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# ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KENTUCKY

INDEXED

PROJECT NO.6- VISION IN TANKS

Report On

Sub-Project No. 6-15 - Study and Development of New Instruments  
for Indirect Fire Control

SUBJECT: PARALLELOGRAM MOUNTING OF REFLEX SIGHT  
FOR 50 CAL. ANTI-AIRCRAFT MACHINE GUN

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Project No. 6-15

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14 October 1944



ARMORED MEDICAL RESEARCH LABORATORY  
Fort Knox, Kentucky

Project No. 6-15  
File No. 413.74-4 SPMEA

14 October 1944

PARALLELOGRAM MOUNTING OF REFLEX  
SIGHT FOR 50 CAL. ANTI-AIRCRAFT MACHINE GUN

1. PROJECT: No. 6 - Vision in Tanks; sub-project 15 - Study and Development of New Instruments for Indirect Fire Control.

a. Authority: Letter Commanding General, Headquarters Armored Force, Fort Knox, Kentucky, File 400.112/6 GNOHD, Dated September 24, 1942.

b. Purpose: To develop a mount which would place the reflex sight above the smoke, be convenient to the gunner, and absorb recoil shock.

2. DISCUSSION:

a. Facts pertinent to the development are as follows:

- (1) This project was jointly initiated by the Gunnery Department of The Armored School and by the Weapons and Ammunition Section of the Armored Board.
- (2) The parallelogram mount was first designed and later improved by the Armored Medical Research Laboratory.
- (3) Three (3) mounts were fabricated locally by a contract with the Armored Board and a similar mount was fabricated by the University of Rochester.
- (4) The mount was designed for a reflex sight developed by the University of Rochester under an NDRC contract at the request of the Armored Board. While specifically the mounts were developed for a 300 mile an hour lead ring type reflex, it is equally adaptable to the 400 mile an hour lead ring type developed for the Anti-Aircraft Artillery Board.

b. The following requirements were considered essential in the design:

- (1) That the sight be elevated 20 to 25 inches above the gun in order to avoid obscuration by smoke.
- (2) The reflex sight must be mounted so that the eye can be



held within one or two inches of the window in order to secure full advantage of the wide field (300 or 400 mile lead ring circles).

- (3) Because of the necessary contact between head and head-rest, shock of recoil must be absorbed in order to eliminate jarring and loss of vision from vibration.

c. The sight mount comprises the following general characteristics:

- (1) A four-member parallelogram is attached to the gun cradle supporting the sight so that the eye is approximately 25 inches above the barrel of the gun in the middle range of operation. (See drawings & specifications attached.)
- (2) A restoring spring device keeps the normal position of the sight suitably placed for the gunner. During changes of elevation, the level at which the eye position is maintained does not appreciably change. As one approaches higher elevations, the eye position moves in somewhat to accommodate the natural forward movement of the gunner as he depresses the grips.
- (3) The spring positioning device satisfactorily absorbs the shock of recoil except at very low elevations where there is some residual disturbance to the head.
- (4) A spring detent and shock absorbing mechanism was incorporated later in the head-rest permitting a movement of  $1/2$  to  $3/4$  inches which satisfactorily removes objectionable shock even when firing at low elevations.
- (5) The entire assembly can be quickly folded flat to the gun when in carrying position.
- (6) A modification was introduced (see supplementary drawings 1 and 2) which allows a quick removal of the sight without disturbing boresight adjustment.
- (7) Experiments were conducted on spring character which resulted in the thinner leaf type shown in supplementary drawing 3.

d. Tests conducted in conjunction with the Armored Board and The Armored School established the following:

- (1) The placement of the sight avoided obscuration.
- (2) Head shock was at no time objectionable, being practically non-existent in the normal anti-aircraft elevation ranges.



- (3) Accuracy of alignment retention appeared to be satisfactory as tracer fire narrowed to a stream comparable to the inherent dispersion of the gun. No accentuation of whip could be noted.
- (4) When crews became accustomed to the use of the rings for lead, marked improvement in effectiveness was noted. (One crew obtained as high as 12 hits in 1000 rounds on a towed sleeve 15 feet in length and 2 feet in diameter at 600 yards.)
- (5) It was not possible to obtain statistically dependable appraisal of the device, but the more experienced anti-aircraft gunners felt that many times increase in effectiveness would be obtained with proper training.

e. Tests conducted by Anti-Aircraft Artillery Board may be commented upon as follows:

- (1) The primary purpose of the mount to raise the sight above obscuration by smoke was not mentioned.
- (2) Suitable platform inevitably necessary for employment of subject sight and mount was not employed; hence erroneous conclusion that the sight was not well positioned. This conclusion was exactly contrary to all our findings.
- (3) No adequate statistics were offered to indicate the possible improvement in anti-aircraft fire.

