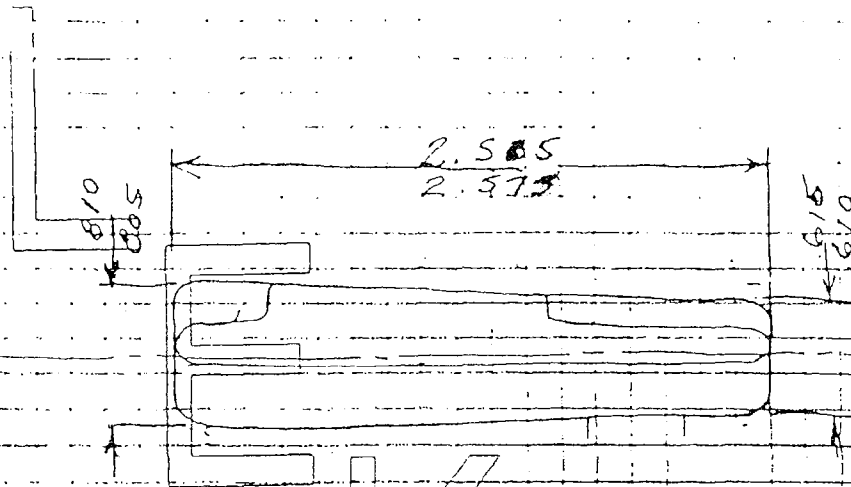
DA
SU

DATE

SUBJECT OF EXPT.

300 SAVAGE FOLLOWER

A



970
- .088
882

835
- .088
747

2930
- .088
2842

.517
- .072
599

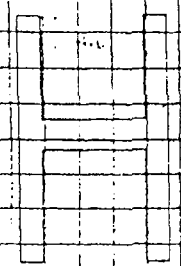
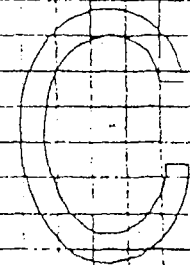
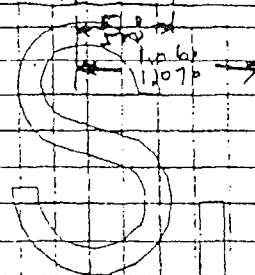
685
- .088
597

2936
- .088
2848

1.142
- .600
242

1.590

Stock
.034 = .034



EX
WT

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DATE
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36-283
AL 0029641

DATE 6-27-44

SUBJECT OF EXPT. 71-72V KINCEPRIN

FIREO LENGTH = 2.475
 LOCKED LENGTH = 2.15

$$d = .055$$

$$D = 395 - 407.7055 = 35.2 \text{ MAX.}$$

STRAIGHT LENGTH = 1.540

2.1 TENS COUS 216 Active

$$P = 11.6 \text{ 1/0}$$

4' FREE LENGTH

$$\frac{2.475}{1.823}$$

$$\text{FIREO } P = (400 - 2475) 11.6 = 19.7$$

$$\text{LOCKED } P = (400 - 2180) 11.6 = 21.1$$

$$\frac{4.00}{5.8} = 1.37$$

$$21 \text{ 1/0 } 20.5 = 23.0$$

S

I

C

71

EXPERIMENTER

WITNESS

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37883
 AL 0029642

26

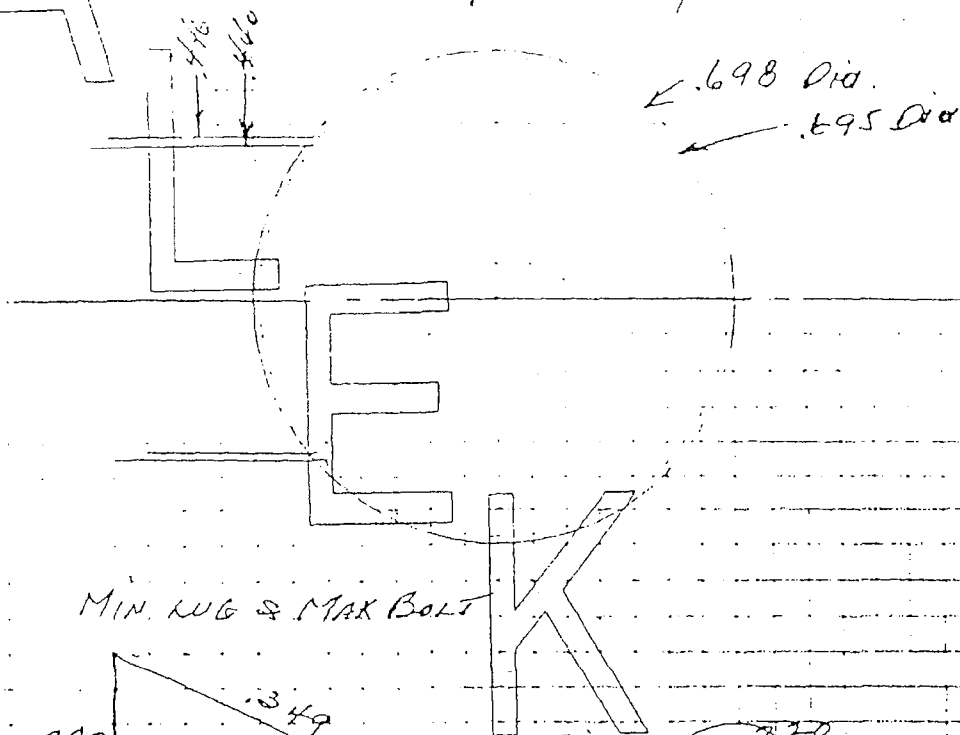
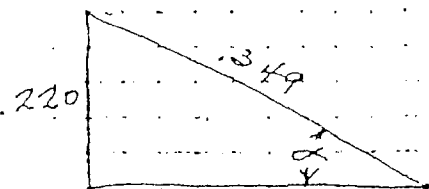
DATE

SUBJECT OF EXPT.

A

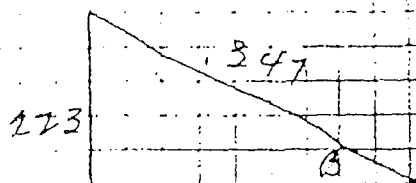
7-12-44

Bolt Body and Leg Intersection


 $\frac{1}{23} \times 10$

 $\sin \alpha = \frac{220}{349} = .6304$

$$\alpha = 39^\circ - 47' - 47''$$

MAX LUG & MIN. BOLT



$$\sin \beta = \frac{223}{347} = .6426$$

$$\beta = 39^\circ - 59' - 5''$$

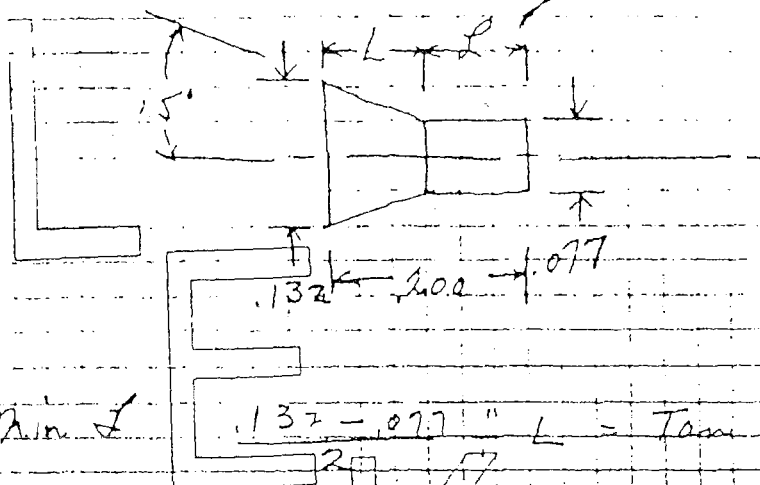
$$\beta - \alpha = 54' - 18'' = 54.3'$$

$$\frac{54.3}{360 \times 60} \times .698 \times \pi = \text{Linear Movement Apex} = .00552''$$

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AL 0029643

DATE

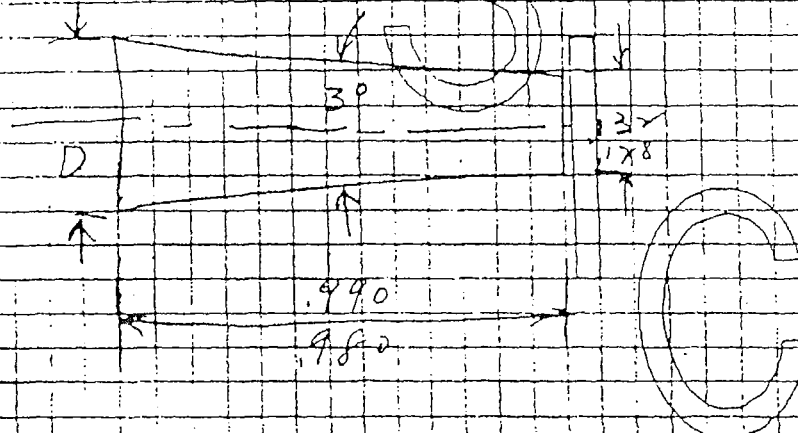
SUBJECT OF EXPT.

