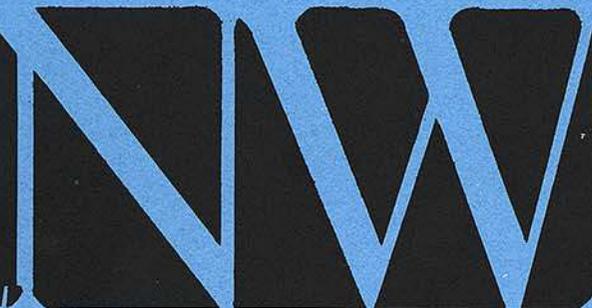


50 ROUND MAGAZINE FOR M-16 RIFLE

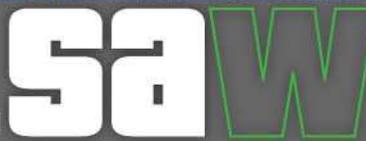
Carroll D. Childers
Joseph C. Monolo

U. S. NAVAL WEAPONS LABORATORY
DAHLGREN, VIRGINIA



Distribution limited to U.S. Gov't. agencies only; Test and Evaluation; February 1971. Other requests for this document must be referred to the Naval Weapons Laboratory.

**DIGITIZED FOR
YOUR REVIEW AT**
WWW.SMALLARMSOFTHEWORLD.COM



ORIGINAL PROPERTY OF



Defence Academy
of the United Kingdom

U. S. NAVAL WEAPONS LABORATORY

Dahlgren, Virginia

22448

Steven N. Anastasion, Capt., USN
Commander

Bernard Smith
Technical Director

NWL Technical Report TR-2536

February 1971

50 ROUND MAGAZINE FOR M-16 RIFLE

by

Carroll D. Childers

and

Joseph C. Monolo

Engineering Department

Distribution limited to U. S. Government agencies only; Test and Evaluation; February 1971. Other requests for this document must be referred to the Naval Weapons Laboratory.

FOREWORD

The Vietnam Laboratory Assistance Program (VLAP) requested that the Naval Weapons Laboratory, Dahlgren, design, develop, and test a fifty round magazine for the M-16 rifle to provide sustained firepower.

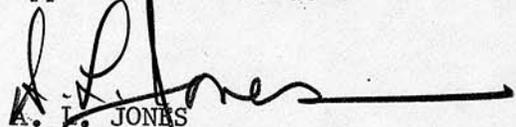
Sincere gratitude is extended to the U. S. Naval SEAL Team Two who carried out evaluation of the magazine under combat conditions. It is also a pleasure to acknowledge the assistance of the Field Test Engineers of Colt Industries for acquiring the weapons and components necessary for study and testing.

This report was reviewed by:

D. W. Culbertson, Head, Mechanical Design Branch.

J. J. Glancy, Head, Product Engineering Division.

Approved for Release:


A. I. JONES
Head,
Engineering Department

ABSTRACT

The Naval Weapons Laboratory, Dahlgren was assigned development of an increased capacity magazine for the M-16 rifle to enhance firepower. A 50 round magazine was fabricated and underwent CONUS and in-country (Vietnam) evaluations. These evaluations revealed the magazine to be applicable to the tasks, reliable, and durable. However, modifications to the proposed design were suggested and effected. The improved design satisfactorily passed required firing tests, and is being recommended for future limited production.

TABLE OF CONTENTS

	<u>Page</u>
FOREWORD	i
ABSTRACT	ii
BACKGROUND AND INTRODUCTION	1
DESIGN THEORY	1
DESCRIPTION	2
DEVELOPMENT	6
EVALUATION	9
CONUS	9
In-Country	9
CONCLUSIONS	16
RECOMMENDATIONS	16
APPENDICES	
A. EVALUATION REPORTS FROM OPERATING FORCES	
B. DISTRIBUTION	

BACKGROUND AND INTRODUCTION

In order to achieve a "quick reaction" capability to respond to urgent field requirements of the operating forces in Vietnam, the Director of Naval Laboratories established the Vietnam Laboratory Assistance Program (VLAP). Representatives from the Naval Weapons Laboratory, Dahlgren (NWL/D) have served four month tours of duty in Vietnam as members of the Naval Research and Development Unit - Vietnam (NRDU/V).

In 1968, the Naval Weapons Laboratory's VLAP representative devoted a large portion of his tour of duty to the needs of the U. S. Navy SEAL Teams operating in the MeKong Delta. From this affiliation came a requirement for sustained firepower for the M-16 rifle in order to provide a high volume of fire during the initial moments of enemy contact.

DESIGN THEORY

Conventional box magazines utilize a coil spring for feeding ammunition into the rifle. Because coil springs have a uniform spring constant, inherent problems confront the designer from the beginning due to the fact that the spring loading increases with the number of rounds loaded. Therefore, NWL selected the constant force spring as a solution to this problem.

The constant force spring is a coiled metal band which resists uncoiling with a force that does not increase with linear displacement. It is a prestressed strip of flat spring stock which coils tightly around a bushing or around successive layers of itself as shown in Figure 1.

Operationally, when the spring is deflected by pulling out the outer end of the coil, Figure 2, the following occurs:

- (1) A resisting force P results.
- (2) Force P has a line of action through the bushing.
- (3) Force P does not increase with increasing deflection (extension) as in a conventional extension spring.
- (4) The change from the original curvature of the material to a straightened condition occurs in the short zone X.
- (5) After passing through zone X, the material L flattens (though not completely) in the direction of pull.
- (6) In the straightened material L, force P results from the tendency of the material to recoil around the bushing. This high recoiling force is related to the configuration in zone X.
- (7) There is no friction inherent in the spring. The only evidence of friction is in the bearing of the bushing.

By a graphical description of load-deflection characteristics, we can explain how a constant-force extension spring reacts when load is applied causing it to deflect or extend. The relation of the load to the deflection of this spring, the gradient K , is expressed in terms of pounds load, P , per inch of deflection, L , and the relationship is plotted in the force deflection curve in Figure 3. A comparison between the zero gradient (no load) of a constant-force extension spring and the positive gradient of a conventional extension spring is shown in this graphical description where line K represents the force versus deflection characteristics of the constant-force spring and line K' represents the force versus deflection characteristics of the conventional spring.

The load of a constant-force (zero gradient) spring can be calculated and a spring made to load specifications. The force developed by a constant-force extension spring is related to the material width b and thickness t by the expression

$$P = Qbt$$

where Q is a factor based on effective working stress and modulus of elasticity.

The constant-force extension spring is basically a high-stress, long-deflection device. It offers great advantages when very low or high initial force (up to maximum rating) at initial deflection is desired, where space is a factor, and where very high cycle life is not a requirement. Like the conventional spring, the constant-force spring stores energy by being forcibly stretched from a "relaxed" position. To release its energy, the constant-force spring recoils around its bushing and exerts the pull. To provide a means of attachment, the free end of the constant-force spring can be straightened or looped, blanked and punched, or spot welded.

DESCRIPTION

The 50 round magazine, Figure 4, is fabricated in halves from 6061 T-6 aluminum and joined by welding along its longitudinal mating surfaces. The upper portion of the magazine is presently made with no curvature due to the limitations imposed by the M-16 magazine receiver. The lower portion of the magazine is designed with a curvature which coincides with that fan formed by arranging the tapered case ammunition side by side. The curved portion does not join with the straight portion of the magazine tangentially. Rather, it is offset toward the projectile end of the round to account for the accumulated diametral change in the tapered rounds stored in the straight section. In effect, this allows line contact over the entire length of the tapered shell case between successive rounds throughout the fully loaded magazine. A blending radius is provided to assure smooth transition at the junction and to prevent over-stressing the spring as it is extended in an unconventional manner. A cross section shows the magazine to be basically

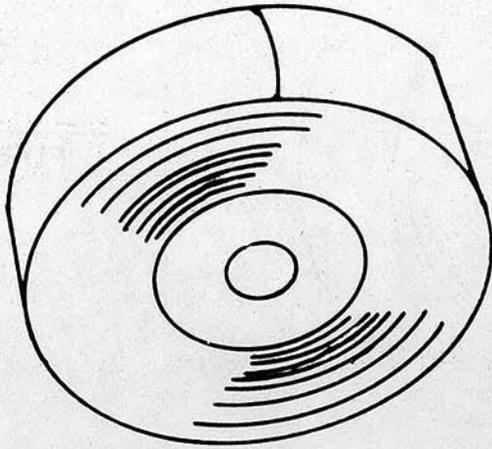


FIGURE 1

THE CONSTANT-FORCE EXTENSION SPRING IN RELAXED POSITION RESEMBLES A TIGHT ROLL OF METAL TAPE. IT IS USUALLY MADE OF STAINLESS STEEL OR HIGH-CARBON SPRING STEEL.