### 3. CONCLUSIONS:

a. The subject reflex sight mount provided an adequate positioning of the sight close to the gunner's eye under all conditions of anti-aircraft fire.

b. Shock disturbance was satisfactorily removed.

c. The positioning avoided previous difficulties of obscuration encountered with all types of anti-aircraft sights tried.

d. Boresighting and alignment were adequately attained.

### 4. RECOMMENDATIONS:

a. That the parallelogram mount be adapted for armored vehicles employing 50 Cal. machine gun for anti-aircraft protection.



b. That platforms be provided in armored vehicles to secure the proper height for the use of subject parallelogram sight.

The conclusions and recommendations set forth above have been concurred in by Headquarters, Armored Center, Kent C. Lambert, Colonel, Acting Chief of Staff, with the further recommendation that with the consideration for adoption of this mount, more stable gun mounts for vehicular mounted .50 caliber machine guns, be developed to take advantage of the inherent good qualities of the parallelogram mount.

Submitted by:

F. S. Brackett, Lieut. Colonel, Sn C

APPROVED

*Willard Machle*

WILLARD MACHLE

Colonel, Medical Corps  
Commanding

7 Incls  
3 Blueprints  
3 Drawings  
Specifications



SPECIFICATIONS FOR REFLEX SIGHT MOUNT

50 Cal. Anti-Aircraft Machine Gun

Detail No.	No. Req'd.	Size, no allowance	Material
1	1	3/8 dia. x 26 lg.	Steel rod
1A	2	1/8 x 2-1/4 x 1-19/32	Steel
1B	2	1/16 x 3/8 x 1-1/2	Spring steel
2	1	3/8 x 1-3/4 x 2-3/8	Brass
3	1	1/4 x 7/8 x 2-3/4	Brass
4	1	1/2 x 7/8 lg.	Brass
5	1	7/8 O.D. x 1/64 thick	Spring steel
6	1	1/4 - 20 st'd.	Wing nut
7	1	3/8 dia. x 1-1/4 lg.	Brass
8	1	1 dia. x 5/8 lg.	Brass
9	1	23/32 O.D. x 3/16 I.D. x 1/32 thick	Steel
10	2		Aluminum casting
11	2	1/2 dia. x 2-3/16 lg.	Drill rod
12	4	1/16 x 1/2 x 3 lg.	Spring steel
13	2	1/16 x 1/2 x 3 lg.	Spring steel
13A	2	1/16 x 1/2 x 1-15/16 lg.	Spring steel
13B	2	1/16 x 1/2 x 1-11/16 lg.	Spring steel
13C	2	1/16 x 1/2 x 1-7/16 lg.	Spring steel
13D	2	1/16 x 1/2 x 1-3/16 lg.	Spring steel
13E	2	1/16 x 1/2 x 15/16 lg.	Spring steel
14	2	5/8 x 7/8 x 1-1/4	Brass
15	2	3/4 dia. x 15/16 lg.	Brass
16	1	3/16 x 3/4 x 20 lg.	Steel
17	1		Iron casting
18	1	7/16 x 1-3/16 x 1-1/2	Steel
19	1	1/16 x 1 x 2	Spring steel
20	1		Aluminum casting
21	1	7/16 dia. x 1-5/16 lg.	Steel
22	1	7/8 x 1 x 3	Steel
23	2		Aluminum casting
24	2	1/2 dia. x 2-1/4 lg.	Drill rod
25 R.H.	1		Iron casting
25 L.H.	1		Iron casting
26		Omitted by revision	
27	2	1/2 dia. x 6-1/16 lg.	Drill rod
28	1		Aluminum casting
29	2		Aluminum casting



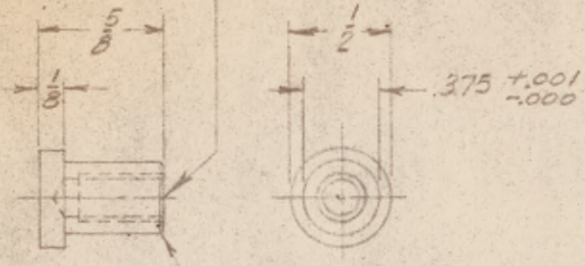
## No. Req'd.

