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Technical Memorandum

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SAFE ARMING SWITCH FOR SHORT SEVEN OR TX-7 USING DIFFERENTIAL PRESSURE

by

W. B. Pepper, Jr.

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW	
1st Review Date: 4/02/97	Determination (Circle Numbers):
Authority: ☐ADC ☒ADD	1. Classification Retained
Name: RB Croner	2. Classification Changed to: U
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Authority: ADD	4. Coordinate With:
Name: W Layne	5. Contains UCAI
	6. Comments: Release

ABSTRACT

A speed dependent, pressure activated arming switch is desirable since it eliminates manual or mechanical setting. Such a switch would not arm the firing system if the weapon is accidentally dropped during the lower speeds of landing and take-off. Locations of baro ports for such a differential pressure switch and the operating pressures are given for the MK-7, MK-6, and TX-13C bodies. Application of the system is contemplated for the MK-7 and Short Seven weapons.

Case No. 409.02

December 8, 1953

SANDIA SYSTEMATIC DECLASSIFICATION REVIEW DOWNGRADING OR DECLASSIFICATION STAMP	
CLASSIFICATION CHANGED TO: U	AUTHORITY: W.C. Layne
Emelda Selph 4/21/97	RECORD ID: 97SN1198
PERSON CHANGING MARKING & DATE	
Carmela M Gallegos 5/5/97	DATED: 4-7-97
PERSON VERIFYING MARKING & DATE	

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Re: Safe Arming Switch for Short Seven or TX-7 Using Differential Pressure

SUMMARY

Using the differential pressure between the total head on the nose flat of the Short Seven and an aft body station (57% if the Mk 6 shape is used and 70% if the TX-13C shape is used), it is theoretically feasible to operate a safe arming switch. If the switch is set to close at a differential pressure of 0.62 pounds per square inch, which is equivalent to a speed of 160 miles per hour at sea level, the switch will close at 216 miles per hour at 15,000 feet and 324 miles per hour at 45,000 feet. A similar pressure system can also be used on the Mk 7 if desired.

INTRODUCTION

On November 30, 1953 Mr. Berry requested Division 5141 to investigate the feasibility of using pressure to operate a safety switch on the Short Seven and Mk 7. The switch is intended to be open for air speeds less than 160 MPH at sea level so that if the bomb were accidentally dropped during take-off or landing, the bomb would be unarmed. The switch should close when the weapon is dropped during an actual operation. The use of a pressure actuated switch is believed to eliminate the human error that is inherent in any other type of mechanical system that has been considered.

ANALYSIS

The use of total head pressure was first considered as a means of closing the switch. However, if such a switch is set to close at 200 miles per hour at sea level, it will not close until a Mach number of 1.26 is reached for 15,000 feet altitude. This difficulty can be

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overcome by using the difference of total head minus body static pressure at an aft station on the body. Since the Short Seven body shape has not definitely been established yet, the aft static pressure on both the Mk 6 and TX-13C are shown in Figure 1. The Short Seven body shape may be similar to the Mk 6 or TX-13C configurations.

By using the total head minus static pressure (ΔP), the percentage change in pressure with increasing velocity is magnified as compared to using only total head pressure. The decrease in ΔP with increasing altitude may be easily compensated for by the increase in ΔP due to a small increase in speed; as may be seen in Figure 1. Wind tunnel measurements of total head at the center of the Mk 6 nose flat are shown in Figure 1 to agree well with the theoretical total head. The total head is insensitive to angle of attack up to 6°. Icing of the pressure ports should not be a problem, since the switch will operate immediately after drop. Full scale measurements of the total head pressure at the center of the nose flat will be obtained from a Mk 4 instrument drop (I-39 or 40) scheduled for January-February, 1954. Data will be obtained for angles of high angles of attack ($\alpha \leq 14°$). A system of four shielded total head tubes located at 10 inch radius from the center of the nose flat is also being tested on the drop, which will provide data on an alternate method of measuring total head if the center pressure should prove undesirable.