7-14-44
Bolt Head - Spring Pin

$$\frac{.132}{.055} = 2.39$$

$$L = \frac{.0215}{.2679} = .082$$

$$\text{Min. } L = 2.00 - .103 = 1.897$$



$$D_{\text{max}} = \frac{.132}{2} + .990 + \tan 15^\circ = .0262$$

$$D_{\text{min}} = .132 - .990 \times .0262 \times 2 = .0518$$

$$D_{\text{max}} = .1838$$

$$D_{\text{min}} = .128 = .980 \times .0262 \times 2 = .0513$$

$$D_{\text{min}} = 1.793$$

EXPERIMENTER

WITNESS

DATE

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AL 0029644

28

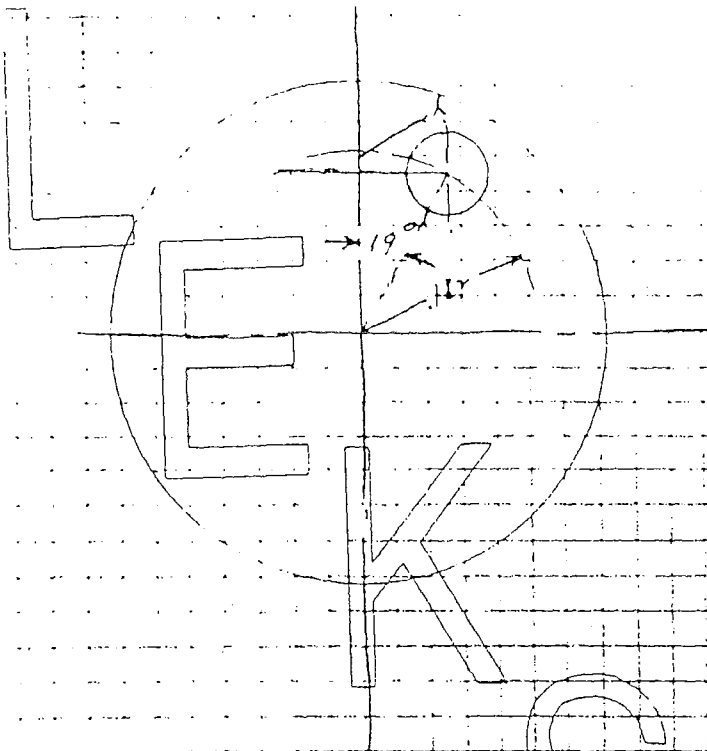
DATE

SUBJECT OF EXPT.

A

7-17-44

Placement of ejector pin hole



$$h = .18x - (.18x \cos 19^\circ)$$

$$= .18x - (.18x \times .9433)$$

$$= .18x - .1721$$

$$= .0109$$

EXPERIMENTER

WITNESS

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AL 0029645

40823

A

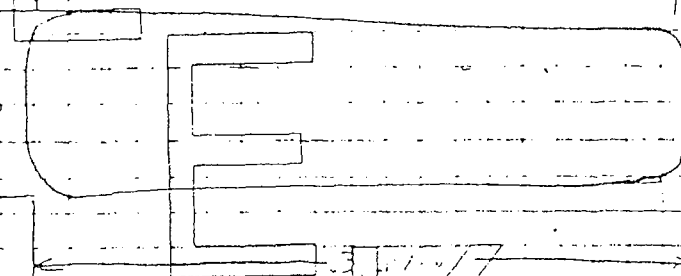
DATE:

7-18-44

SUBJECT OF EXPT.

See H & L Follower

81
80



10x5
615

3.590
3.575

2.720
8.17
8.590

SIC

H

EXPERIMENTER

DATE

WITNESS

DATE

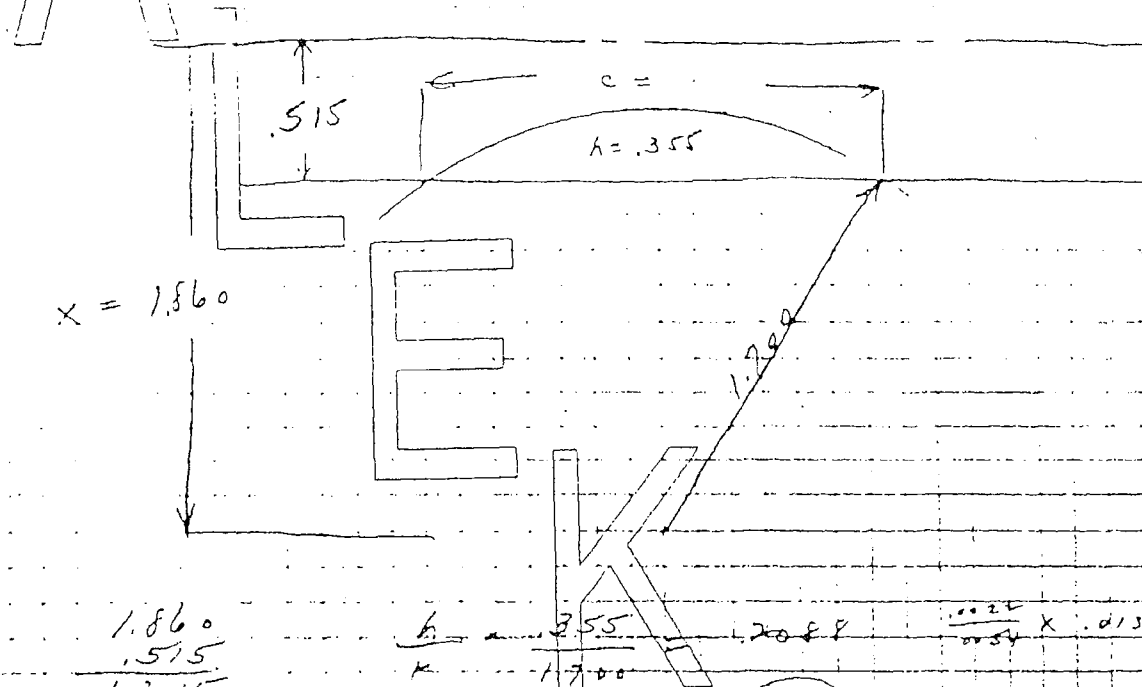
41 083
AL 0029646

30

DATE

SUBJECT OF EXPT.

Calculations of letter centers for Fine control



$$\begin{array}{r} 1.860 \\ - 0.515 \\ \hline 1.345 \\ - 1.700 \\ \hline -0.355 \end{array}$$

$$\frac{h}{k} = \frac{0.355}{1.700} = 0.2088$$

$$\frac{0.025}{0.054} \times 0.013 = 0.005$$

$$\frac{c}{k} = 1.223$$

$$C = 2.080$$

For 1.645 center

$$\frac{r}{k} = \frac{2.080}{1.645} = 1.265$$

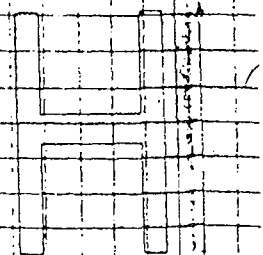
$$\frac{0.006}{0.013} \times 0.005 = 0.0023$$

$$\frac{h}{r} = 2.254$$

$$h = 371$$

$$\begin{array}{r} 1.645 \\ - 371 \\ \hline 1.274 \\ - 0.515 \\ \hline 0.759 \end{array}$$

$$x = 1.645 - 371 + 0.515 = 1.789$$

EXPERIMENTER
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4.2.28.3

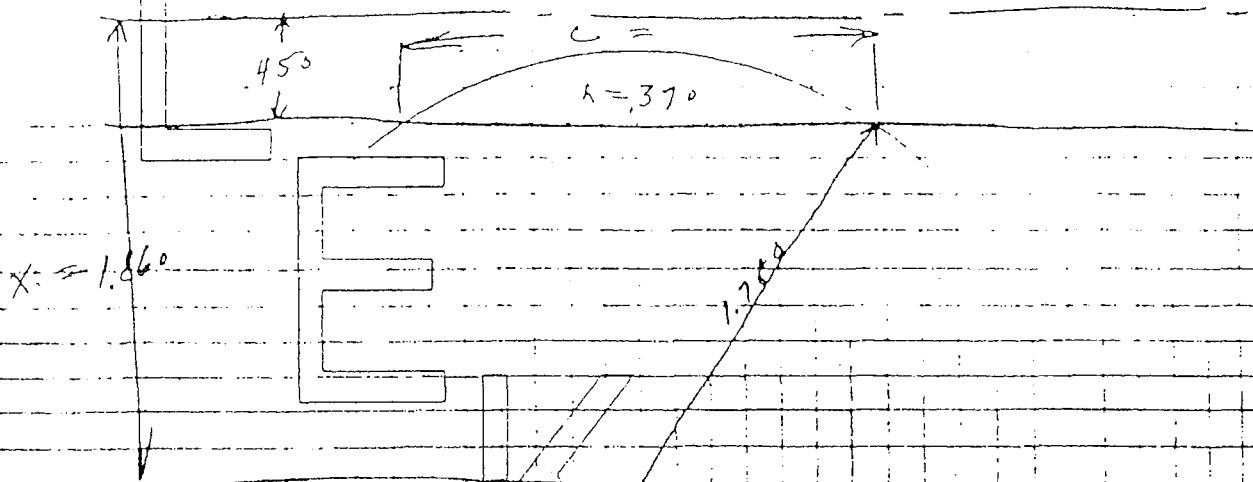
AL 0029647

DATE

7-19-45

SUBJECT OF EXPT.