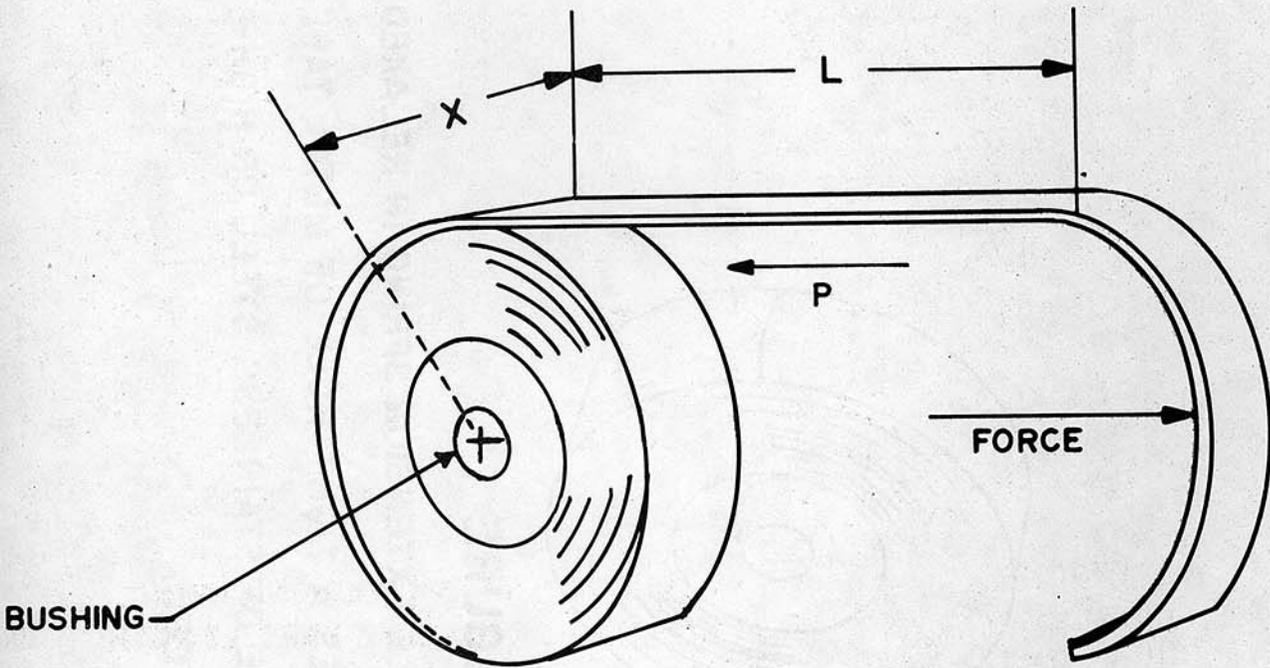


FIGURE 2

THE CONSTANT-FORCE SPRING DEVELOPS ITS RESISTING FORCE INCREMENTALLY RATHER THAN CUMULATIVELY AS EXPLAINED IN THE TEXT.

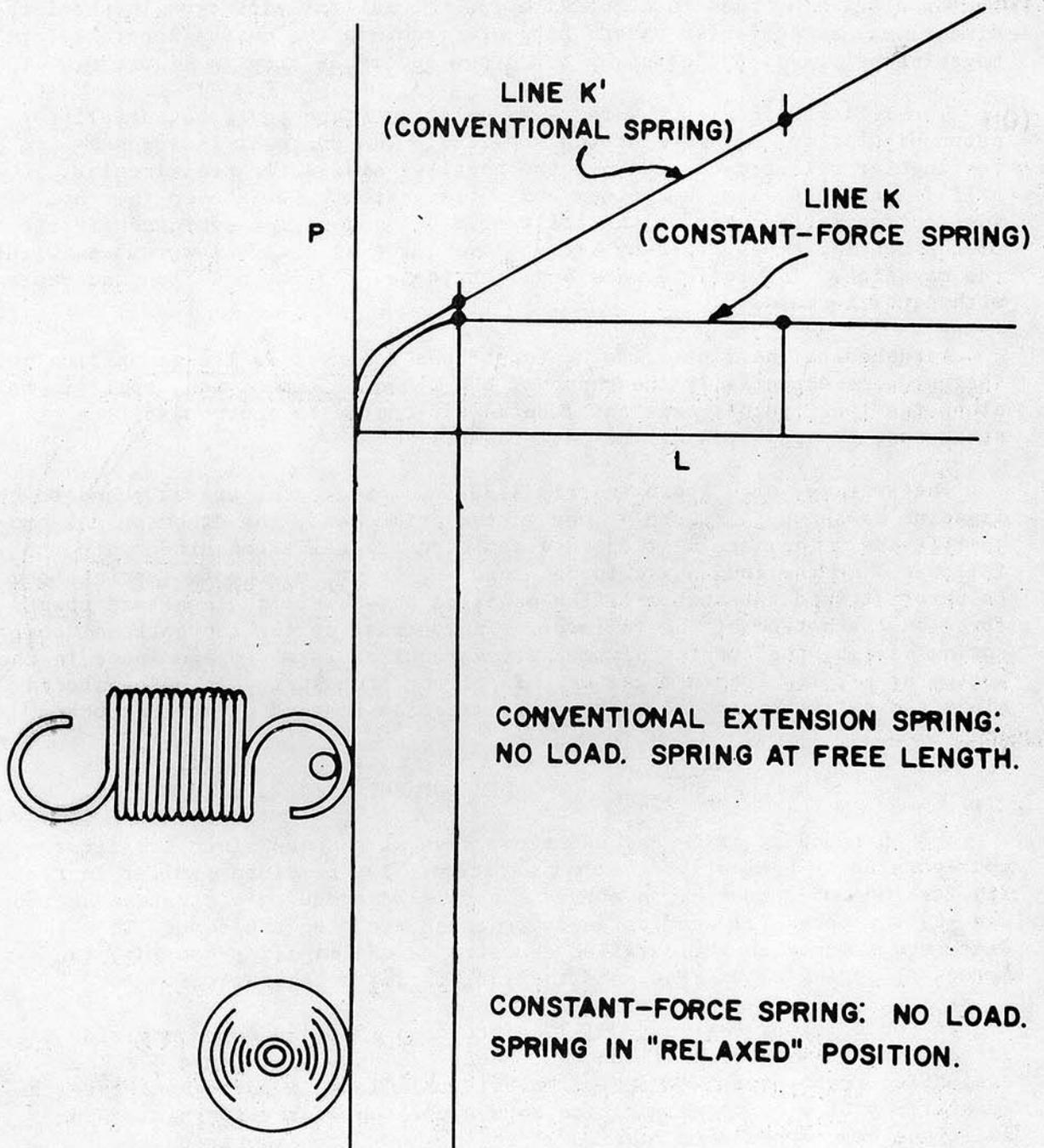


FIGURE 3

RELATIONSHIP BETWEEN LOAD AND DEFLECTION FOR CONVENTIONAL EXTENSION SPRING AND CONSTANT-FORCE SPRING.

rectangular. In order to compensate for the lateral variation in shell case dimensions, semicircular raised ribs are machined the entire length of both magazine halves as indicated by the cross sectional view in Figure 4.

The follower in Figure 4 is rectangular in shape and substantially perpendicular to the sides of the magazine. The follower includes a rectangular relief machined into two parallel sides, two semicircular reliefs machined into the bottom and a flat, smooth surface on the top. The rectangular reliefs on the follower sides engage the semicircular ribs of the housing sides, thereby acting as a guide as the follower moves within the magazine. The follower has been fabricated from both Teflon and Pactene with equal success.

Attached to the flat, smooth, top of the follower is the ammunition guide. The guide is essentially the shape of one round of ammunition, split in half along the longitudinal axis and mounted off-center to accommodate the staggered, tapered rows of the cartridges.

The springs, with approximately 3.30 lb. force each, are attached to the magazine as shown in Figure 4, one on the primer end, the other on the projectile end. They are nestled in a semicircular relief machined into the follower. As the rounds are loaded into the magazine, the two springs begin to unroll toward the bottom of the magazine and maintain a constant upward force on the bottom of the follower. In contrast to the conventional coil spring design, the constant force spring requires less storage space in the bottom of a fully loaded magazine. In effect, the spring is being stored along the entire front and back of the magazine instead of at the bottom.

DEVELOPMENT

The 50 round magazine has undergone several changes since its first configuration. Basically, the configurations have remained similar in that (1) for the outer housing, a curved shape is attached to a straight section, and (2) the mechanism and inside components have been the same. The differences occur in the detailed geometry of the magazine housing, the method of spring attachment, and the inside rib configurations.

In the original design (MOD 1), a standard issue 20 round magazine was fitted with an extension of constant radius as shown in Figure 5. The evaluation results of this design are given in Table 1 and demonstrate the feasibility of a 50 round magazine to use constant force springs. Nine additional magazines were fabricated in the MOD 1 configuration.

By testing and evaluating these magazines, two inherent problems became evident. First, the magazines were generally sluggish in feeding, and secondly, the primer end of the rounds tended to seat too low causing the bolt to "pick-up" the round in the middle of the case. These two problems were apparently a result of the inability of the transition zone, between the housing's straight and curved sections, to account for the divergence inherent in tapered cartridge cases.