An illustration of the plumbing system using the shielded total head tubes on the Mk 6 shape is shown in Figure 2 A differential pressure gage is connected with one lead to total head through a manifold (to minimize angle of attack effects) and the other lead to a manifold fed by four ports at the 57% body station. The pressure switch will close at 160 miles per hour at sea level if the contact points are set to close when the pressure differential across the diaphragm is 0.62 pounds per square inch. As may be seen in Figure 1, the switch will close at 216 mph at 15,000 feet or 384 mph at 45,000 feet. The use of an aft pressure at 70% length for the TX-13C shape will give similar results.

If desired, the same pressure system and switch may be used on the higher fineness ratio Mk 7. The dotted curves in Figure 1 show the static pressure at the 128 inch body station. If the same switch is used on the Mk 7 and is set to operate at 160 mph for sea level pressure (0.62 p.s.i. differential), the switch will close at 198 mph at 15,000 feet and 350 mph at 45,000 feet. The total head pressure could be measured with a single tube at the nose of the Mk 7, or from a fin tip probe.

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CONCLUSIONS

The use of a differential pressure between the total head and body static pressure at an aft port of the Short Seven (57% length on the Mk 6 or 70% on TX-13C) or 125 inches on the Mk 7 as a means of operating a safe arming switch has been investigated theoretically.

The following conclusions were drawn:

1. The differential pressure method appears to be feasible to operate a safe arming pressure switch for both the Short Seven and Mk 7.

2. If the switch is set to close at 0.62 pounds per square inch, which is equivalent to 160 mph at sea level, the switch will close at 216 mph at 15,000 feet and 334 mph at 45,000 feet.

W. B. PEPPER, JR. - 5141

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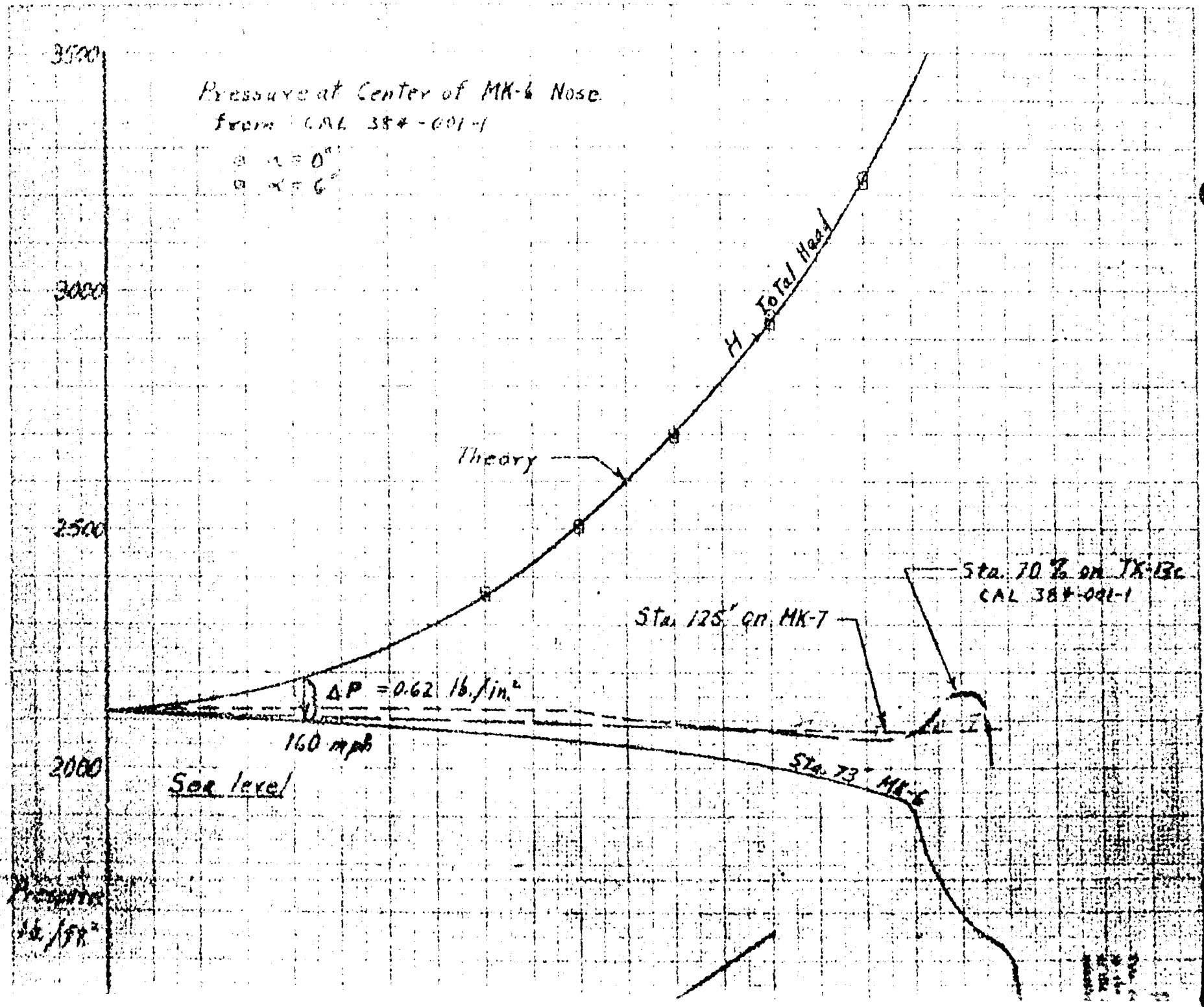