Cutters centers



$$\frac{1.860}{.870} = 2.138$$

$$\frac{1.860}{.450} = 4.133$$

$$\frac{h}{r} = \frac{.370}{1.750} = .211$$

$$\frac{.001}{.005} \times .013 = .0026$$

$$\frac{1.750}{.450} = 3.889$$

$$\frac{c}{r} = 1.221$$

$$c = 2.173$$

$$\frac{2.173}{.450} = 4.829$$

For 1.750 R cutter

$$\frac{c}{r} = \frac{2.173}{1.750} \times 1.242 = 1.542$$

$$\frac{.011}{.014} \times .005 = .0039$$

$$\frac{h}{r} = 2.162$$

$$h = .3785$$

$$\frac{1.750}{.3785} = 4.623$$

$$X = 1.750 - .378 + .450 = 1.822$$

EXPERIMENTER

WITNESS

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43883
AL 0029648

32

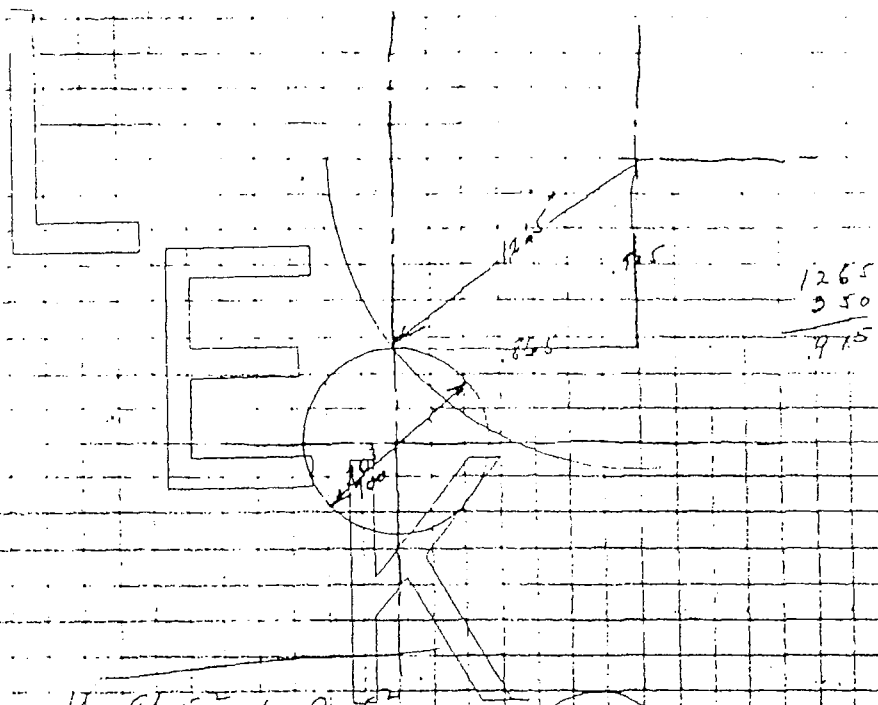
DATE

7-20-44

SUBJECT OF EXPT.

Extraction from Center Center

A



$$\sqrt{.865^2 + .915^2}$$

$$\sqrt{.748^2 + .837^2}$$

$$\sqrt{.458^2 + .5^2}$$

=

=

S

C

$$\frac{.85}{.15}$$

$$\frac{.20}{.10}$$

$$\frac{.20}{.10}$$

H

EXPERIMENTER

WITNESS

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44-283

AL 0029649

DATE 9-5-44

SUBJECT OF EXPT.

Assembly of m 7x1 & m 7x2

Two of the four models were assembled complete 9-5-44. The bolt heads were turned on and pinned to determine their actual strength requirements.

	m 7x1 300 H&H	m-7x2 300 Sec
Headspace before	Max + .001"	Min
After 500 shots	Max + .0035"	1.49999 Min

The m-7x1 showed very high pressure on proofing.

The m-7x2 showed only ordinary pressure on proofing.

The m-7x2 ball head had broken loose before firing. Only the pins were holding it. However it held quite satisfactorily for proofing.

A 45° chamfer was cut in the bolt body of the 7x2 and the ball head broke out.

Considerable trouble was experienced with the softags. Carter checked one and found it would not meet the drawing. The softag surface was .005 under 1mm and .030" misplaced.

EXPERIMENTER
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AL 0029650

9-11-42

M-722 bolt head & Socket

After approximately 40 regular 300 Lbs. loads the M-722 bolt head broke loose a second time. Inspection of the joint showed that the brace was not sufficient. The head was joined a third time using a ring of 1000° F. silver solder in a relief spot on the head. At the same time several test specimens were made up and checked on the tensile machine using different brazing compounds. The maximum joint strength obtained with a poor brazing compound was 7000^{lb} force to separate head and body, the best joint gave 25000^{lb}. It was decided that the ring of brazing compound in a relief spot constituted the best joint.

The M-722 bolt handle bent during the proofing. Due to head retraction (rough chamber). Opening the bolt by ^{top} hitting with a stick of wood eased the bending. The handle was replaced and the chamber smoothed.

EXPERIMENTER

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4/6/83

AL 0029651

DATE

9-13-46

SUBJECT OF EXPT.

Time control characteristics

$$\begin{array}{r} 1.046 \\ .315 \\ \hline 1.361 \end{array}$$

min clear and trip

1.241

.571

max diam trip hole to Rec E

1.762

1.361

.401

.430

.401

.029

max steel engagement

1.048

.335

1.383

1.239

.519

1.758

max diam trip hole to Rec E

1.758

1.383

.375

.435

.375

.050

max steel engagement

.521

.060

.581

.435

.050

.385

.585

.335

.720

.720

.078

.798

.798

.195

.603

581 max diam Rec E to bottom of bolt stop pin

603 min diam Rec E to steel contact on bolt stop pin

Then .022 min clearance

.391

.195

.586

.586

.160

.646

.649

.646

.003

min clearance between
Steel Bolt stop pin with
safety on

47883

AL 0029652

EXPERIMENTER

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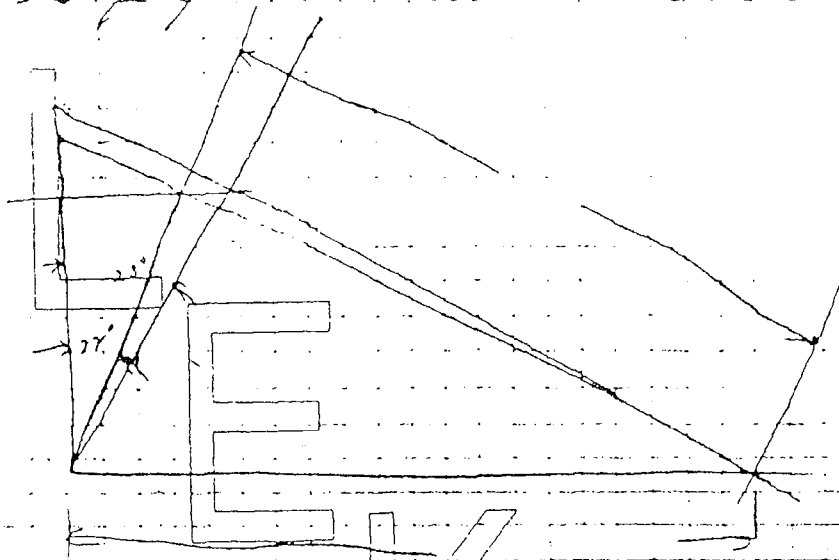
36

DATE

SUBJECT OF EXPT.

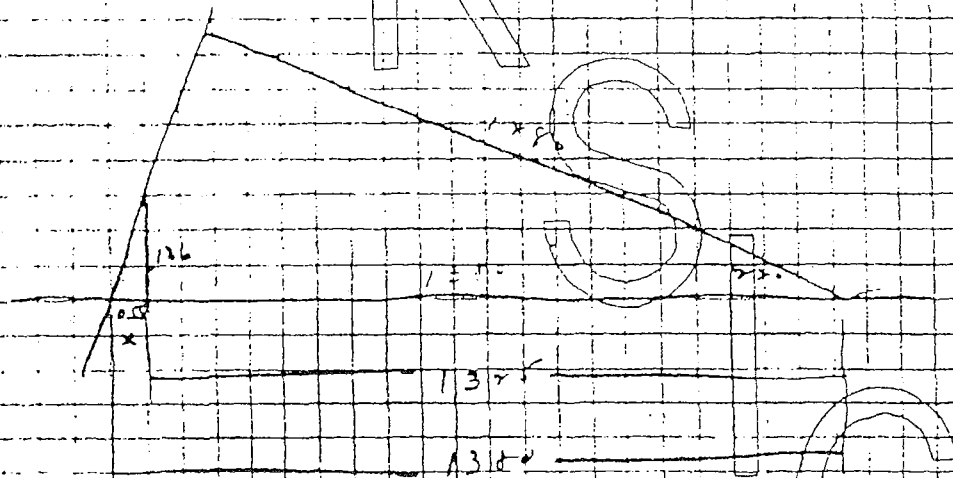
9-13-00

Safety of Fire Control Characteristics (cont)



$$\frac{2580}{871} = \frac{143}{4}$$

0.17



FOR 23°X

$$\frac{1.375}{13.6} = \frac{x}{13.6} \quad x = 0.577$$

$$\frac{1.375}{0.577} = 2.383$$

$$9 \times 0.1383 = 1.245$$

$$\frac{1.375}{1.245} = 1.104$$

How slow
during the 23°

EXPERIMENTER

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AL 0029653

DATE

9-13-44

SUBJECT OF EXPT.

Softly conditions

$$\begin{array}{r} 1.048 \\ 078 \\ \hline 970 \end{array}$$

$$\begin{array}{r} 1.241 \\ 651 \\ \hline .590 \\ 387 \\ \hline .977 \end{array}$$

$$\begin{array}{r} .977 \\ 970 \end{array}$$

Max. Softly interference = .007

$$\begin{array}{r} 1.046 \\ 82 \\ \hline .964 \end{array}$$

$$\begin{array}{r} 1.248 \\ 649 \\ \hline .597 \\ 391 \\ \hline .988 \\ 964 \end{array}$$

Max Softly Int. = .019

Changed slow to note from 012 and max 026

EXPERIMENTER

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49.283
AL 0029654

38

DATE

SUBJECT OF EXPT.