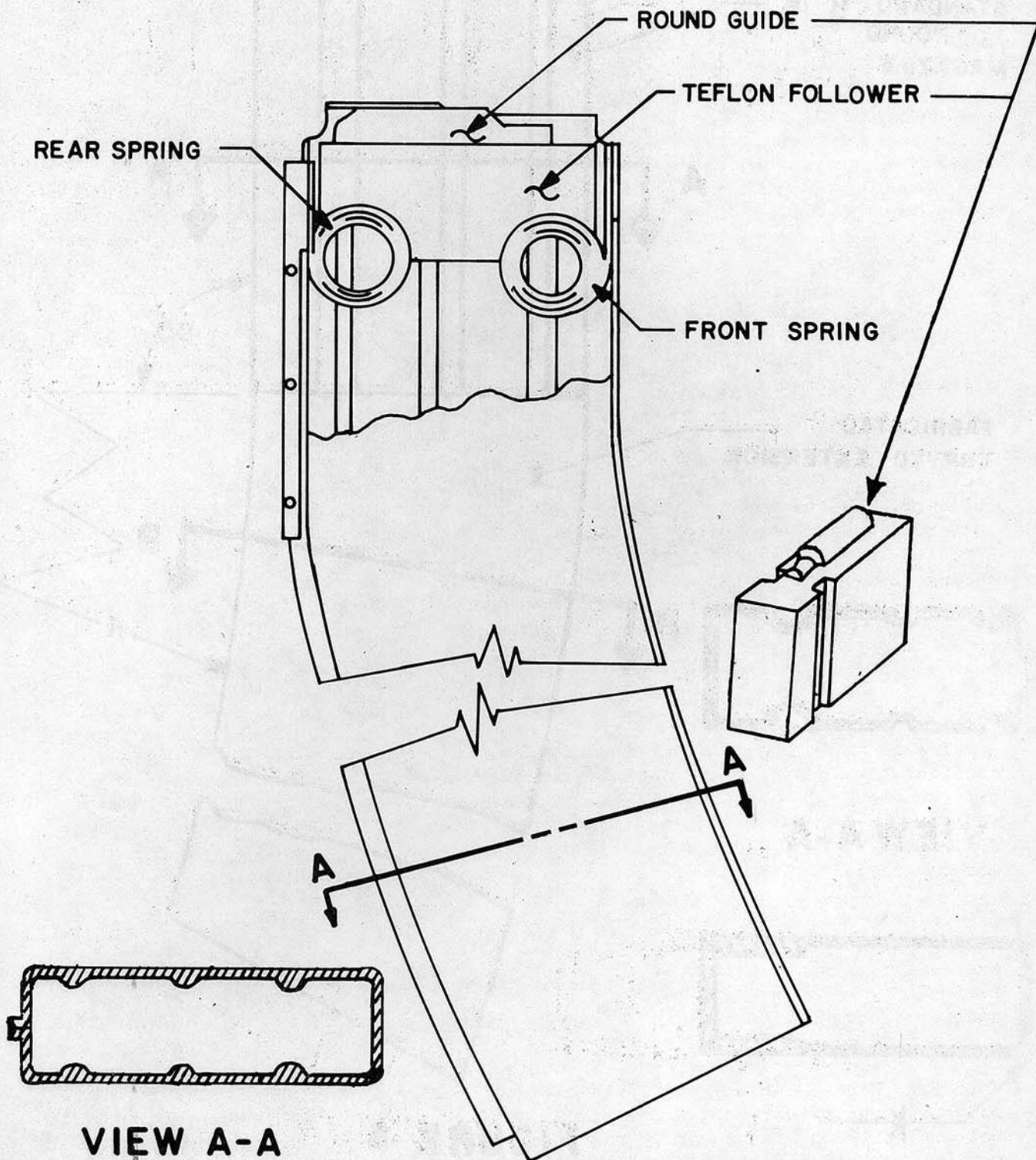
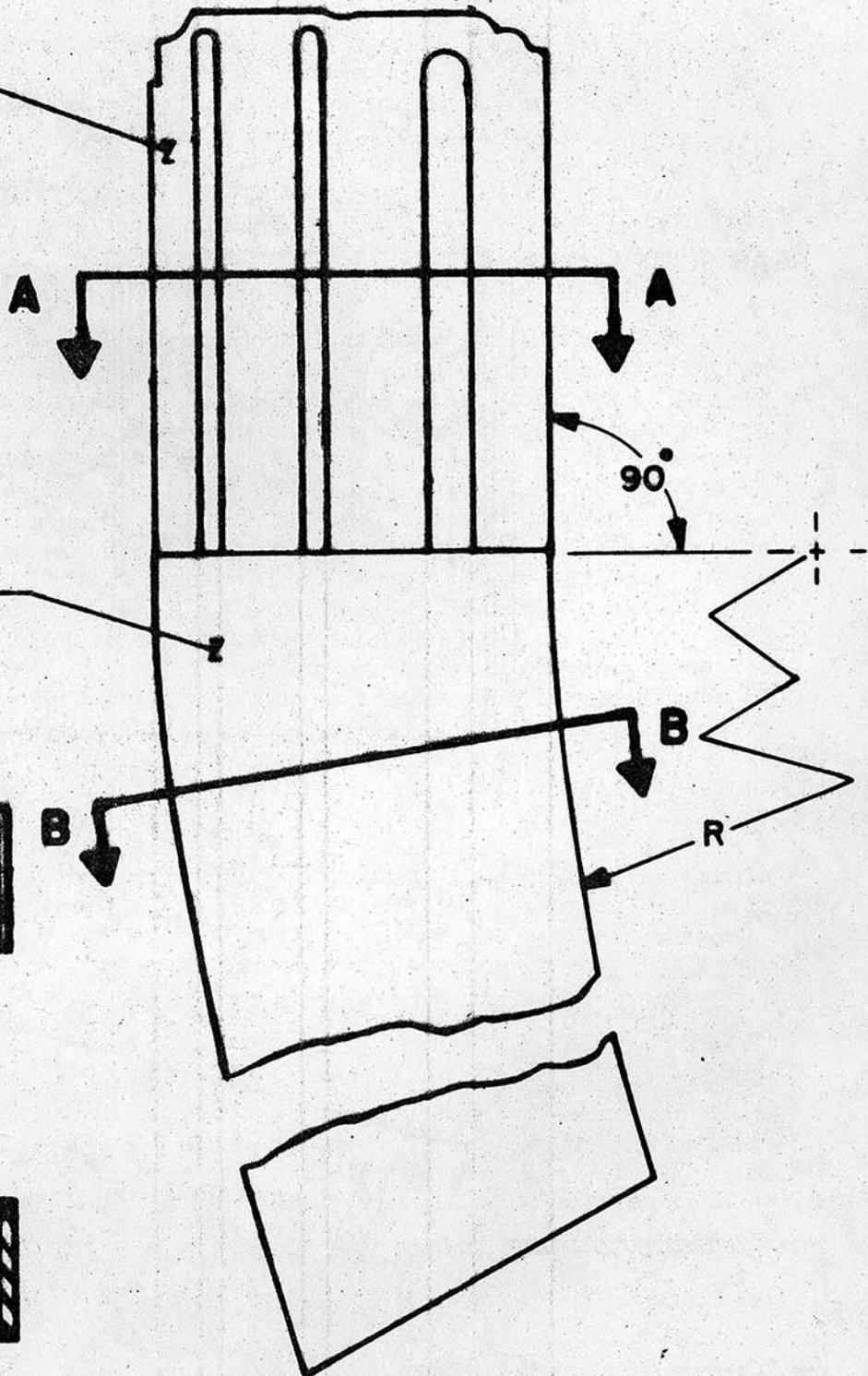


FIGURE 4

BANANA SHAPED 50 ROUND MAGAZINE FOR
M16 RIFLE

STANDARD M-16
20-ROUND
MAGAZINE



FABRICATED
CURVED EXTENSION

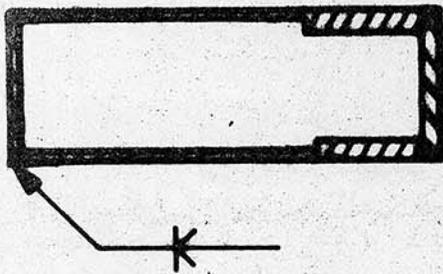
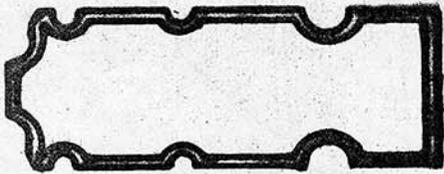


FIGURE 5

MOD I 50 ROUND MAGAZINE

To compensate for the two problems which occurred in the MOD 1 design, the curved part of the MOD 2 magazine housing was offset at $10^{\circ}47'$ to the straight section, as shown in Figure 6. The entire outer body of this magazine was machined in halves instead of using a straight section of a standard magazine welded to a machined curved section. Forty-two magazines of this design were fabricated. Of these, approximately one-third demonstrated the same type of failures as occurred in MOD 1. The magazines which passed CONUS evaluation were shipped to Vietnam for in-country evaluation. These in-country results are reported in Appendix A.

From the conclusions of the in-country test and evaluation, MOD 3A and MOD 3B configurations were designed and fabricated. The MOD 3A design, Figure 7, incorporates a $10^{\circ}47'$ offset as does the MOD 2 design, but the points of offset have a blending radius to avoid a sharp contour which would eventually cause spring failure by fatigue cracking. In addition, the rounds in the MOD 3A design are given additional clearance along their longitudinal axis by extending the straight section on the primer end of the magazine an additional distance A (Figure 7) down from the magazine lips before picking up the blending radius to the curved section. MOD 3B, Figure 8, was machined with the straight section meeting the curved section tangentially. Although this design is similar to that of MOD 1, it differs in that the interior rib configuration reduces the drag which was present in the MOD 1 design. In addition, the spring tension was increased approximately 27%. The housing of both styles was machined in two sections from 6061-T6 aluminum and joined by welding. The inside ribs on both were semicircular in cross section as opposed to the truncated-triangular cross section of earlier models.

Figure 9 illustrates the different combinations of follower and guides used on all MOD's during CONUS evaluation. View A illustrates the combination used presently for MOD 3A.