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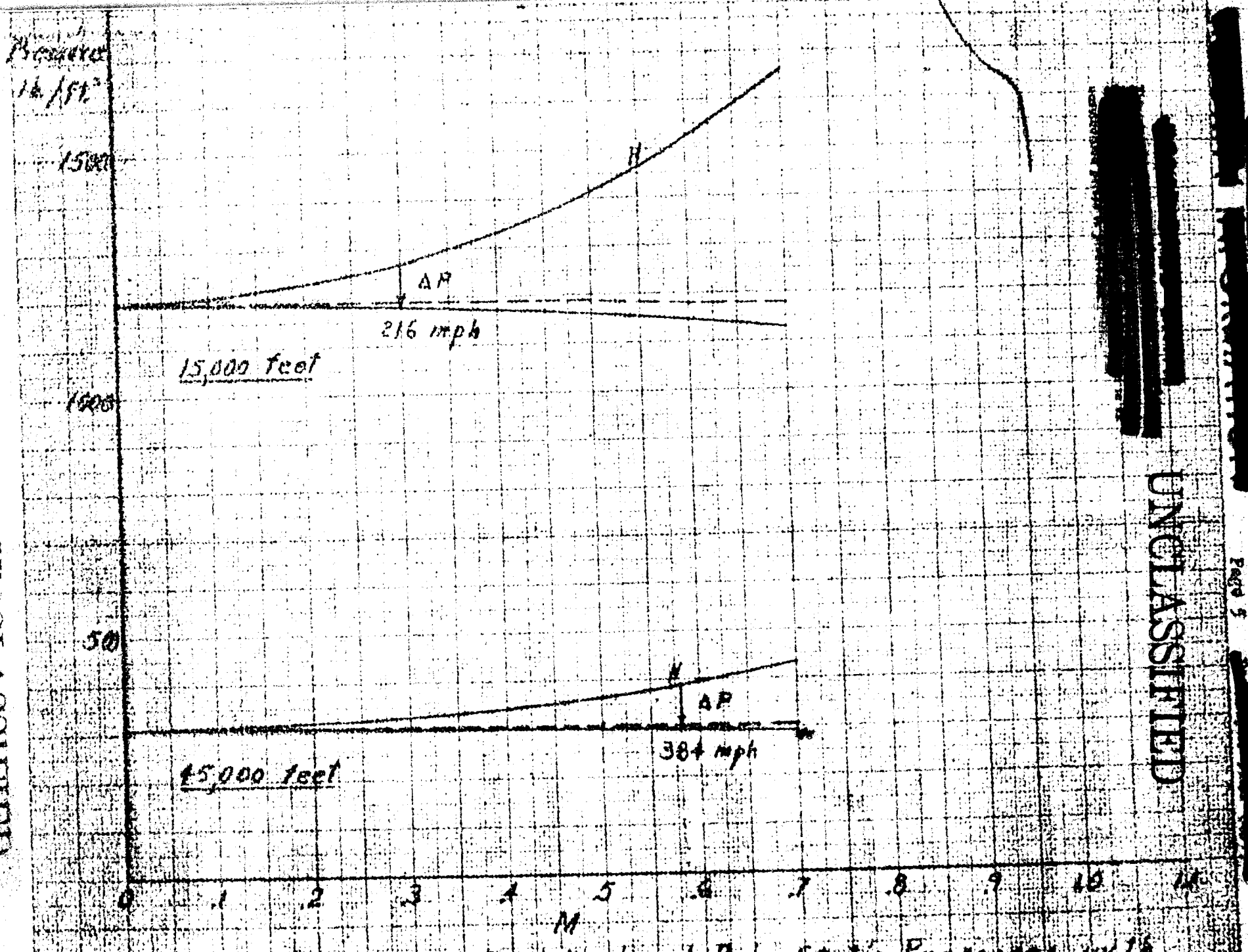