Thermal Spring design

Thick. OD - .170

Thin. OD - .164

ASSUME MEAN DIA .167

LEAD .380 ENTENDED .050 4#

LEAD .340 COMPRESSION LOAD

$$\delta^s = \frac{2.55 PD}{S} = \frac{2.55 (4) .141}{70,000} = .00025$$

$$\delta = .029" \text{ USE } .028$$

SOLID HT. SAY 2.70 = 9 COILS APPROX

$$\frac{P}{F} = 36.2$$

$$F = \frac{4}{36.2} = .11$$

$$.380 + .110 = .490 \text{ FREE LENGTH}$$

$$4^{\text{th}} \text{ LOAD } S = \frac{2.55 PD}{\delta^s} = \frac{2.55 (4) .139}{.0000717} = 14,700 \text{ PSI}$$

$$5^{\text{th}} \text{ LOAD } = 11,000 \text{ PSI}$$

$$6^{\text{th}} \text{ LOAD } = 9,700 \text{ PSI}$$

EXPERIMENTER

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AL 0029655

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SUBJECT OF EXPT.

Steel Spring (Cont)

$$\frac{P}{F} = \frac{3 d^4}{80^3 N}$$

$$= \frac{11,500,000 (.000001615)}{11.500,000 (.000001615)} = 36.6 \frac{\text{lb}}{\text{in}}$$

FREE LENGTH = 490

90% = (490 - 380) 36.6 = 4.1# 7.8#

WT COCKED = (490 - 340) 36.6 = 5.5# 6.7#

WT FIRED = (490 - 280) 36.6 = 7.1# 7.8#

WT STAKED = (490 - 280) 36.6 = 7.1# 7.8#

$$\frac{D}{d} = 5 \quad \text{WAHL K} = 1.51$$

$$S = P \frac{2.55 (1.51)}{.0000319} K = P 16,200 K$$

$$\text{COCKED } S = 4 (16,200) 1.31 = 85,000 \text{ PSI}$$

$$\text{FIRED } S = 5.5 = 117,000 \text{ PSI}$$

$$80\% S = 6.1 = 130,000 \text{ PSI}$$

$$\text{SOLID } S = 7.1 = 163,000 \text{ PSI}$$

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AL 0029656

TV
DATE
SUBJECT OF EXPT.

9-11-41
Seal Spring (second)

A

1.32

36

4#
5.5#

$$36(4) = 1.32 P$$

$$P = 1.1 \#$$

$$36(5.5) = 1.32 P$$

$$P = 1.5 \#$$

Second Spring

O.D. - 1.67

WIRE - 220

MEAN D - 1.41

$$29.5(X - 380) = 4 \#$$

$$X = \frac{35}{29.5} + \frac{380}{119} = 1500 \text{ FREE LENGTH}$$

$$P = \frac{11,500,000 (0.00000417)}{64 (0.0078)} = 29.3 \#$$

$$Index = 5.4 = 1.78 \text{ WALL K}$$

COCKED	(500 - 380)	29.3	=	3.5 #	
FIRE	(500 - 340)	"	=	4.7 #	$S = P \frac{2.55 (1.41)}{0.0000178} K$
STACKED	(500 - 280)	"	=	7.8 #	
80%	(215)	"	=	6.2 #	$= P 20,400 K$

COCKED'S	3.5	(20,400)	1.78	=	92,000 PSI
FIRE	4.7	"	"	=	123,000
STACKED	7.8	"	"	=	204,000
80%	6.2	"	"	=	162,000

EX JMENTER
WITNESS

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52,993
AL 0029657

DATE 9-18-44
SUBJECT OF EXPT. Gun Spring (Hand)

$$\frac{P}{F} = \frac{G d^4}{8 D^3 N}$$

$$\begin{aligned} 0.28 &= d \\ 1.12 &= D \\ 8 &= N \end{aligned}$$

$$= \frac{11,500,000 (0.000000615)}{64 (0.00268)} = 41.2 \text{ in}$$

$$41.2 (X - 3.80) = 3.5$$

$$X = \frac{3.5}{41.2} + 3.80 = 3.88 \text{ in FREE LENGTH}$$

$$\text{WT COCKED} = 3.88 - 3.80 (41.2) = 3.5$$

$$\text{FIRED} = 3.40 = 5.1$$

$$\text{STUCK} = 2.52 = 8.8$$

$$\text{80\%} = 7.0 = 7.0$$

$$S = P \cdot 2.55 (1.31) = P \cdot 16,200$$

$$\frac{P}{d} = 5 \quad \frac{P}{d} = 1.31$$

$$\text{COCKED } S = 3.5 (16,200) 1.31 = 74,000$$

$$\text{FIRED } S = 5.1 \quad \quad \quad = 108,000$$

$$\text{STUCK } S = 8.8 \quad \quad \quad = 187,000$$

$$\text{80\% } S = 7.0 \quad \quad \quad = 148,000$$

EXPERIMENTER

WITNESS

DATE

DATE

53083

AL 0029658

DATE

SUBJECT OF EXPT.

20-4-5
M-722 Preliminary Tests

Also preliminary soundations in the m-722
gave an indication to find the cartridge
base looking under the bolt. The bolt
on the m-722 is noticeably bent on closing
in the operation. A few of these also were
fired at the target with very good results.

E

K

S

I

C

H

EXAMINER
WITNESS

DATE
DATE

54883
AL 0029659

DATE

9-21-44

SUBJECT OF EXPT.

M-721 Preliminary tests

After propellant in 721 had cooled
apex head again (.227"). Max heating
on assembly and poor contact on the legs
continued to this condition.

E

K

S

I

C

H

EXPERIMENTER

WITNESS

DATE

DATE

55783

AL 0029660

±±

DATE

SUBJECT OF EXPT.

9-26-44 Spring Line Telescope Check (Report)

min 1.311

BOLT

.451

.315

.433

.064

1.263

1.311

.048 min Protusion

060
5.614
1.317
6.931
6.100

FP
max 1.317

0.1400
450

225
5.5
720

.449

.309

.477

.260

1.245

1.317

.072 max Protusion

min over all lengths

Rec + Sec

$\tan 23^\circ = \frac{9.285}{X} = \frac{1.264}{X}$

X = 1.309

4.019
1.365
6.184
47
5.137

4.871 Rec
1.364 Sec
6.190
47
6.143

Bolt

5.360

.492

4.863

.265

4.598 max

495
170
205

500
150
175

$\tan 23^\circ = \frac{4.245}{X} = \frac{X}{116}$

X = .0462

4.245
116

X = 56.4

Cocking Pin

6.184
64
6.120

6.190
64
6.126

560
450
1.210 max
4.598
5.100
5.100

Imp in line
to shoulder

ERIMENTER

WITNESS

DATE

DATE

56-8831

AL 0029661

DATE
SUBJECT OF EXPT.

9-26-44

Cooking Tolman chuck (Revised)

Tolman on 1.5 H. 1.2

$$\frac{1.5}{1.2} = 1.25$$

X = 1.25

Rec 5.715 min
5.220 max

Hot min

DH - max

309

315

5.335

5.360

5.664

5.675

437

434

5.241 Used

Rec of hot from
shoulder

5.241 used

1.00

5.327 used

35

Cooking Price notch

5.292

553

150

400

400

5.602

437

6.129

435

5.731

434

6.165

6.837

8.12

5.325 notch to stop shoulder

5.125

3.00

max stroke

560

145

415

437

315

812

145

444

58.9

5.602

5.325

notch to stop shoulder

6145

796

5349 notch to stop shoulder

5008

0.341

max stroke

309

400

796

1.00

5.602

437

6.129

3.00

150

400

400

6.00

5.602

437

6.00

3.00

EXPERIMENTER
WITNESS

DATE
DATE

57283
AL 0029662

46

DATE

SUBJECT OF EXPT.

9-27-44

Max Solid Weight of Main Spring

1.000
 .530
 1.530
 1.010
 2.540

Bolt Spring

450
 .560
 1.010

cooking Piece

5.608
 .255
 5.353
 2.840
 2.513

max Solid Weight 721

722

4.758

255

4.503

2840

1.663

max Solid Weight 722

EXPERIMENTER

DATE

WITNESS

DATE

55883
 AL 0029663

DATE
SUBJECT OF EXPT.

9-27-44

Main Springs

m-72
A-753-7

24.4 - 26.8 at 2.0 - 2.83 diff.

Length of piece

985
365
620
330
950
742
1,692

430
62
492
250
742
5357
1,692

Strain 0.313
Prest 0.54

3.265
850
2.815

297
350
635
3175

3.348
510
2.498

3.665 Length of piece 19 #

3.348 Length of cracked 21 #

5800
3,665
2,135 = 18.5 #
2,111 #
2,396

5800
3,348
2,452

= 21.1 #

24.4
26.5
51.2

2.97
2.20
77

25.6
6.63
32.23

3.348
3.628
290
145
493

19.8 # X 297 = 5.8" # from Energy 4

S = 8 P.D. = 8 (52.2) 345 (1.00) = 184,000
π d³ = 3.1416 (1.00)³

Max Working Stress = 121,000

m-72
59283

EXPERIMENTER
WITNESS

DATE
DATE

AL 0029664

48

DATE

SUBJECT OF EXPT.