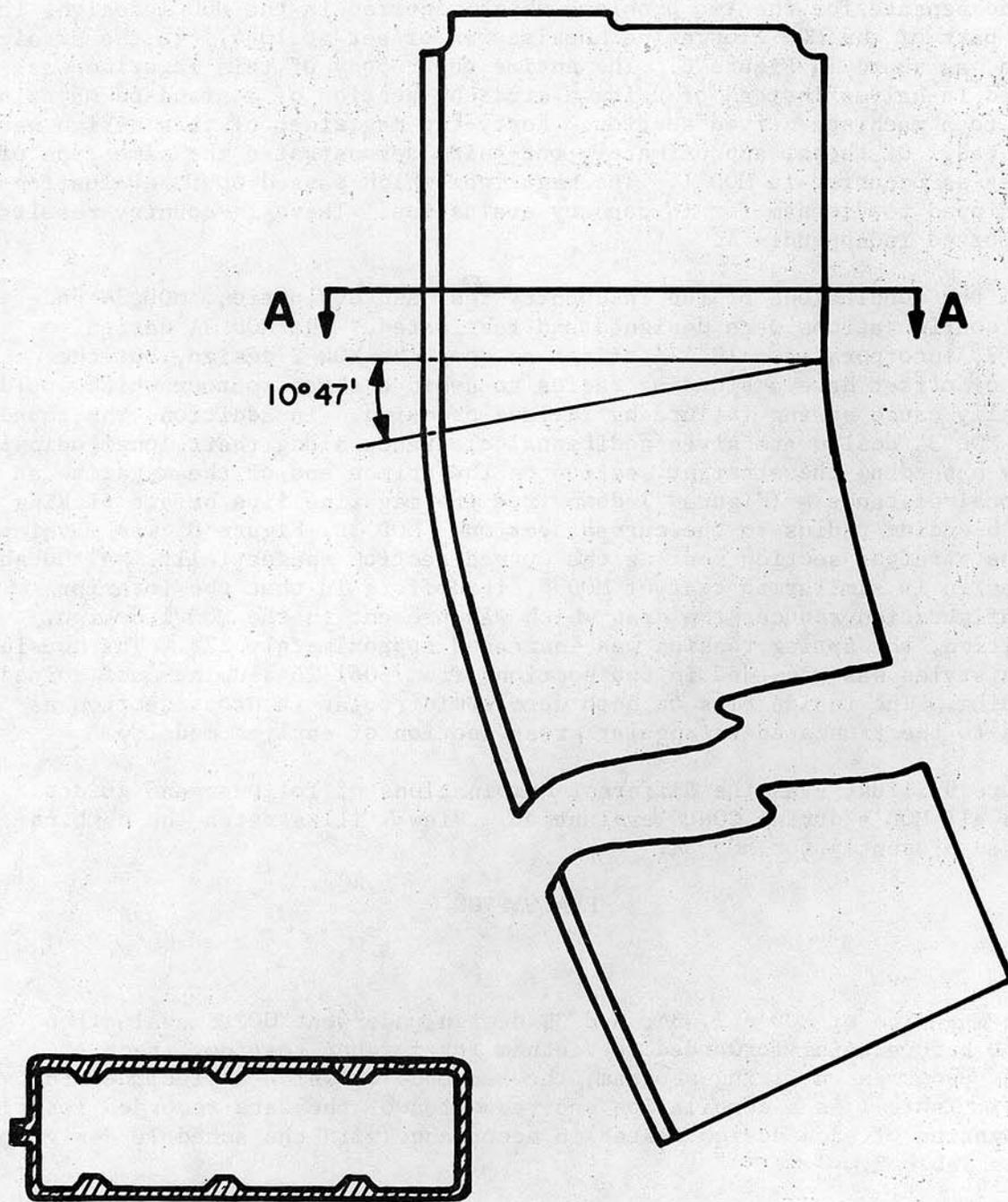
EVALUATION

CONUS

Each magazine of MOD's 2, 3A, and 3B design underwent CONUS evaluation at NWL/D before being forwarded to Vietnam for further testing. Each magazine underwent a firing program, the sequence of which is included in Table 2. Table 1 is a compilation and reduction of the data recorded for each magazine of each design tested in accordance with the schedule designated in Table 2.

In-country

Forty-two MOD 2 magazines were fabricated, 32 of which were sent to NRDU-V for in-country evaluation by the operating forces. One was evaluated by the Air Force Base Defense at Phy Cat for a period of six weeks. Four magazines were evaluated informally by the First Reconnaissance Battalion, 1st Marine Division, and by the First Force Reconnaissance Company, FMFPAC at Danang. The remainder of the magazines were evaluated by U. S. Navy SEAL Team Two in the MeKong Delta. Evaluation reports from the operating forces are enclosed in Appendix A.

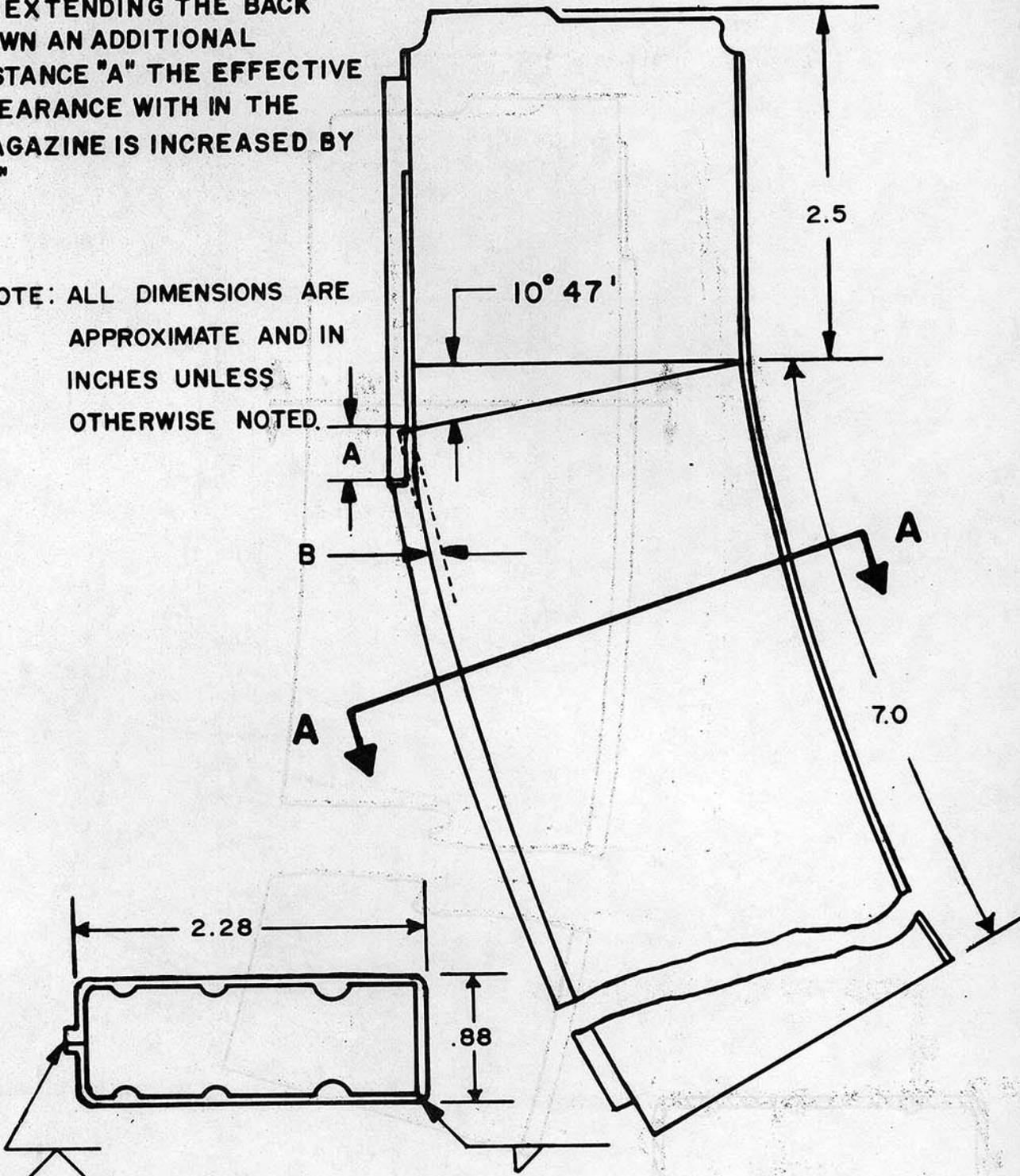


VIEW A-A

FIGURE 6
MOD 2 50 ROUND
MAGAZINE FOR M16 RIFLE

BY EXTENDING THE BACK
DOWN AN ADDITIONAL
DISTANCE "A" THE EFFECTIVE
CLEARANCE WITH IN THE
MAGAZINE IS INCREASED BY
"B"

