B.I.O.S.—FINAL REPORT No. 469

ITEM No. 4

SLOTTED TUBE CATAPULT OPERATED by T and Z STOFF FOR LAUNCHING THE FLYING BOMB (Preliminary Survey)

BRITISH INTELLIGENCE OBJECTIVES

SUB-COMMITTEE

Slotted Tube Catapult Operated

by

T and Z Stoff For Launching The Flying Bomb

(Preliminary Survey)

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BIOS Target No. C4/48(b)

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B.I.O.S. REPORT

Slotted Tube Catapult Operated by T and Z Stoff

1. Object of Visit

A.I.2(g), D.of I(R) report number 8/X describes the catapults as found in Northern France, and some general information has been obtained from Prof. Walter during his interrogation in this country.

The object, therefore, of this visit to Bosau (the catapult experimental station of Walter Werke, Kiel) was to witness the operation of the catapult and investigate the nature and progress of developments beyond that stage used in Northern France.

A team of investigators are making an intensive study of the Walter Werke at Kiel and their report will cover the subject of the present report in greater detail.

2. Developments

There appear to be four lines of development to improve the service type as used in Northern France:-

(a) A re-design of the ramp structure, which serves to strengthen and maintain the stability of the slotted firing tube, without modifying the latter.

(b) A re-design of the method of applying the sealing tube to the slot on the pressure side of the firing piston.

(c) Increased launching speed.

(d) A complete re-design of the pressure generator breech trolley involving the replacement of the compressed air bottles by a secondary T and Z Stoff unit which injects the main fuel into the firing breech.

3. Construction of launching ramp

Basically, a tube provided with a longitudinal slot has negligible hoop strength, and the provision of such strengthening has obviously been a design item of major importance. The general form of construction used in the original ramp is shown in Fig.1(a); the tube is supported transversely, at 9½ in. intervals throughout its entire length by elaborate diaphragms

which provide adequate strength to slotted tube to resist excessive distortion. Running parallel to the tube and carried on the outer sides of the diaphragms are a pair of channel joists which provide adequate strength in bending to each span of the supported inclined ramp. The unit lengths (eight to a ramp) are six metres (20 feet) long and it has undoubtedly been a difficult item to manufacture in order to avoid distortion. The overall section is about 3 ft. square and the slotted tube 11½ in. bore.

Fig.1(b) illustrates the modified design. Here the units are only 3 metres long and although the structure is no lighter in weight (per foot run) it is much easier to manufacture. Externally, this ramp is of much cleaner construction - having a flat topped circular section approximately 2½ ft. diameter.

Each 3 metre section weighs approximately 2 tons and the 6 metre section 4 tons.

4. Sealing tube arrangement

This item is of particular interest since upon the effectiveness of it depends the successful functioning of the catapult. Fig.2(a) indicates the arrangement in the service type. Here the sealing tube, anchored at the breech end of the slot, passes through a tunnel in the driving lug and through notches formed in two piston heads. Initially the tube is hung at intervals on suspenders made of aluminium wire which are swept away with the passage of the piston, and have to be replaced preparatory to every launch.

Fig.2(b) shows the modified arrangement. The sealing tube is housed in a recess alongside the piston driving lug and on the passage of the piston is forced into the upper one of the two slots. Some assistance is given to this operation by admitting pressure from the firing tube through small holes spaced at intervals along the tube. This method avoids notching the piston heads and the necessity for a tunnel through the driving lug.

It was stated that this method resulted in being able to develop two extra atmospheres of pressure with the same charge compared with the original sealing arrangement when a maximum pressure of about sixty atmospheres is developed.

5. Improved lauhching speeds

The catapult, as designed for launching a flying bomb, accelerates a mass of 5000 lbs. to a speed of 360 ft. per sec. with a mean acceleration of 13½g (peak acceleration about 16½g). Experiments are stated to have been made to launch lesser

weights at high speeds. In this respect a mass of 1100 lbs. is stated to have been launched at 700 ft. per sec. using the standard charge. It is presumed that a higher pressure was used to inject the T and Z Stoff fuels into the firing breech. These high speed trials were made using the modified sealing arrangement and would appear to demonstrate the successful development of a high speed catapult which might have operational as well as experimental applications.