Figure 1. Variation of Total Head and Body Static Pressure with Mach Number for Sea Level, 15,000 feet, and 45,000 feet.

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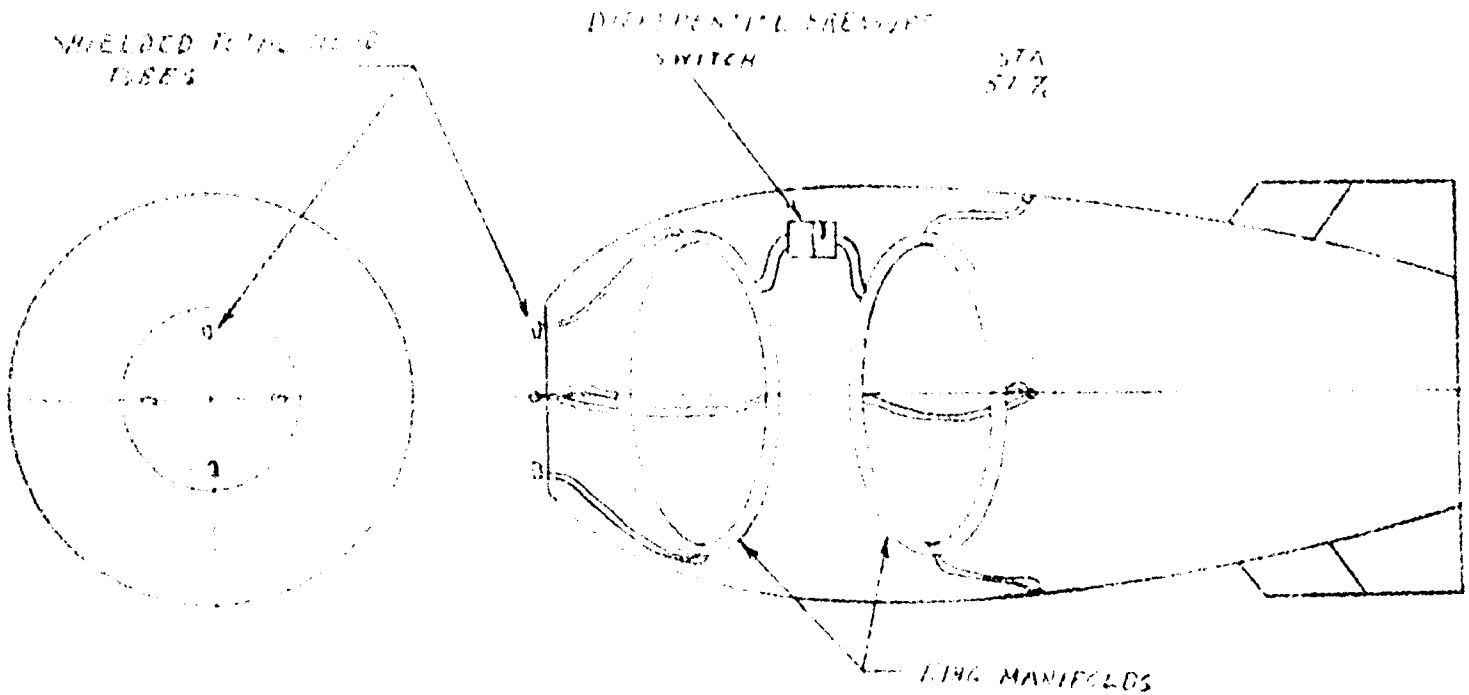

FIGURE-2 DIFFERENTIAL PRESSURE INSTALLATION on SHORT SEVEN
[illegible] SAFE ARMING SWITCH

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