Main Spring in 722

Spring in the Lion Hall

" " " on 753" Pm

Main Spring 1.600" Free Length

055 wire

400 out side

29 total coils

27 active

$$\text{Spring Rate } \frac{F}{\Delta} = \frac{G d^4}{8 D^3 N} = \frac{11,500,000 (0.0500915)^4}{8 (27)^3 (47.12)} = 1.24$$

Cocked Length 2.495

- 27 =

Final Length 2.815

17.4

Stress

31.3

Part 054

7.7

$$\begin{array}{r} 5313 \\ 2656 \\ 1490 \\ \hline 4246 \end{array}$$

S

$$S(\text{stress}) = \frac{8 P D K}{\pi d^3} = \frac{8 (31.3) (34.5) (1.05)}{\pi (0.0506)^3} =$$

$$\text{Wt. COILED} = 42 - 2.495 (11.8) = 20.1$$

$$\text{Wt. FIRED} = 42 - 2.815 (11.8) = 16.5$$

$$18.5 \times 2.97 = 5.47 \text{ " Energy}$$

$$\text{Max Working Stress} = 117,000 \text{ psi}$$

EXPERIMENTER

WITNESS

DATE

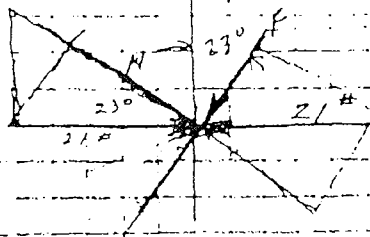
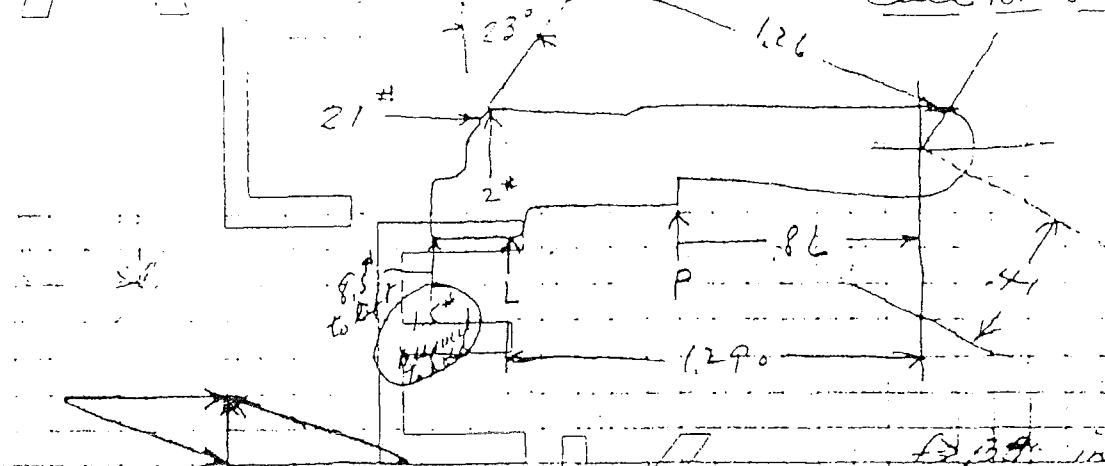
DATE

AL 0029665

60783

DATE 12-70-44
SUBJECT OF EXPT. New Seal & Safety

Cals. on old seal



13.39 in dust chamber
A = 1.29 in oil

$$\text{NORMAL FORCE} = N = 21 (\cos 23^\circ) = 21 (.92) \\ N = 19.3$$

MOMENTS ABOUT O Neglecting F

$$2 (1.29) + P (.86) = 22.8 (.41) +$$

$$\cos 23^\circ = .920 = \frac{21}{N}$$

$$N = 22.8$$

$$F = NF \\ = 19.3 () \\ = 1.1$$

$$P (.86) = 9.35 - 2.58$$

$$P = \frac{6.77}{.86} = 7.87$$

$$L = \frac{6.77}{1.29} = 5.25$$

USING MEASURED FORCES

$$1.5 (1.5) = P (.86)$$

$$P = 2.6$$

$$L = 1.75$$

MOMENTS TO FIND F

$$1.5 (1.5) + 2 (1.29) + P (1.26) = 22.8 (.41)$$

$$P (1.26) = 9.35 - 2.25 - 2.58$$

$$P = \frac{4.52}{1.26} = 3.59$$

$$\frac{F}{N} = f = \frac{3.59}{19.3} = .186$$

61.783

EXPERIMENTER
WITNESS

DATE
DATE

AL 0029666

50

DATE

12-20-46

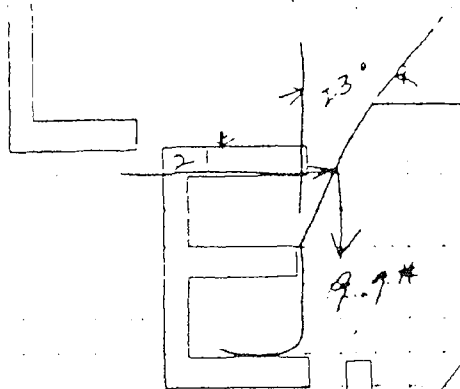
SUBJECT OF EXPT.

New Sec. & Safety

(cont)

Calc on old sec. & Safety

$$\text{Actual } L = \frac{8.5(1.5)}{1.29} = 9.9^{\#}$$



4.3/1 = ADVANTAGE

$$3.6(1.29) + 22.8(4.1) - 2(1.29) = 1.29$$

$$4.57 + 9.35 - 2.58 = 1.29$$

$$\text{Then } L = \frac{11.24}{1.29} = 8.8^{\#}$$

$$\begin{array}{r} 11.24 \\ 4.31 \\ \hline 13.64 \\ 2.58 \\ \hline 11.29 \end{array}$$

Actual Load to put safety on = 8.8# off = 4.3#

Theoretical on = 15.9# neglecting safety friction

6.2# includes the detent

Detent = 3.5#

$$\frac{N}{8.8} = \cos 45 = .707$$

$$N = 6.2^{\#}$$



$$\frac{X}{3.90} = \cos 45 = .707$$

$$X = 2.76$$

$$P_{\text{safety}} = \frac{2.76 \times 6.2}{9.9} = 1.8^{\#}$$

$$\text{By case } \frac{9.9}{4.3} = 2.3^{\#} \text{ to put safe on}$$

$$\text{actual } = 6^{\#} - 3.5^{\#} = 2.5^{\#}$$

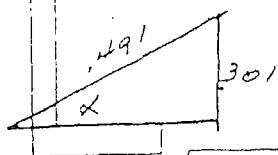
EXPERIMENTER
WITNESSDATE
DATE62283
AL 0029667

DATE

1-3-48

SUBJECT OF EXPT.

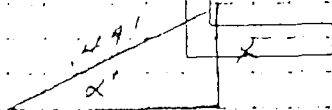
New location of Safety Detector in Housing



$$\sin \alpha = \frac{301}{491} = .613 \quad \alpha = 37^\circ - 48'$$

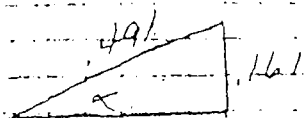
Adding 5' to alpha

$$\alpha' = 42^\circ - 41'$$



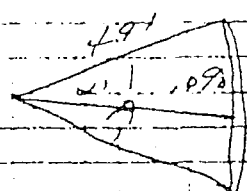
$$\sin \alpha' = .6792 = \frac{x}{491}$$

$$x = 334 \quad \text{not satisfactory}$$



$$\sin \alpha = \frac{161}{491} = .3277$$

$$\alpha = 19^\circ - 8'$$



$$\sin \alpha' = \frac{.090}{.491} = .1831$$

$$\alpha' = 10^\circ - 33'$$

$$A = 21^\circ - 6'$$

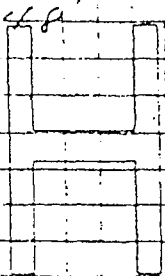
$$\begin{array}{r} 10.45 \\ 21.36 \\ 10 \\ \hline 41.81 \end{array}$$

$$\alpha + A = 40^\circ - 14'$$

$$37^\circ - 48'$$

$$\text{USE } 40^\circ - 48'$$

$$\sin 40^\circ - 48' = .6534 = \frac{x}{491} \quad x =$$



63083

EXPERIMENTER

DATE

WITNESS

DATE

AL 0029668

52

DATE

10-18-65

SUBJECT OF EXPT.

COCKING & TOL. CHECK.

Sear Pin Hole from Lug = 3.971 MAX
 " " to Sear Point = 1.8036 MAX

LUG SEAT TO POINT OF SEAR 5.2746 MAX

MAX LUG TO BOLT HANDLE = 4.380

MIN LUG TO COCKING POINT .309 3 BOLT HEAD

4.505 3 BOLT BODY

4.814

4.35 3 CAM SEAT

4.749

1.550 3 CAM POINT to shoulder

5.379

1.45 2 shoulder to notch

5.184 11

4.380 3

Dist. Sear Pin

to Point

at 7

$$\tan 27^\circ = \frac{\log 5}{.140} = \frac{x}{.140}$$

$$x^{\text{max}} = .0714$$

$$x^{\text{min}} = .0765$$

$$\cos 27^\circ = \frac{.891}{x} = \frac{.891}{x}$$

$$y^{\text{max}} = 1.375$$

$$y^{\text{min}} = 1.369$$

$$1.375 - .0714 = 1.3036$$

$$.0714$$

$$1.3036$$

$$1.369 - .0765 = 1.2925$$

$$.0765$$

$$1.2925$$

$$1.3036$$

$$2.5961$$

$$1.298$$

+ .030 for camming into notch in bolt

giving .025 MIN OVER TRAVEL

IF PRIMARY EXTRACTION GATE IS O.K.

.021

$$\tan 27^\circ = \frac{.021}{x} = \frac{.021}{x}$$

$$.028$$

6.4283

EXPERIMENTER

WITNESS

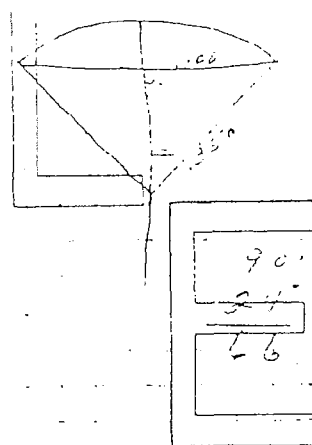
DATE

DATE

AL 0029669

DATE 10-18-45
SUBJECT OF EXP'T.