6. Airless injection system

In the normal arrangement the T and Z Stoffs are expelled from their respective tanks into the reaction breech by admitting compressed air to these tanks. In the new arrangement a subsidiary T and Z Stoff unit is used to provide the injection pressure. Fig.3 shows the new arrangement. The main reagents are contained in cylinders and expelled by means of pistons. The two pistons are mounted on a common rod which carries a third piston working in a cylinder. To this third cylinder is admitted the gaseous products of the subsidiary T and Z Stoff unit.

Whilst filling the main T Stoff cylinder a measured portion is allowed to overflow into a trough which is pivoted about its longitudinal axis. Immediately below this trough is a second one carrying peebles soaked in Z Stoff. The launching operation is initiated by tipping the T Stoff trough and discharging its contents over the Z Stoff peebles. The two troughs are accommodated within a small chamber connected, through a non-return valve, to the steam piston.

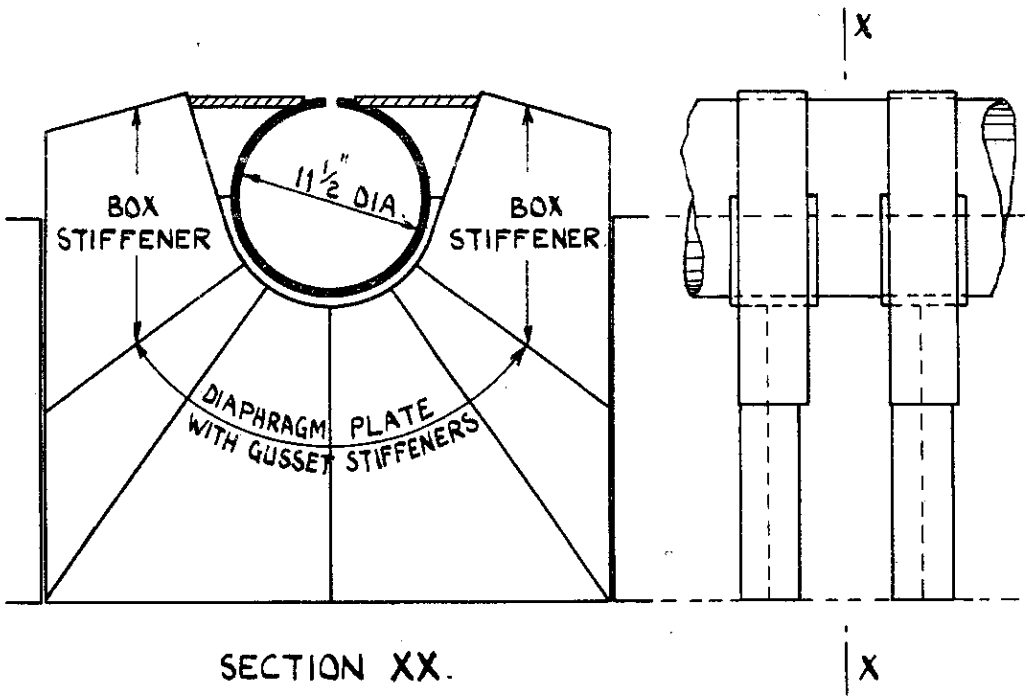
With the object of increasing the rate of flow to the reaction breech, as the velocity of the launching piston increases, the rate of flow is controlled by the passage of a tapered rod (moving with T Stoff piston) through a fixed orifice.

The steam cylinder is connected to the main reaction breech through a non-return valve so that once the cycle of operation has been initiated by the subsidiary unit, the pressure in the main breech provides the injector pressure - the areas of the three pistons being so designed in conjunction with the tapered control rod in the path of the main T Stoff supply, that uniform (or as near uniform as possible) acceleration is obtained.

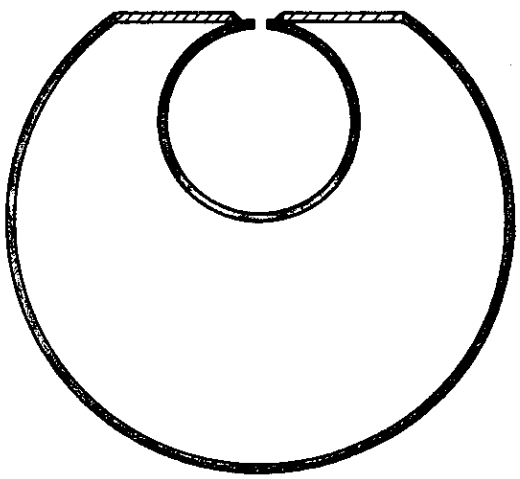
The "airless" unit has not yet been fully proved and only a few low speed launches have been made.