## Standard Stock

No. Req'd.	Standard Stock
20	Washer, lock for #10 machine bolt (steel)
4	#10-24 x 1 hex. head machine bolt (brass) threaded 3/8 from end
8	#10-24 hex. head machine bolt nut (brass)
1	#8-32 x 3/8 lg. flat head machine screw (brass)
2	#8-32 x 5/8 lg. fillister head cap screw (brass)
1	#52 x 7/8 lg. drill rod (.063 dia.)
1	#52 x 3/8 lg. drill rod (.063 dia.)
12	#10-24 round head machine screw (brass)
8	#2/0 x 1 lg. taper pin
4	3/8 I.D. washers (steel) finished
4	3/32 dia. x 1 lg. spring steel cotter
2	#10-24 x 1-5/8 hex. head machine bolt (brass)
2	#10-24 x 1-1/4 hex. head machine bolt (brass)
4	3/8 - 16 N.C. slotted nut (steel)
2	#30 x 7/8 lg. drill rod (.127 dia.)
2	#8 - 32 x 1/2 flat head machine screw (brass)
2	#6 - 32 x 7/16 round head machine screw (brass)
2	Washers, lock (steel) for #6 machine screw
1	3/16 x 1-3/4 lg. flat head rivet
1	3/32 dia. x 1/2 spring steel cotter
1	1/4 - 20 x 3/4 round head cap screw (steel)
1	Washer, lock (steel) for 1/4 cap screw
1	1/4 - 20 x 5/8 Allen oval pt. set screw
1	Nut, lock (steel) for 1/4 - 20 set screw
7	5/16 - 18 x 7/8 lg. hex. head bolt (steel)
7	Washer, lock (steel) for 5/16 bolt

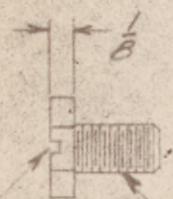


#3 DRILL  $\frac{1}{2}$  DEEP  
 $\frac{1}{4}$ -28 N.F. TAP  $\frac{7}{16}$  DEEP