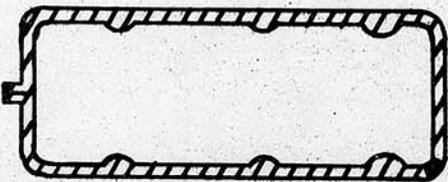
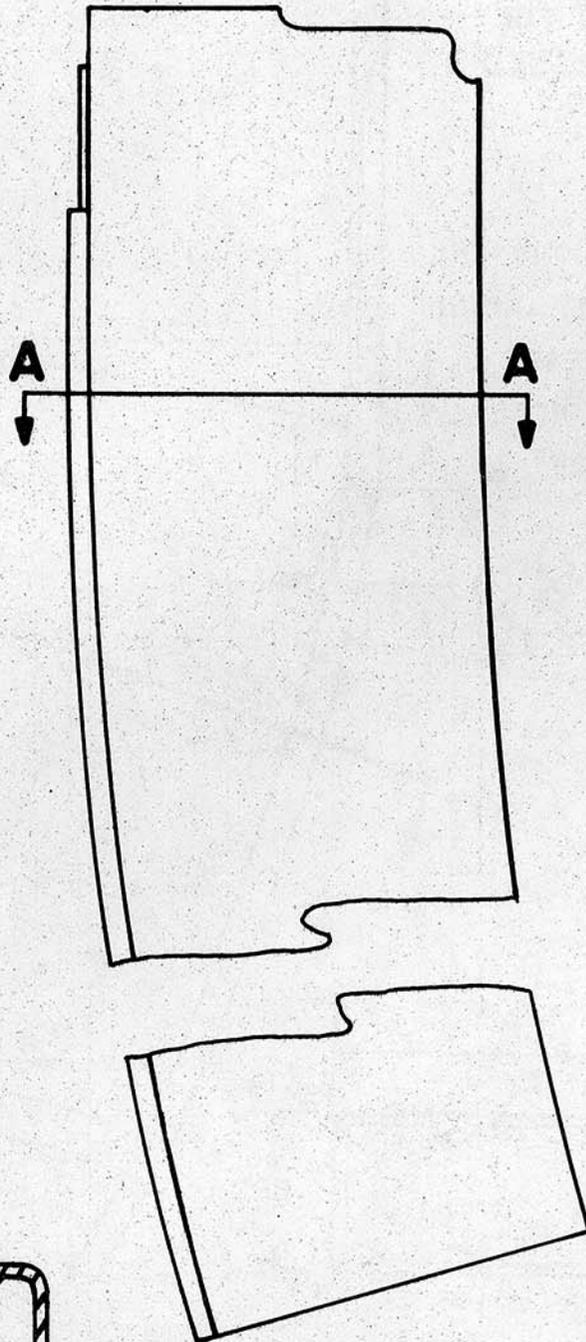
NOTE: ALL DIMENSIONS ARE
APPROXIMATE AND IN
INCHES UNLESS
OTHERWISE NOTED.



VIEW A-A

FIGURE 7

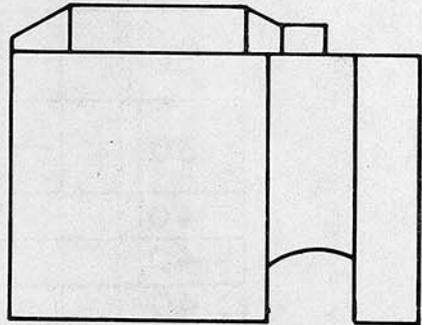
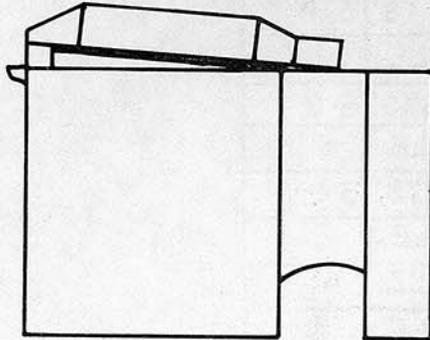
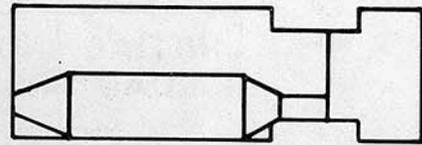
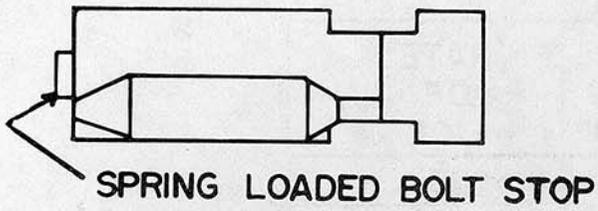
**MOD 3 A 50 ROUND
MAGAZINE FOR M16 RIFLE**



VIEW A-A

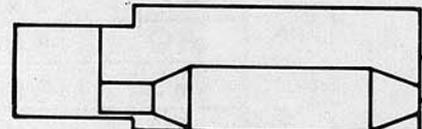
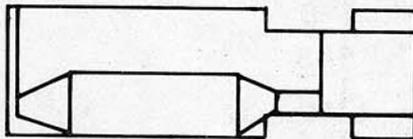
FIGURE 8

MOD 3 B 50 ROUND MAGAZINE FOR M16 RIFLE

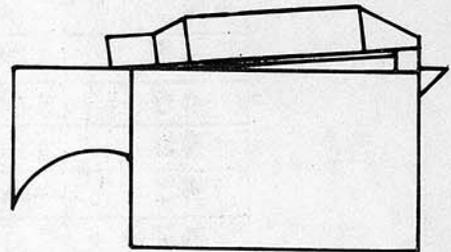
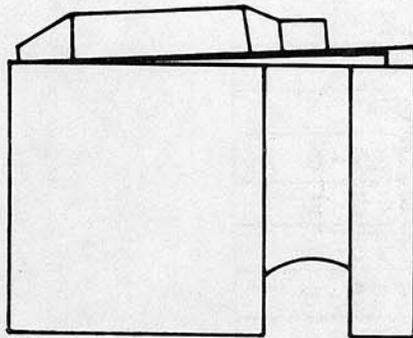


A

B

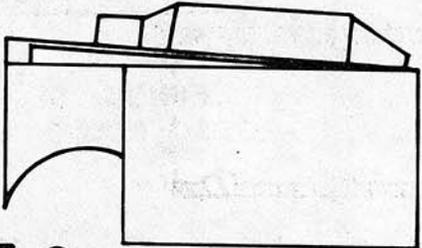
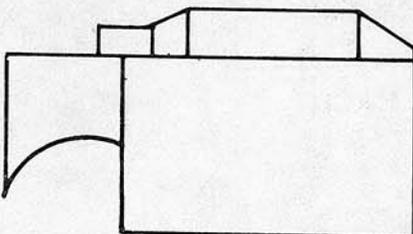
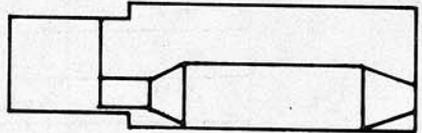
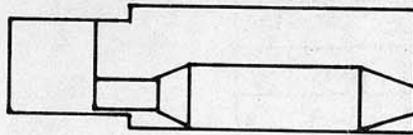


SPRING LOADED BOLT STOP



C

D



E

F

FIGURE 9

**INTERNAL COMPONENTS FOR 50 ROUND
MAGAZINE**

INITIAL LOAD	NO. OF ROUNDS FIRED	RATE OF FIRE
30	10	SINGLE
	20	BURSTS: 5-8
30	10	SINGLE
	20	BURSTS: 5-8
30	10	SINGLE
	20	BURSTS: 5-8
40	10	SINGLE
40	10	SINGLE
40	10	SINGLE
40	40	SINGLE
40	3 BURSTS	BURST: 5-8
40	3 BURSTS	BURST : 5-8
40	3 BURSTS	BURST : 5-8
40	40	BURST : 5-8
45	10	SINGLE
45	10	SINGLE
45	45	SINGLE
45	3 BURSTS	BURST: 5-8
45	3 BURSTS	BURST : 5-8
45	3 BURSTS	BURST : 5-8
45	45	BURST : 5-8
47	10	SINGLE
47	10	SINGLE
47	47	SINGLE
47	3 BURSTS	BURST: 5-8
47	3 BURSTS	BURST : 5-8
47	3 BURSTS	BURST : 5-8
47	47	BURST : 5-8

FIRING SEQUENCE FOR EACH
50 ROUND MAGAZINE

TABLE 2

TABLE 1

CONUS EVALUATIONS FOR ALL MAGAZINES

MOD	MAGAZINES NO.	APPROX. ROUNDS PER MAGAZINE	OBSERVATIONS (Type of Failures)
1	1	1000	No failures to feed
	2, 3, 4, 5, 6, 7, 8, 9, 10	500	1. Magazine sluggish 2. 1/2 Feed: i.e., primer end of bullet too low, causing bolt to pick up bullet in the middle of the cartridge case
2	3, 4, 5, 8, 10, 12, 13, 16, 17, 18, 20, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33-42*	100	No failure to feed
	1, 2, 6, 7, 9, 11, 14, 15, 19, 21, 22, 28	100	1. Magazine sluggish 2. 1/2 Feed: i.e., primer end of bullet too low, causing bolt to pick up bullet in the middle of the cartridge case
3	1	1500	No failure to feed
	2, 3, 4, 5, 6, 7, 8, 9, 10	500	No failure to feed
	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	100	Magazine too sluggish causing bolt to pass over rounds without picking up round

*33-42 were rejected prior to test firing due to failure to feed manually.

MOD 3A magazines were fabricated to comply with the recommendations of the NRDU-V final report as follows:

- a. The tension of the constant force feed spring was slightly increased.
- b. A bolt stop was included in the magazine to keep the bolt in the rearward position after the last round is fired.
- c. The junction of the curved portion of the magazine housing at the straight section was blended smooth to prevent spring kink.

Ten magazines of MOD 3A design were tested at NWL/D. Seven of the ten have been sent to Vietnam for further evaluation by SEAL Team Two.