The impression gained is that the complication to obviate the use of three simple bottles of compressed air, is scarcely justified but demonstrates that it is a practical possibility.

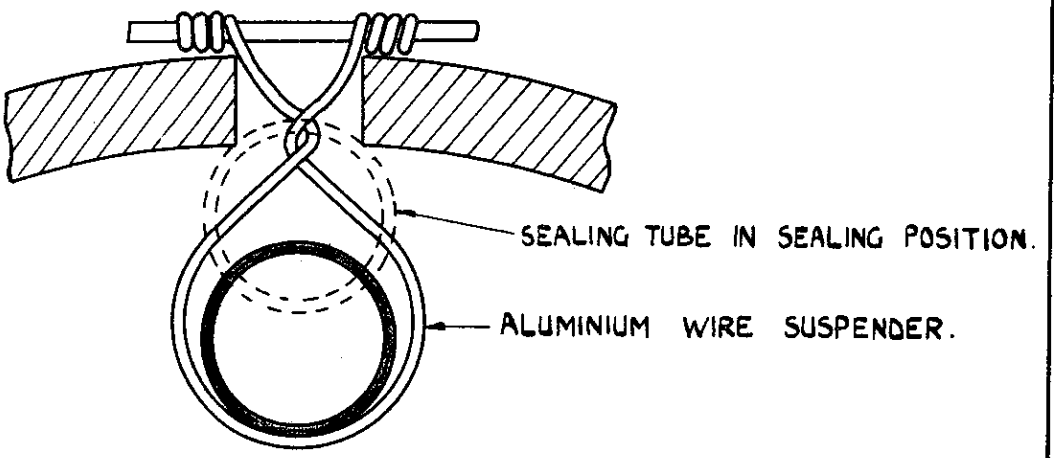
Naval Aircraft Department,
Royal Aircraft Establishment.



CONSTRUCTION OF ORIGINAL TYPE OF RAMP.
FIG. 1a

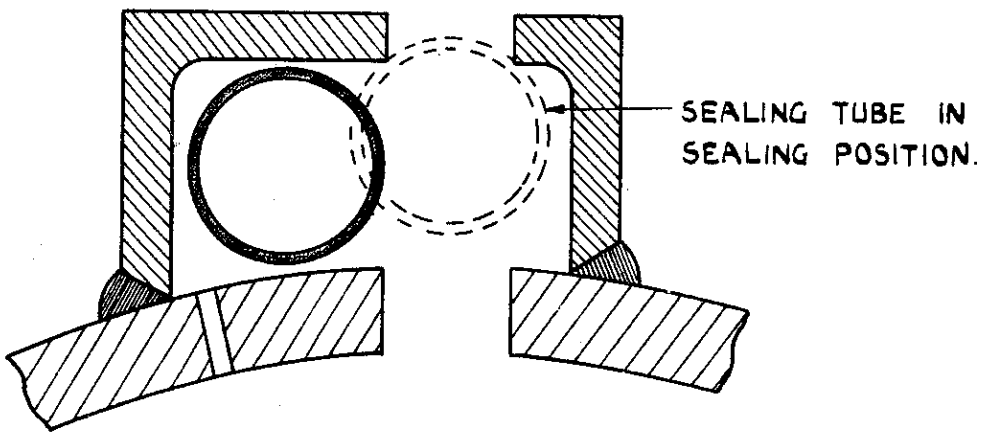


CONSTRUCTION OF MODIFIED TYPE OF RAMP.
FIG. 1b



SEALING TUBE ARRANGEMENT FOR ORIGINAL TYPE OF RAMP.