PRINTER EXTENSION CHECK



$$\sin \alpha = \frac{15}{35} = .2855$$

$$\alpha = 16.35'$$

$$3d = 5/4000$$

Sear pin hole from Rec Lug =	3.970 ± .1	1
Sear pin hole to sear notch =	1.298 ± .56	5.6
	5.268 ± .66	

Bolt Head =	3.12 ± .3	3
Bolt Body =	4.5075 ± .25	2.5
	4.8195 ± .55	
Cam Seat =	1.0325 ± .25	2.5
	4.7870 ± .80	
Cam point to shoulder =	5.55 ± .50	5.0
	5.3420 ± .13.0	
Shoulder to notch =	1.1025 ± .25	2.5
	5.1995 ± .15.5	

Lug to Bolt Head =	4.3775 ± .25	2.5
--------------------	--------------	-----

Rec shoulder to Ext cam =	4.3675 ± .25	2.5
Cam =	1.025 ± .25	2.5
	4.4709 ± .5	

5.268 ± .66	8.23 ± .1	5.1995 ± .15.5	65783
4.470 ± .50	7.98 ± .11.6	4.3785 ± .25	
7.98 ± .11.6	10.24 ± .22.1	8.226 ± .18.1	

EXPERIMENTER
WITNESS

DATE
DATE

AL 0029670

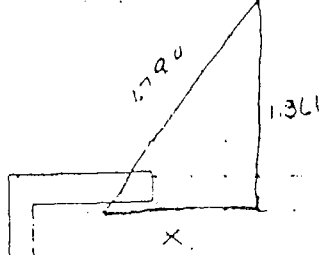
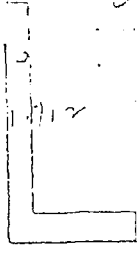
54

DATE 10-22-45
SUBJECT OF EXPT.

A

New section part & extraction can. Cut the rod
as per request of engineering.

$$\begin{array}{r} 1.712 \\ .613 \\ \hline 1.361 \end{array}$$



$$\begin{array}{r} 1.712 \\ .351 \\ \hline 1.361 \end{array}$$

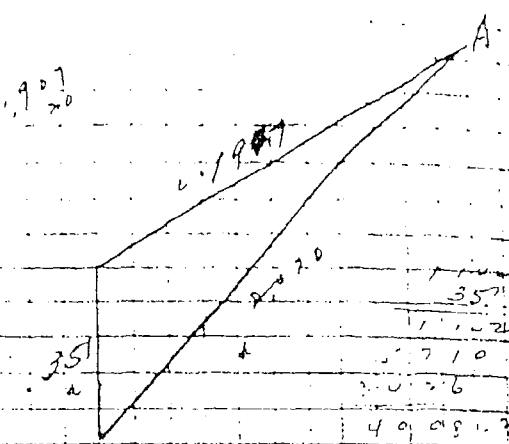
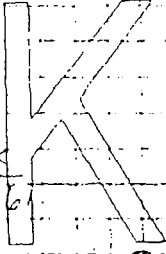
$$\begin{array}{r} 1.712 \\ .351 \\ \hline 1.361 \end{array}$$

$$.76 = \frac{1.361}{1.791} = \cos \alpha$$

$$\alpha = 40^{\circ} 32'$$

$$\tan \alpha = .855 = \frac{x}{1.361}$$

$$x = 1.165$$

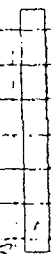


$$36^{\circ} 11'$$

$$\frac{1.712}{x} = \cos 36^{\circ} 11'$$

$$x = 2.605$$

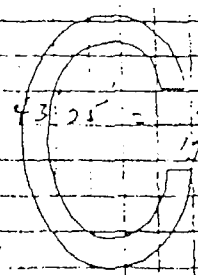
$$\alpha = 9^{\circ} 13'$$



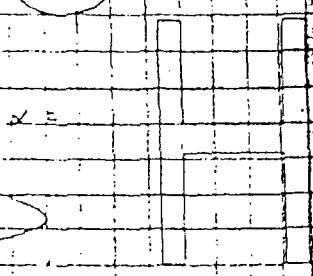
$$\begin{array}{r} 2.010 \\ .433 \\ \hline 1.577 \end{array}$$

$$\begin{array}{r} 2.010 \\ .433 \\ \hline 1.577 \end{array}$$

$$\sin 43^{\circ} 25' = \frac{x}{1.73}$$



$$\sin \alpha = \frac{1.165}{1.361}$$



$$\alpha = 27^{\circ} 31'$$

EXPERIMENTER
WITNESS

DATE
DATE

660783
AL 0029671

DATE
SUBJECT OF EXPT.

$$h = .351(1 - .8254)$$

$$= .351(1.1746)$$

$$= .0402$$

Angle of chord on ext com on Rec = 13° 47' with h

N.C.

117
112

E

1.93
1.79
1.14

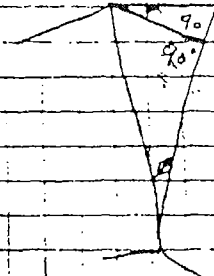
$$\tan x = \frac{1.145}{1.14} =$$

$$x = 39.16'$$

$$9 + 355 = \frac{x}{.351}$$

$$\frac{1.71}{320} = \frac{1.39}{x}$$

$$\sin x = \frac{.4647}{.351} = \frac{x}{.351}$$



$$\frac{21556}{331} = \frac{21256}{x}$$

$$\frac{106780}{63768} = \frac{7460851}{x}$$

$$\frac{14941}{x} = \frac{7460851}{x}$$

$$\sin 43.13' = \frac{1.308}{x}$$

$$\frac{1.165}{1.43} = \frac{1.308}{1.392}$$

$$x = 1.910 \text{ outer Rept cam}$$

$$677.83$$

EXPERIMENTER

WITNESS

DATE

DATE

AL 0029672

56

DATE

SUBJECT OF EXPT.

$$\sin A = \frac{r}{bc} \sqrt{s(s-a)(s-b)(s-c)}$$

$$a = 4.99$$

$$b = 2.070$$

$$c = 1.90$$

$$4.469$$

$$2.2345$$

$$400$$

$$1.7555$$

$$2.2345$$

$$2.070$$

$$1.625$$

$$2.2345$$

$$1.6$$

$$2.2345$$

$$2.2245(1.7245)(1.645)(1.3345)$$

$$3.22 =$$

$$1.33$$

$$2.136$$

$$4.625$$

$$= .508$$

$$\sin A = .2348$$

$$A = 13.5 - 3.5$$

$$34 = 12$$

$$47 = 77$$

$$\sin 47 = \frac{x}{1.90} = .7406$$

$$x = 1.407$$

$$1.165$$

$$\cos \alpha = \frac{1.43}{1.46}$$

$$26791$$

$$351$$

$$20791$$

$$103955$$

$$62373$$

$$107297641$$

$$14594$$

$$\alpha = 11.45$$

eft com chord angle with Horiz

$$1910$$

$$179$$

$$120$$

$$1145$$

$$120$$

$$89$$

$$A = 43.39 \text{ eft com angle with Rec.}$$

EXPERIMENTER

WITNESS

DATE

DATE

68 of 83

AL 0029673

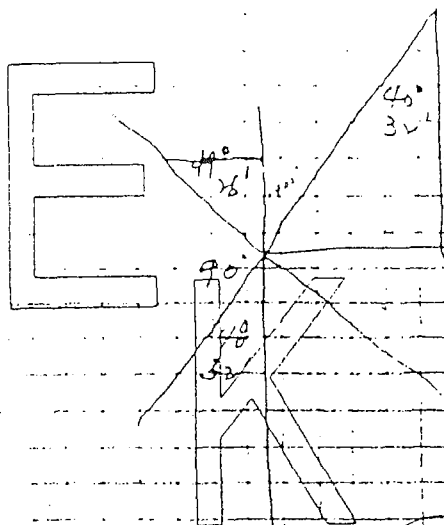
DATE

SUBJECT OF EXPT.

$$\frac{1.165}{1.361} = \tan \alpha$$

$$\alpha =$$

$$\frac{1712}{351} = 13.61$$



$$\frac{189}{130.37} = 49.28'$$

$$\frac{64}{37} = 1.73$$

$$\cos 49.28' = \frac{1.405}{x}$$

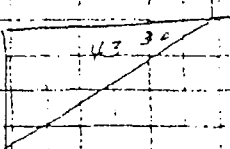
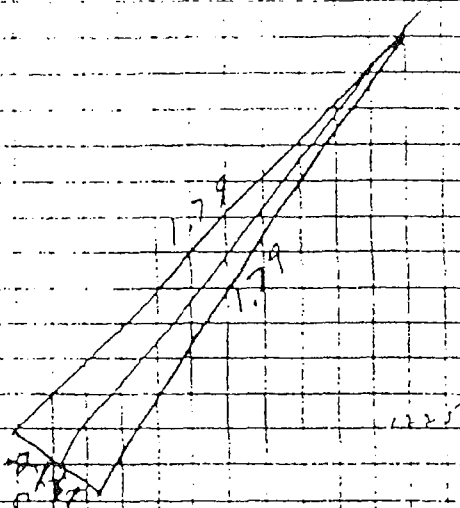
$$x = 6.499$$