CONCLUSIONS

CONUS evaluation concluded that the proper functioning of the magazine increased as the contact area between the rounds and the magazine decreased. It was found that the semicircular inside ribs provide less friction against the rounds.

The U. S. Navy Research and Development Unit, Vietnam (NRDU-V) final report, supported by both CONUS and In-country evaluations, has concluded that:

- (1) "The MOD 3A fifty round magazine for the M-16/CAR-15 rifle has application in the mission tasks of the SEALS and FORCE RECON type groups".
- (2) "The MOD 3A fifty round magazine for the M-16/CAR-15 rifle is operationally reliable providing proper cleaning and maintenance is performed".

RECOMMENDATIONS

Before a 50 round magazine is released to production, one additional design having a constant radius over the entire length should be evaluated. This radius should conform to the fan formed when tapered rounds are arranged side by side. Engineering drawings of this proposed design made at NWL/D indicate that it will conform to the space limitations of the M-16 rifle magazine receiver. Theoretically, this would be an ideal design for production drawing processes.

The MOD 3A magazine design is then recommended for further limited production. This MOD 3A design is similar to the MOD 2 design which NRDU-V recommended in their final report, but includes their recommended improvements. Complete documentation for the manufacture of the MOD 3A magazine is available at the Naval Weapons Laboratory, Engineering Department, Mechanical Design Branch. Documentation is identified by Naval Weapons Laboratory DL30532, Magazine Assy., 50 Round.

With these recommendations, the VLAP effort in this project is terminated.

APPENDIX A

EVALUATION REPORTS FROM OPERATING FORCES

NRDU-V:JAP:w1k
3900
Ser 157
30 August 1969

From: Chief, U. S. Navy Research and Development Unit, Vietnam
To: Commander U. S. Naval Forces, Vietnam

Subj: Final Report of 50 Round Magazine for M-16/CAR-15 Rifles
(NRDU-V Project 22-69); submission of

Ref: (a) NWL Dahlgren ltr FC-2:FKC:jmy:ms 3900 of 18 Feb 1969 (NOTAL)
(b) NRDU-V ltr 3900 Ser 36 of 24 Feb 1969 (NOTAL)
(c) NWL Dahlgren ltr FPA:JCM:lfe 3900/V of 7 Apr 1969 (NOTAL)
(d) SEAL Team TWO Det ALFA ltr 3960 Ser 102 of 11 July 1969 (NOTAL)
(e) SEAL Team TWO Det ALFA ltr 3960 Ser 114 of 5 Aug 1969 (NOTAL)
(f) S-3 FIRST Force Recon Co. ltr 3/GRW/waw 4600 of 11 Aug 1969

Encl: (1) NWL Dahlgren Photographs of 50 Round Magazine (3)
(2) Sample Users Checklist
(3) Summary of Users Checklists

1. Purpose. The purpose of this project was to design and fabricate a 50 round magazine for use with the M-16 and CAR-15 rifles.

2. Background.

a. In mid 1968, a representative of the Naval Weapons Laboratory (NWL), Dahlgren, Virginia, during his tour with the U. S. Navy Research and Development Unit, Vietnam (NRDU-V), had discussions with various SEAL Team members throughout the Republic of South Vietnam (RVN). These discussions indicated that although the Stoner 63 weapons system provides the capability of a 160 round drum magazine, these systems are in such short supply that only one or two could be provided for each team. In order to provide a high volume of fire during the initial moments of enemy contact, the concept of a 50 round magazine was proposed by reference (a). This proposal was made an official NRDU-V Vietnam Laboratory Assistance Program (VLAP) project by reference (b).

b. Two different 50 round magazines were proposed and fabricated for evaluation. The first of these two types was provided under a contract awarded Colt Industries for 35 units which were delivered to NWL in April and May 1969. These magazines consisted of three 20 round magazines welded together and fitted with a new design follower and Neg'ator spring combination. Upon completion of CONUS tests of these magazines they were distributed to SEAL Team II for evaluation.

c. The second type of magazine was one machined from aluminum and 42 of this type were made from the NWL design by the Naval Ordnance Station, Forest Park, Illinois. These units were fitted with the same follower and Neg'ator spring combination.

d. A comparative analysis of the two types of magazines was made by NWL and the results of that comparison resulted in the forwarding (reference (c)) of the second type of magazine to RVN for combat evaluation by SEAL and MARINE RECON FORCE personnel. These magazines were received at NRDU-V and distributed to the operating forces in early July 1969.

3. Objectives. The objectives of the evaluation of the 50 round magazine were to:

a. Determine its operational applicability for use by SEAL, MARINE RECON and similar groups.

b. Determine its operational reliability.

c. Determine the durability of the new type Neg'ator springs.

4. Discussion and Findings.

a. Prior to the receipt of the test 50 round magazines, the NWL Project Engineer and magazine designer C. D. Childers, arrived in RVN as an NRDU-V VLAP representative at the THIRD Marine Amphibious Force Headquarters in Danang, RVN. Upon receipt of the prototype magazines, they were inspected by Mr. Childers for proper functioning. At this time it was noted that the magazine with base plate would hold only 47 rounds. Several of the units were found to have a faulty feed cycle and were removed from those to be distributed. The remainder of the magazines were distributed equally between the FIRST Force Reconnaissance Company of the FIRST Marine Division (Rein) and SEAL Team TWO Detachment ALFA.

b. The SEAL's and the RECON personnel both test fired in a secure area all of the magazines issued to them to insure the proper operation of the equipment and to familiarize themselves with the characteristics of the M-16/CAR-15 rifles using this increased load of ammunition. Subsequently, the magazines were used on about ten SEAL operations and eight RECON patrols. In all, approximately 40 different men had possession and use of the magazine and only six feed failures were reported. Each of the magazines had an average of 500 rounds fired through them. Five of the feed stoppages were attributable to overloading and poor cleaning procedures. The sixth stoppage occurred when the Neg'ator spring folded over the top of the follower and kinked. This last magazine has been returned to NWL for analysis. There were no failures to feed in a combat situation.

c. The evaluation as conducted by SEAL Team Two Detachment ALFA was reported in references (d) and (e). These two reports indicated that the 50 round magazine is operationally suitable for SEAL Team use. The one drawback concerning this magazine for SEAL use came from one 14 man platoon and apparently concerning only one phase of their operations. This comment was that the magazine was too bulky and too long and that when in defensive positions the magazine's length caused the user to expose more of his body when in the prone position.

d. The report of the FORCE RECON evaluation, reference (f), showed that the primary use of the magazine was by the forward security man on the patrol. The following paragraphs are quoted directly from that report.

"The 50 round magazine has proven to be a very effective piece of combat equipment. In the month of July the magazine was used on eight reconnaissance patrols. It was used effectively in three contacts with the enemy. On 13 July 1969 the forward security man of a reconnaissance patrol was equipped with the 50 round magazine. When the patrol made contact the initial base of fire provided by the point man was sufficient to maintain a fire superiority which killed five NVA.

On 26 July 1969 the magazine was also used by the forward security man of a reconnaissance patrol. The patrol made contact and the tremendous fire power delivered by the 50 round magazine equipped M-16 rifle provided the initial momentum needed to maintain fire superiority.

On 28 July 1969 the 50 round magazine once again proved to be a valuable piece of equipment in a combat situation. A four man element of a reconnaissance patrol were confronted by a larger NVA force. The initial fire power supplied by 50 round magazine coupled with the three other 18 round bursts from the regular M-16 rifles was sufficient to overcome the enemy. The result was four NVA killed and several wounded.

In each combat incident in which the 50 round magazine was employed favorable results occurred. It has the same effect as a light weight machine gun with its initial fire power".

6. Conclusions. The following conclusions are made based on the previous information.

a. The 50 round magazine for the M-16/CAR-15 rifles has an application in the mission tasks of the SEALS and FORCE RECON type groups.

b. The 50 round magazine for the M-16/CAR-15 rifles is operationally reliable providing proper cleaning and maintenance is performed.

c. The new type Neg'ator springs and follower is durable.

7. Recommendations. The following recommendations are made.

a. Prior to any production the following modifications be made to the NWL designed 50 round magazine.

(1) The tension of the Neg'ator spring be slightly increased.

(2) The material from which the rib on the back of the magazine is made be changed to one which has better rust-resistance qualities.

(3) The magazine exterior should be ribbed to allow the proper functioning of the ammunition loading "cheater".

(4) A bolt stop should be included in the magazine to keep the bolt in the rearward position as in the standard 20 round magazine.

(5) The angle bend in the magazine should be curved to facilitate magazine loading.

(6) Base plates should be provided with the magazines.

b. The fifty round magazine should be adopted for use by U. S. Navy SEAL Teams. The magazines should be carried as team equipment and serialized for positive control. The following issue level is recommended.

(1) One magazine per rifleman.

(2) Four magazines for use by LDNN assigned to SEAL Platoons during deployment.

(3) Two magazines for use by ST/PRU advisors.

(4) Two magazines as rotatable spares.

c. The U. S. Marine Corps Development and Education Center, Quantico, Virginia should investigate the adoption of the fifty round magazine for Marine Corps use in specific cases.

d. The Commanding Officer, U. S. FIFTH Special Forces should investigate the adoption of the 50 round magazine for his operational units.

e. The magazine, if adopted in its present length should not be loaded with more than 45 rounds.