BRASS  
 1-REQUIRED

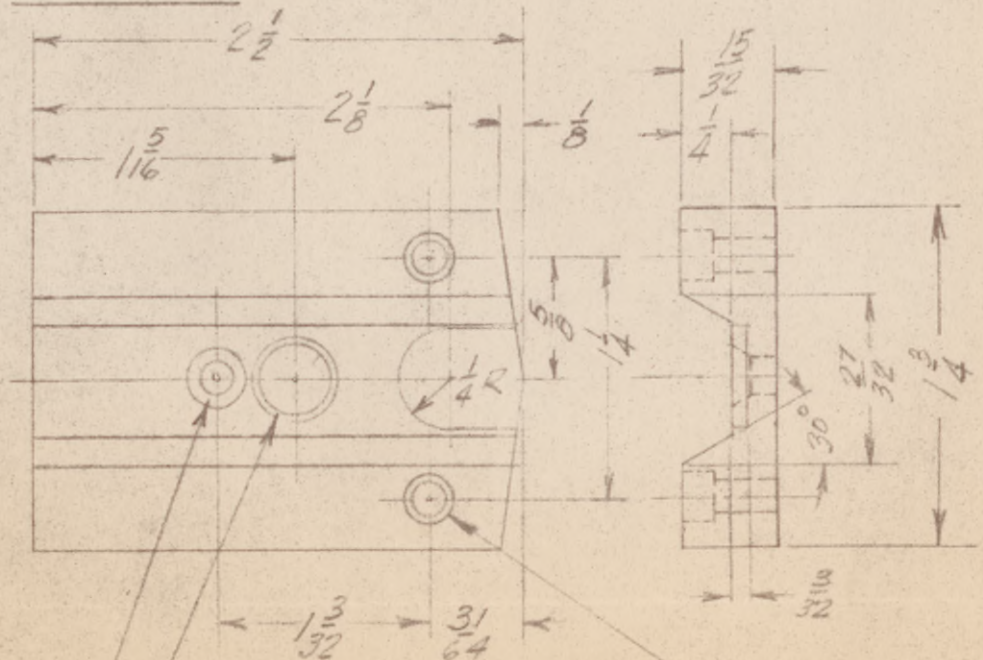
$\frac{1}{32}$  CHAMFER



SLOT  $\frac{1}{16} \times \frac{1}{16}$   
 $\frac{1}{4}$ -28 N.F. THREAD

$\frac{1}{4}$ -28 x  $\frac{7}{16}$  LG. STD CAP SCREW  
 CUT OFF HEAD AS SHOWN

1-REQUIRED



#0 DRILL THRU  
 $\frac{3}{8}$ -24 N.F. TAP THRU  
 #19 DRILL  $\neq$  CT'SK FOR  
 #8-32 FT H'D MACH. SCREW

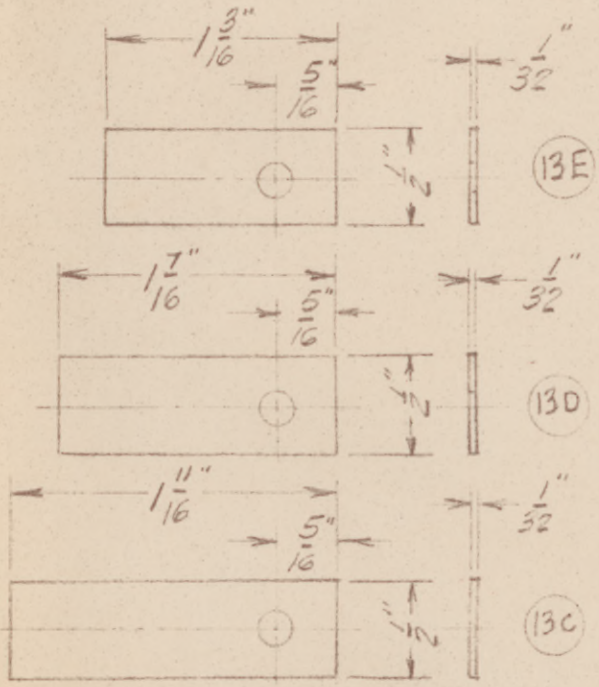
#19 DRILL THRU  
 $\frac{9}{32}$  COUNTERBORE  $\frac{5}{32}$  DEEP  
 2-HOLES

FIG. 1









DETAIL # 12 & # 13

CHANGE THICK. FROM  $\frac{1}{16}$ " TO  $\frac{1}{32}$ " ALL OTHER DIMENSIONS REMAIN THE SAME

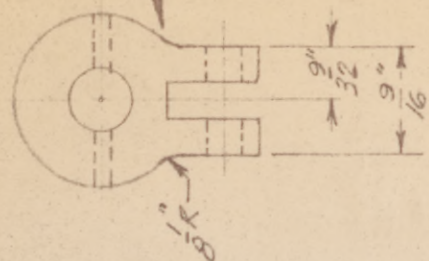
NOTE:

4-REQUIRED OF EACH SPRING 12, 13, 13A, B, C, D, E & F

MACH. BOLT LENGTH CHANGED

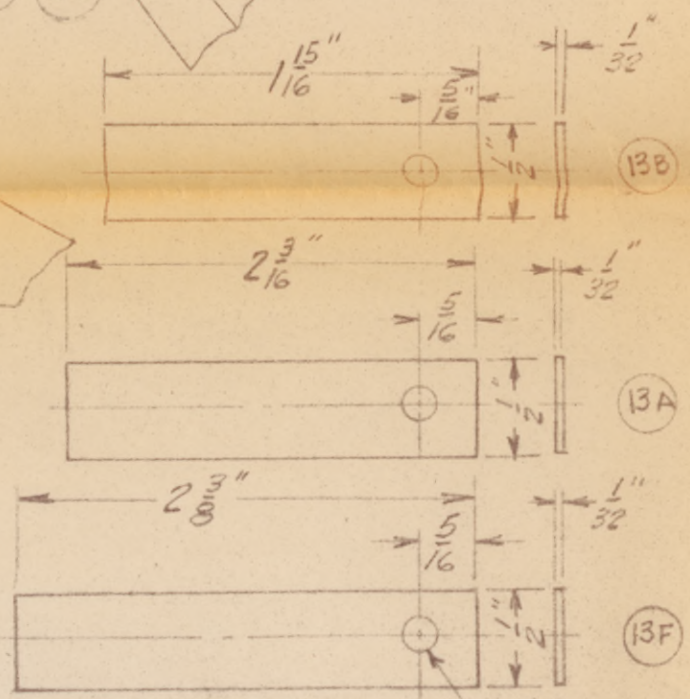
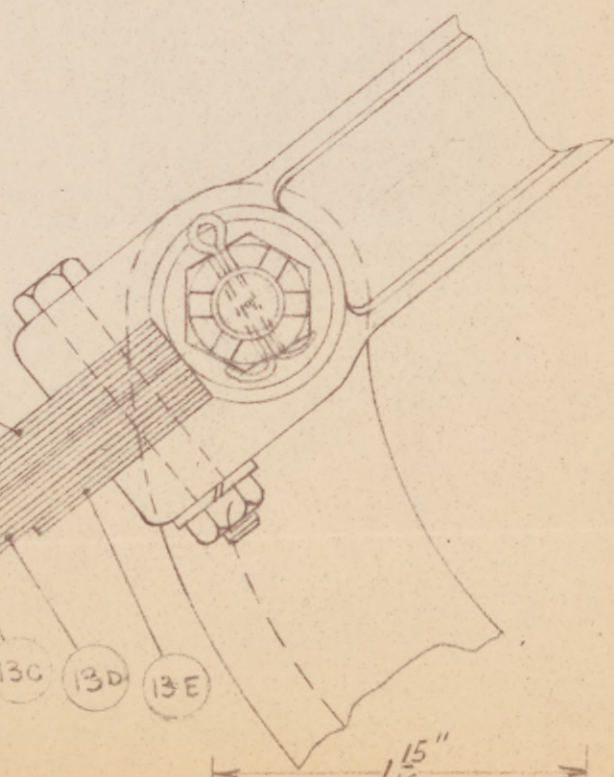
#10-24 x  $\frac{7}{8}$  Lg.

$\frac{1}{16}$ " SPACER



DETAIL # 14

ALL OTHER DIMENSIONS REMAIN THE SAME AS ON DETAIL DRG. DATED MAY 4, 1944



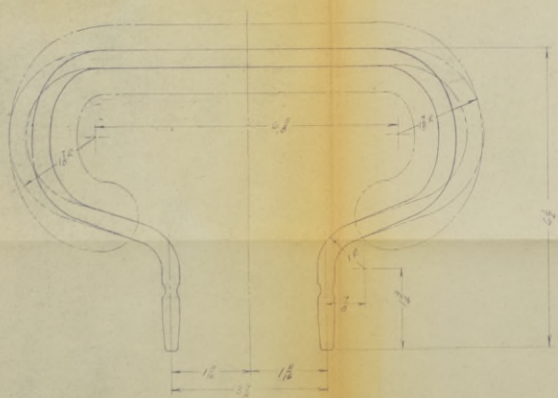
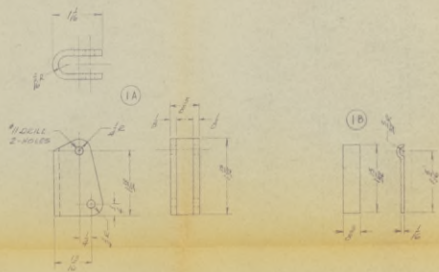
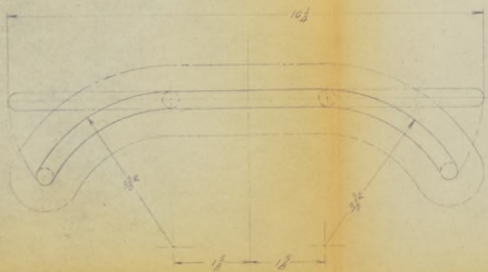
#11 DRILL ALL SPRINGS

FIG. 3









DETAIL DRAWING OF HEADREST FOR REFLEX SIGHT MOUNT

ARMED MEDICAL RESEARCH LABORATORY

DESIGN BY J. TOL. R. S. BARKETT DRAWN BY L. E. ARDOLD

REVISIONS NOT INDICATED APRIL 7, 1944

SCALE FULL SIZE

OCT 14, 1944