$$x = 2.161$$

$$\sec 49.28' = 1.5387$$

$$x = 1.5387 (1.405)$$

$$x = 2.161$$



$$\tan 43.30' = \frac{1.225}{x}$$

$$x = 1.29$$

$$6.9883$$

EXPERIMENTER

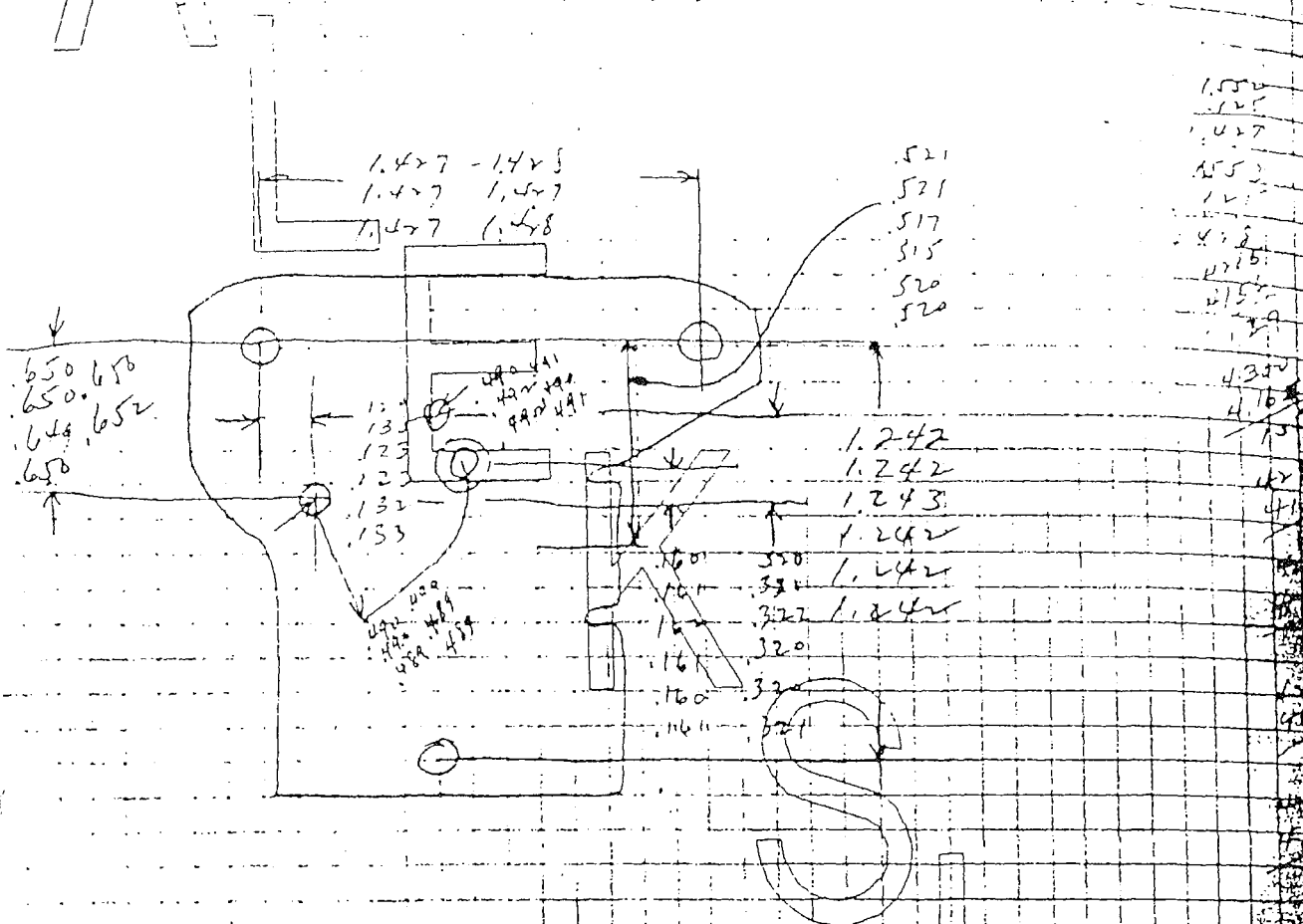
WITNESS

DATE

DATE

AL 0029674

6-73
Chickson Hovaingo



EXPERIMENTER

WITNESS

DATE _____

DATE _____

AL 0029675

60

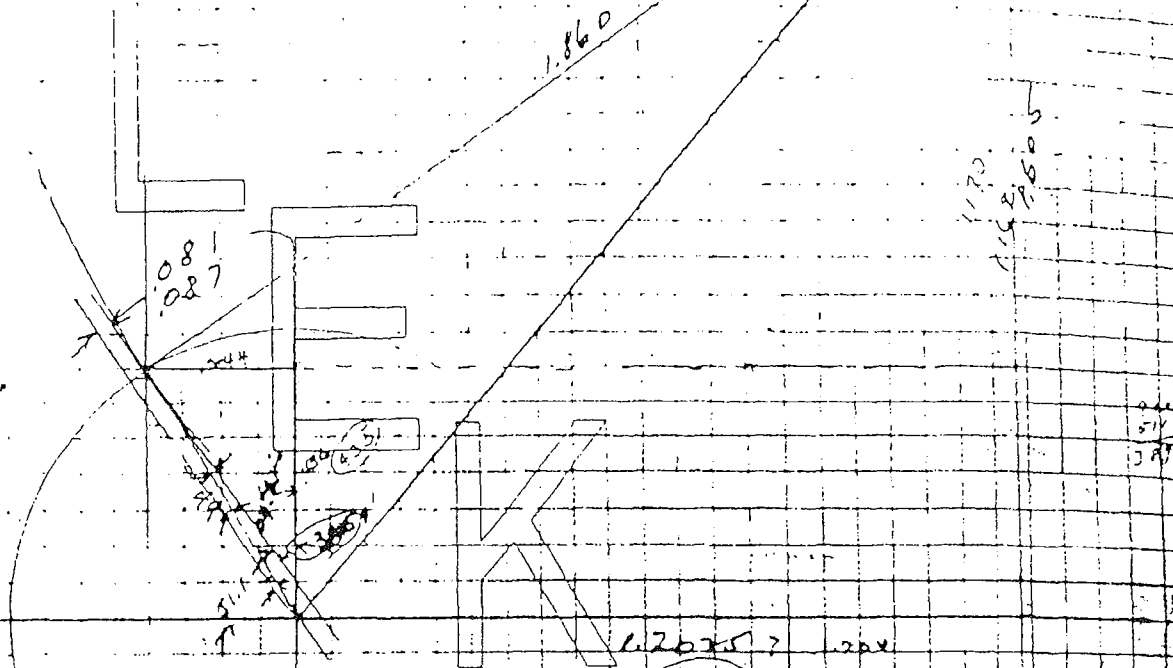
DATE

3-13-46

SUBJECT OF EXPT.

Extraction com

A



$$\sin 51.1^\circ = \frac{498.2}{x}$$

$$x = 311$$

$$x_{\text{true}} = 311$$

$$\begin{array}{r} 38.9 \\ 29.25 \\ \hline 9.65 \end{array}$$

$$1.2025 \times 20x$$

$$1.12 \times 19$$

$$\sin 29.15^\circ = \frac{498}{x} \rightarrow 490.962$$

$$x = 29.15$$

$$29 - 16 = 48$$

$$\tan 29.15^\circ = \frac{44}{x} = 51.1$$

$$x = 456$$

$$\begin{array}{r} 38 \quad 59 \\ 29 \quad 15 \\ \hline 9 \quad 44 \end{array}$$

$$\begin{array}{r} 1.2025 \\ 244 \\ \hline 1.4465 \end{array}$$

$$\begin{array}{r} 1605 \\ 1435 \\ \hline 1169 \end{array}$$

$$\tan \beta = \frac{1240}{x} = \frac{x}{1.169}$$

$$x = 1.1448$$

$$\sin \beta = \frac{1.1448}{1.86} = 278$$

$$\beta = 51.1$$

$$\tan \beta = \frac{1.4465}{1.169} = 1226$$

$$\beta = 51.1$$

$$\sin 9.14^\circ = \frac{x}{499} = 1.69$$

$$x = 0.863$$

$$x = 0.682$$

$$\begin{array}{r} 1.44 \\ 244 \\ \hline 1.190 \end{array}$$

$$\frac{x}{1.190} = 1.255 \quad 72.783$$

EXPERIMENTER

WITNESS

DATE

DATE

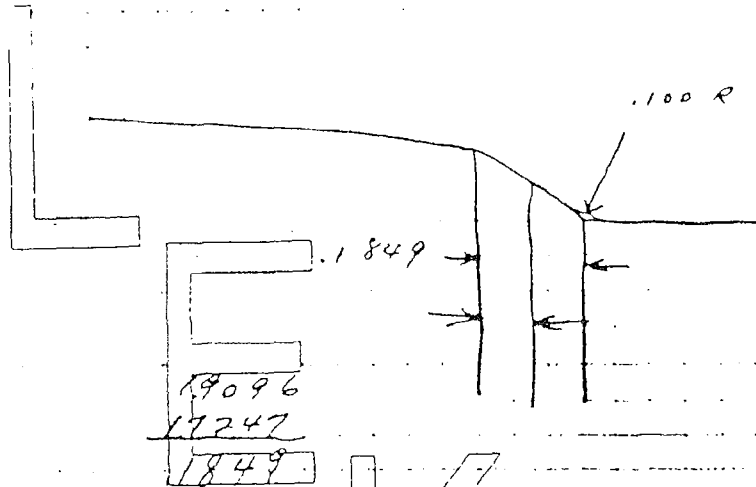
AL 0029677

DATE _____

4-8-46

SUBJECT OF EXPT.