D. L. HOWARD

Copy to:

CNO (OP-721)
(OP-07TX)
(OP-345)

CHNAVMAT (Code 03L2)
(Code 0332)
(PM-12)

CINCPACFLT

CINCPAC

DIRNAVLABS

COMUSMACV (MACSA)
(J3-052)

COMOPEVFOR

DEPCONOPTEVFORPAC

CO, III MAG (FRDTSEO)

FMFPAC

CG, 1st MAR DIV (Rien) (G-3)

CG, MCDEED, QUANTICO

HQMC (Code AX-2)

CO, 1st FORCE RECON CO (S-3)

CO, ACTIV, LONG BINH

DIR, ARPA/RDFU-V

DIR, CDTC

CG, 7th AIR FORCE (DAFSC/COL HENDRICK)

COMNAVORDSYS COMHQ (Code 0312B)

COMNAVSPECWARGRUPAC

COMNAVSPECWARGRULANT

OIC, SEAL TEAM TWO, DET ALFA

CO, SEAL TEAM TWO

CO, SEAL TEAM ONE

NOL WHITE OAK (Code 0211)

NWL DAHLGREN (Code FPA)

NWC CHINA LAKE (Code 40703)

CO, 5th SPECIAL FORCES

Summary of Users Checklists

1. Geographic Conditions.
 - a. Terrain: Mud, six inches to four feet in depth (DELTA) and from very dense brush and steep mountains to gentle slopes and trails (I CORPS).
 - b. Temperature Range: 80-100°F, average 94°F.
 - c. Weather Conditions: Variable, from heavy monsoon rains to clear sunny, humid weather.
2. Difficulty in loading magazine. Some difficulty encountered in loading the first ten rounds. A possible cause of this was thought to be the angular bend near the top of the magazine. In addition, the magazine was not ribbed so as to be able to accept the loading "cheater" without slipping.
3. Is magazine too long? No.
4. Approximate time between loading magazine and firing. Time reported between one hour and five days with about an 18 hour average.
5. Did magazine fit loose or tight in rifle? Tight.
6. Did magazine wear from being placed in rifle? No.
7. Did lips of magazine spread after usage? No.
8. How often was magazine cleaned? An average of once.
9. Total rounds fired from magazine. From 200 to 900 with an average of 500.
10. Number of stoppages. Total of six.
11. Does sand/dirt normally encountered on patrol foul magazine? Yes, however, most all users tape all openings to prevent this.
12. Did stoppage occur consistently at any particular point? No.
13. Did stoppage occur with left or right bullet feeding into chamber? Both with no pattern apparent.
14. Users theory as to cause of most frequent type of stoppage. Improper cleaning or a dirty magazine.
15. Generally, how did magazine perform? Very good.
16. Comments. The spring tension should be increased slightly.
17. Recommendations. See report.
18. Preferred size of magazine. 50 rounds.

DEPARTMENT OF THE AIR FORCE

DAFSC

Evaluation of 50 Round Magazine

Chief, NRDUV, Box 20
FPO 96626

1. Attached are the results of our six weeks test of one of your developmental 50 round CAR-15 magazines at Phu Cat.
2. We appreciate being allowed to participate in the field evaluation of this CAR-15 magazine. I am forwarding a copy of the pictures received from you and a copy of our evaluation to our base defense program office at Wright Patterson AFB and would appreciate being advised if the Navy develops a production source for this new magazine.

GERALD K. HENDRICKS, Colonel, USAF
Commander

1 Atch a/s

Final Summation

3 Sep 1969

SUBJECT: Testing of the CAR-15

The magazine will not lock in the M-16 with the bolt forward. The locking catch needs to be a fraction wider. The material at the top of the magazine appears to be too thick and uneven. The front of the bullet is a fraction higher than the rear, so this needs to be modified to where the front of the bullet slants down a fraction. I believe the magazine will then lock in place with the bolt forward. The magazine needs a slot so that the stripper will fit. By placing a stop and dust protector on the bottom, the magazine will only hold 47 rounds but will work perfect. With 50 rounds in the magazine the rollers protrude out too far and I believe this would eventually lead to problems by handing. Over 15,000 rounds were fired using the CAR-15.

CHARLES L. ARNN, TSgt., USAF
NCOIC, Special Activities

OFFICER IN CHARGE
SEAL TEAM DETACHMENT ALFA
FPO SAN FRANCISCO 96627

ST-2/ALFA/BSW/hmc
3960
Ser: 102
11 July 1969

From: Officer in Charge, SEAL Team Detachment ALFA
To: Commander Naval Special Warfare Group, Atlantic

Subj: Report on the Limited Test and Evaluation of Magazine
Fifty (50) Round CTG 5.56 F/M-16A1 Rifle

Ref: (a) SEAL Team TWO ltr Ser 509 of 17 June 1969

Encl: (1) Photo
(2) Users check list

1. This report on the limited T & E of the 50 round magazine for rifle M-16A1 5.56mm.
2. Commanding Officer, SEAL Team TWO established the T & E of the 50 round magazine in Vietnam and directed Officer in Charge, SEAL Team Detachment ALFA to conduct the T & E. This report is submitted in accordance with reference (a).
3. A follow-up report will be submitted when enough time has lapsed is to permit a more amplified and concise report on the use and operation of the 50 round magazine in a combat environment.

B. S. WILLIAMSON

Copy to:
CO, SEAL Team TWO
CO, SEAL Team ONE
SEAL Det ALFA Files
GMCS BARRETT

TABLE OF CONTENTS

1. Abstract
2. Conclusions
3. Recommendations

1. Abstract. The 50 round magazine is a new concept in the follower drive spring, containing two negator springs that drive the teflon follower and 50 rounds of 5.56 ammunition to a feed/chambering position. It was designed to give the shooter a 50 round capability in either automatic or semi-automatic fire. There is at present in custody of SEAL Team Det ALFA, two different fabrications that are referred to in this report as first generation (Figure 1), and second generation (Figure 2). First and second generation are identical internally. They differ in the construction of the magazine body. First generation consists of three M-16 round magazines tack welded together. Second generation is a one piece body. The first generation magazine test and evaluation has sufficient time in-country for a comprehensive evaluation. The second generation has been on test since 24 June 1969; fifteen days from the date of this report. It is believed that the first generation is operationally unsuitable as stated in this report. The second is operationally suitable for SEAL Team use in the Republic of Vietnam.

2. Conclusions. It is concluded that:

a. The first generation 50 round magazine has presented failure to feed 100% of the time in automatic mode and 50% of the time in semi-automatic mode.

b. The failure to feed was caused by mud entering the large openings in the magazine body. The mud encountered on the patrols is in abundance both in the III and IV corps tactical zone area of operation. Mud between the negator springs places them out of round retarding the ability to feed.

c. The magazine fully loaded (50 rounds) allows the first ten to 15 rounds to fall out of the magazine with a slight shake. Also causes the round to rattle.

d. That the shooter at times (firefight or ambush) is unable to determine if the malfunction is due to the magazine's failure or a misfired round.

e. The seven personnel that have used the magazine all have had failure to feed in the two cyclic firing modes. The personnel are all SEAL personnel from different locations in the MeKong Delta. Three of these personnel no longer carry the 50 round (first generation) magazine.

f. The second generation (Figure 2) has had no failure to feed (only 700 rounds fired). Mud is seldom found in the magazine if it has a base plate (all personnel tape or cover the bottom of the magazine).

g. All personnel that have been contacted that are operating with the second generation magazine are more than satisfied, and request more.

3. Recommendations. Officer in Charge, SEAL Team Det ALFA recommends that:

- a. Stop procurement of first generation 50 round magazines due to failure to feed with a full 50 round load.
- b. Procurement of second generation 50 round magazines continue.
- c. A magazine base plate be included.
- d. A metal less susceptible to rust and corrosion or a preservative coating be used on the rear rib of the magazine.
- e. That the first generation magazine in country be used with a reduced load of 30 to 50 rounds, tape all openings, empty magazines after each operation, and replace all first generation 50 round magazines with second generation when available.

NWL/Dahlgren Note of Clarification:

The "first generation magazines" referred to in this report are 50 round magazines fabricated by welding sections of three 20-round magazines together. This was done at the special request of SEAL Team II as an interim measure prior to receipt of the second generation magazines (MOD 2 and 3A). These interim magazines were quite susceptible to damage and the environment and generally speaking, a magazine of this configuration either worked well 100% of the time, or it would not work at all. This configuration of the magazine is not described in this report.

OFFICER IN CHARGE
SEAL TEAM DETACHMENT ALFA
FPO SAN FRANCISCO 96627

ST-2/ALFA/BSW/hmc
3960
Ser: 114
5 Aug 1969

From: Officer in Charge, SEAL Team Detachment ALFA
To: Commanding Officer, SEAL Team TWO

Subj: Report on T & E of Magazine 50 Rounds for Rifle M-16
and XM177E2 5.56MM

Ref: (a) Officer in Charge, SEAL Team Det ALFA ltr Ser 102 of
11 Jul 69

1. The report on the magazine 50 round for M-16 and XM177E2 is forwarded.
2. Commanding Officer, SEAL Team TWO established the T & E of the 50 round magazine in the Republic of Vietnam and directed Officer in Charge, SEAL Team Detachment ALFA to conduct the T & E. This is the second report submitted. (See reference (a)).
3. This is a follow-up report as stated in paragraph 3 of reference (a) and unless otherwise directed will terminate the reporting connected with magazine 50 round for M-16 and XM177E2.