274 Rem.



19096

17247

1849

274314

2157

43/1

292

21, 1394

10697

2-4-2

p. 46

527

1875

1.7222

17242

.0030

4294

2142

19117

1909L

0021

300

—

37

1689

20542

1990

506

0:0

5

61

0

20479

1940

1075

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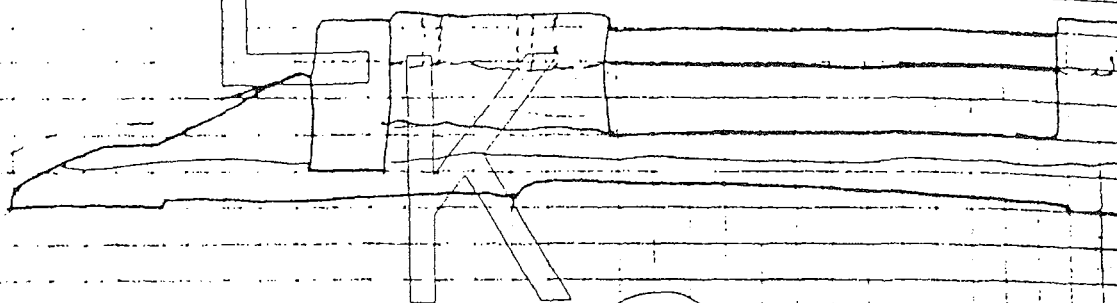
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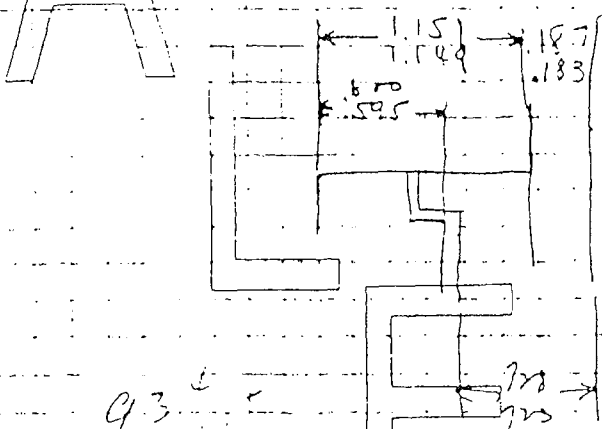
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Bolt + Bolt. Class



93

95

1.149

1.183

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004 class
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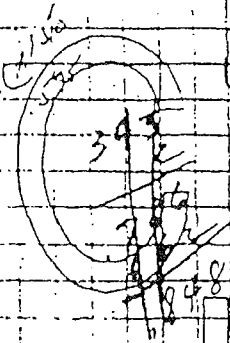
1.149

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10-1-48

New Calculations for Report in
Product Engineering Article

BARREL STRUCTURE

FORMULAE

Lame's

$$S = \frac{P(r_2^2 + r_1^2)}{r_2^2 - r_1^2}$$

S = stress tang.

P = int press.

 r_1 = inside r. r_2 = outside r.

$$r_1 = .750 = .0625$$

$$r_2 = .575 = .331$$

$$S = \frac{P}{t} \quad t = \text{thickness}$$

$$P = 84000 / .331$$

$$= \frac{1}{2} \frac{(250) 84000}{.575}$$

$$S = \frac{84000 (.331)}{.269}$$

$$S = 18,250 \text{ tangit.}$$

$$= 123,000 \text{ P.S.I.}$$

$$\frac{123000}{1.875} = 65,625$$

ORDINANCE

$$\theta = \frac{P}{\frac{3}{2} \left(\frac{r_2^2 - r_1^2}{r_2^2 + 2r_1^2} \right)}$$

θ = Elastic Limit
of material
used.

$$= \frac{84000}{\frac{3}{2} \left(\frac{.261}{.724} \right)}$$

$$= \frac{84000}{.724}$$

$$= 116,000$$

$$= 150,000$$

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COX'S

$$Y = \frac{2}{3} \frac{P}{W^2 - 1} (2W^2 + 1)$$

$$W = \frac{\text{outside dia}}{\text{inside dia}}$$

$$= \frac{1.15}{.5} = 2.3$$

$$W^2 = 5.19$$

P = PRESSURE UNIT

Y = STRESS

$$Y = \frac{2}{3} \frac{84000}{4.19} = 152000$$

AVERAGE S USING LAMES $P_0 = 0$

$$S = P \left(K_1^2 + \frac{r_2^2}{r_1^2} \right) / (r_1^2 - r_2^2)$$

Substituting

$$r = .750 \quad S_1 = 123,000$$

$$r = .331 \quad S_1 = 80,600$$

$$r = .412 \quad S_1 = 57,200$$

$$r = .494 \quad S_1 = 45,600$$

$$r = .576 \quad S_1 = 38,800$$

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CONT.

$$AREA = \frac{123,000 + 89,600}{2} (.081) = 8230$$

$$\frac{89,600 + 57,200}{2} (.081) = 5560$$

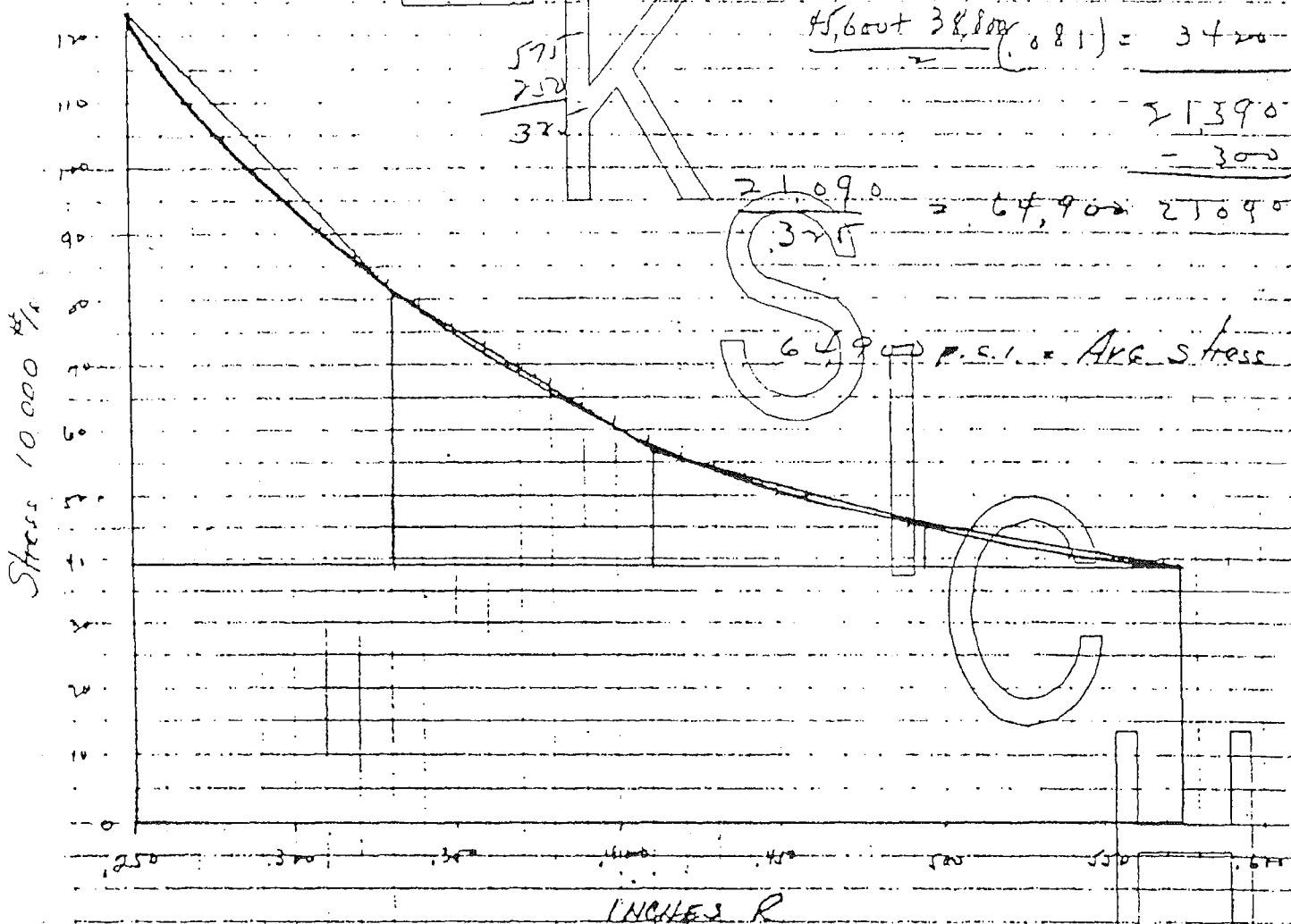
$$\frac{57,200 + 45,600}{2} (.082) = 4160$$

$$\frac{45,600 + 38,800}{2} (.081) = 3420$$

$$\begin{array}{r} 21390 \\ - 3000 \\ \hline \end{array}$$

$$\frac{21090}{.325} = 64,900 \text{ P.S.I.} = \text{Avg Stress}$$

64,900 P.S.I. = Avg Stress



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LOCK TIME

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

$$E = 15$$

$$V = \frac{V_1 - V_2}{2}$$

$$V_1 = 0$$

$$V = \frac{V}{2}$$

$$V = \frac{2.5}{T}$$

$$V = \sqrt{\frac{2E}{M}}$$

$$T = \frac{2.5}{V} = \frac{2.5}{\sqrt{\frac{2E}{M}}} = \frac{2.5}{\sqrt{\frac{2 \times 15}{M}}} = \frac{2.5}{\sqrt{\frac{30}{M}}} = \frac{2.5}{\sqrt{30}} \sqrt{M}$$

$$2 \left(\frac{3000}{12} \right)$$

S

$$2(0.0022)$$

$$\sqrt{2 \left(\frac{3000}{12} \right) \times 0.0022} = \frac{67.9 \times 0.0022}{32}$$

$$\frac{0.0022}{0.00467}$$

$$= \frac{0.0022}{\sqrt{2 \times 46}}$$

$$= \frac{0.0022}{14.9}$$

$$= 0.00034$$

C

$$2 \left(\frac{3000}{12} \right) = \frac{1}{2} \frac{67.9(0.0022)}{32} V^2$$

$$T^2 = \frac{4S^2}{2 \times 15}$$

$$T^2 = \frac{2 \times 15}{M}$$

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