B. S. WILLIAMSON

Copy to:
CO, SEAL Team ONE
Naval Weapons Center (Code 3576)
COMNAVFORV (Code 301B)

TABLE OF CONTENTS

1. Abstract
2. Conclusions
3. Recommendations

1. See reference (a) for Abstract.

2. Conclusions. It is concluded that:

a. The 50 round magazine is operationally suitable for SEAL Team use in the Republic of Vietnam.

b. The opinion of the users are 50% for and 50% against the use of the 50 round magazine as a standard issue magazine for operational use.

c. That one platoon (8th platoon located in My Tho) does not use the 50 round magazine for the reason stated below.

(1) It is too bulky and too long.

(2) Because of its length it hinders the shooter when on ambush, placing the shooter higher off the ground when in a prone position, weapon at the ready, exposing the body 50% more than with the 30 round magazine.

(3) The 8th platoon (14 men) have had little or no trouble with second generation 50 round magazine in its ability to feed, firing over 200 rounds in both a secure area (weapon test fire) and contact with enemy (ambush and firefight).

d. 7th platoon (Nha Be) has had little or no trouble in the 50 round magazine second generation to feed. A limited amount of rounds have been fired by the 7th platoon due to limited operations in preparation for departure to CONUS.

e. 9th platoon (Nha Be) 14 men total in platoon and six of the 14 men carry the M-16 XM177E2 or CAR-15. The six users report little or no failure to feed with second generation 50 round magazine.

f. Opinions differ between personnel from; we don't need any, to replace all presently issued magazines with 50 round types. By far the majority say one per man in a weapon-ready magazine with remainder of basic load 30 round magazines.

3. Recommendations. Officer in Charge, SEAL Team Detachment ALFA recommends that:

a. Proper authority consider the issue of one 50 round (second generation only) magazine per man.

b. Each rifleman (M-16 XM177E2 or CAR-15) be deployed with one 50 round magazine plus one for each LDNN assigned to a platoon (two or four) and two magazines to compensate for loss and damage. One 50 round magazine also be issued to ST/PRU advisors.

c. When a returning platoon departs Vietnam they return with their 50 round magazines that were issued to the platoon commanders prior to departure CONUS. This will enable positive control and repairs if needed.

d. Fifty round magazine be considered equipage and not a consumable item and serialized for more positive control.

1ST FORCE RECONNAISSANCE COMPANY
1st Marine Division (Rein), FMF
FPO San Francisco, California 96602

3/GRW/waw
4600
11 Aug 1969

From: Operations Officer
To: CG III MAF (G-3) (R&D)

Subj: The 50 round magazine

The 50 round magazine has proven to be a very effective piece of combat equipment. In the month of July the magazine was used on eight reconnaissance patrols. It was used effectively in three contacts with the enemy. On 13 July 1969 the forward security man of a reconnaissance patrol was equipped with the 50 round magazine. When the patrol made contact the initial base of fire provided by the point man was sufficient to maintain a fire superiority which killed five NVA.

On 26 July 1969 the magazine was also used by the forward security man of a reconnaissance patrol. The patrol made contact and the tremendous fire power delivered by the 50 round magazine equipped M-16 rifle provided the initial momentum needed to maintain fire superiority.

On 28 July 1969 the 50 round magazine once again proved to be a valuable piece of equipment in a combat situation. A four man element of a reconnaissance patrol were confronted by a large NVA force. The initial fire power supplied by 50 round magazine coupled with the three other 18 round bursts from the regular M-16 rifles was sufficient to overcome the enemy. The result was four NVA killed and several wounded.

In each combat incident in which the 50 round magazine was employed favorable results occurred. It has the same effect as a light weight machine gun with its initial fire power.

The average temperature in which the magazine was used was 95°. The terrain ranged from very steep and dense to gentle slopes and trails. The weather was wet on half the 30 days which it was used in the field. The weather did not effect the magazine in any noticeable way. The first ten rounds seem difficult to load. It has been recommended that the bend in point A figure #2 of your photo be rounded off to ensure easier loading of the magazine. It is not too long and it fits tightly in the weapon with no apparent wear. The lips of the magazine did not spread. It must be cleaned after each patrol on the inside or the spring tends to hang up. Approximately 800 rounds were fired through each magazine. Reloading is relatively quiet. Five stoppages occurred from overloading the magazine. Overloading coupled with poor cleaning procedures can account for the stoppages. Stoppages occurred when the magazine was filled to its 50 round capacity and it hadn't

3/GRW/waw
11 Aug 1969

been cleaned after being used on two patrols. There has been no consistent pattern in stoppages from left or right bullet feeding. The magazine never failed in a combat situation and generally has performed very well. The 50 round magazine is as reliable as the user. Keeping it reasonably clean and not overloading it will increase its proficiency. The design and size of the magazine are very good. I recommend the size of the magazine remain at 50 rounds but not be loaded over 40 rounds. The strength of a magazine being built for 50 rounds ensures the safety of a 40 round load.

NWL/Dahlgren Note of Clarification:

Marine Reconnaissance personnel evaluated only the MOD 2 magazine.

G. R. Willson
By direction

APPENDIX B

DISTRIBUTION

Commanding General
US Army Test & Evaluation Command
Aberdeen Proving Ground, Maryland 21005
Attn: Code AMX-AA-AX (J. L. Baer)

Chief of Naval Operations
Department of the Navy
Washington, D. C. 20350
Attn: Code OP-721
Code OP-7TX
Code OP-345

Director of Naval Laboratories
Department of the Navy
Washington, D. C. 20360

Commanding General
Marine Corps Development & Educational Center
Quantico, Virginia 22134

Commandant
Headquarters, US Marine Corps
Washington, D. C. 20380
Attn: Code AX-2

Commanding General
7th Air Force (DAFSC)
APO San Francisco, California 96307

Commander
Naval Ordnance Systems Command
Washington, D. C. 20360
Attn: Code 0312B
Code 08
Code 08313

Commander, Special Warfare Group - Pacific
Coronado, California 92118

Commander, Special Warfare Group - Atlantic
Little Creek, Virginia 23521

Commanding Officer
SEAL Team I
Naval Amphibious Base
Coronado, California 92118

Commanding Officer
SEAL Team II
Naval Amphibious Base
Little Creek, Virginia 23521

Commander
Naval Ordnance Laboratory
White Oak, Silver Spring, Maryland 20910
Attn: Code 0211

Commander
Naval Weapons Center
China Lake, California 93555
Attn: Code 40703

Commanding General
US Army John F. Kennedy Center for Special Warfare
Fort Bragg, North Carolina 28307
Attn: CO, 5th Special Forces
ISSO Ft. Bragg

Commander
US Military Assistance Command - Vietnam
FPO San Francisco, California 96626
Attn: Code MACSA

Colt Industries - Colt Firearms Division
150 Huyshope Avenue
Hartford, Connecticut 06102
Attn: Mr. Kanemitsu ITO

Commanding General
US Army Weapons Command
Rock Island, Illinois 61201
Attn: Code AMC-CPM-RS
Code AMSWE-RES
Code AMSWE-REE
Code CDCCD

Director
Army Material and Mechanics Research Center
Aberdeen Proving Ground
Aberdeen, Maryland 21005
Attn: Code AMXMR-RM

Commanding General
US Army Material Command
Washington, D. C. 20315
Attn: Project Manager, Special Warfare

Defense Document Center
Cameron Station
Alexandria, Virginia 22314 (2)

Local:
MAL 2 MAP-3 5
EPM 10 File

*11 copies to Childers
1 copy EP file
7*

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Naval Weapons Laboratory Dahlgren, Virginia 22448		2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	
		2b. GROUP	
3. REPORT TITLE 50 ROUND MAGAZINE FOR M-16 RIFLE			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates)			
5. AUTHOR(S) (First name, middle initial, last name) Carroll D. Childers and Joseph C. Monolo			
6. REPORT DATE February 1971		7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO.		9a. ORIGINATOR'S REPORT NUMBER(S) TR-2536	
b. PROJECT NO.			
c.		9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
d.			
10. DISTRIBUTION STATEMENT Distribution limited to U. S. Government agencies only; Test and Evaluation; February 1971. Other requests for this document must be referred to the Naval Weapons Laboratory.			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY	
13. ABSTRACT The Naval Weapons Laboratory, Dahlgren was assigned development of an increased capacity magazine for the M-16 rifle to enhance firepower. A 50 round magazine was fabricated and underwent CONUS and in-country (Vietnam) evaluations. These evaluations revealed the magazine to be applicable to the tasks, reliable, and durable. However, modifications to the proposed design were suggested and effected. The improved design satisfactorily passed required firing tests, and is being recommended for future limited production.			

U. S. NAVAL WEAPONS LABORATORY SCIENTIFIC, TECHNICAL and ADMINISTRATIVE PUBLICATIONS

TECHNICAL REPORTS: Scientific and technical information on the work of the Laboratory for general distribution.

TECHNICAL NOTES: Preliminary or partial scientific and technical information, or information of limited interest, for distribution within the Laboratory.

CONTRACTOR REPORTS: Information generated in connection with Laboratory contracts and released under NWL auspices.

ADMINISTRATIVE REPORTS: Administrative information on the work, plans and proposals of the Laboratory.

ADMINISTRATIVE NOTES: Preliminary or partial administrative information, or information of limited interest, for distribution within the Laboratory.

Details on the availability
of these publications
may be obtained from:

**TECHNICAL LIBRARY
U. S. NAVAL WEAPONS LABORATORY
DAHLGREN, VIRGINIA 22448**