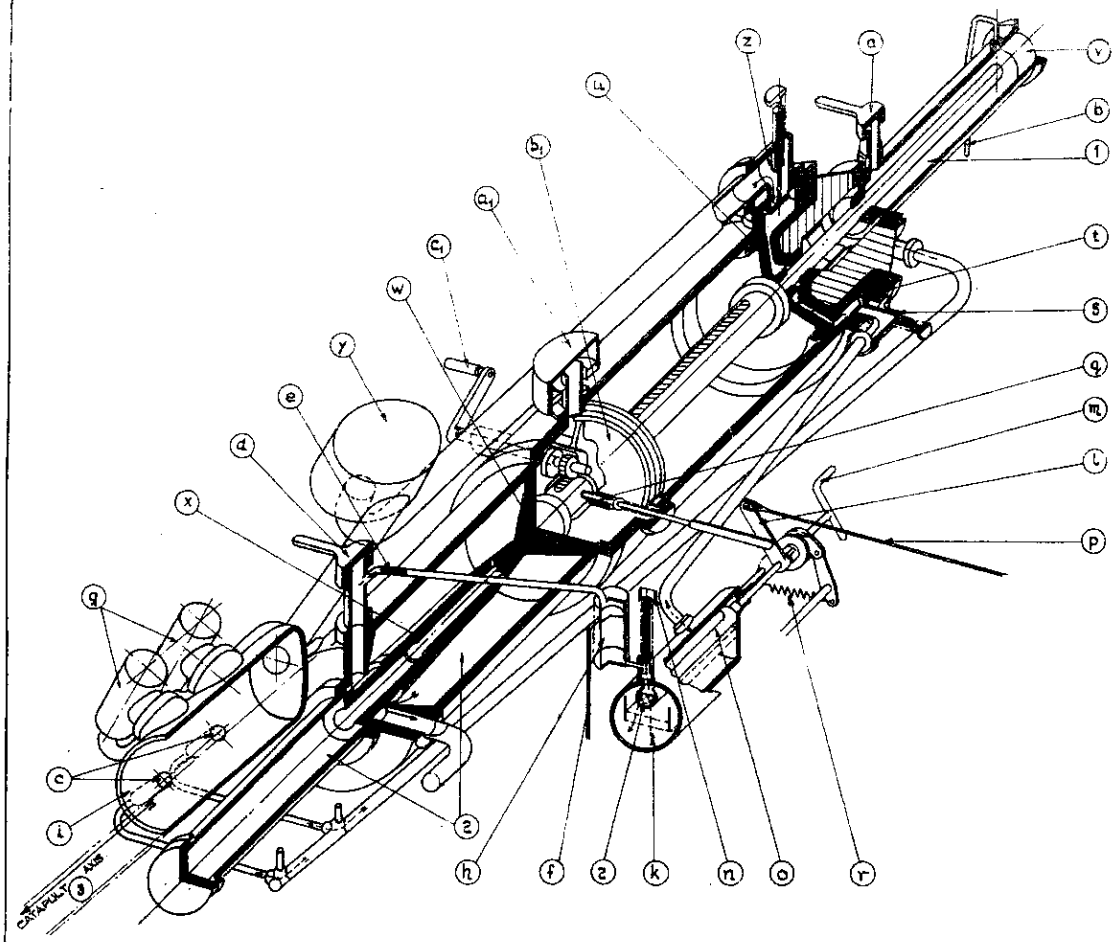
FIG. 2 a.



SEALING TUBE ARRANGEMENT FOR MODIFIED TYPE OF RAMP.

FIG. 2 b.

FIG. 3



NAMES OF COMPONENT PARTS		
1 Z STOFF	i NOZZLE CARRIER (REACTION BREECH)	t DRIVING - STEAM CYLINDER
2 T STOFF	k TIPPING DECOMPOSER	u STEAM PISTON
a Z STOFF - FILLING POINT	l TRIGGER LEVER	v Z STOFF PISTON
b Z STOFF - OVERFLOW	m TROUGH OPERATING HANDLE	w T STOFF PISTON
c Z STOFF INJECTION NOZZLES	n CONTROL VALVE	x T STOFF CONTROL ROD
d T STOFF FILLING POINT	o TIPPING TROUGH	y CENTRIFUGAL EXTRACTOR
e VISIBLE SECTION (SIGHT GLASS)	p TRIGGER CORD (LANYARD)	z OVERFLOW VALVE
f T STOFF OVERFLOW	q SAFETY PIN	a_1 AIR CLEANER
g T STOFF INJECTION NOZZLES	r SPRING	b_1 INTERMEDIATE WALL
h T STOFF MEASURING VESSEL	s ENTRY VALVE	c_1 RE-SETTING CRANK HANDLE

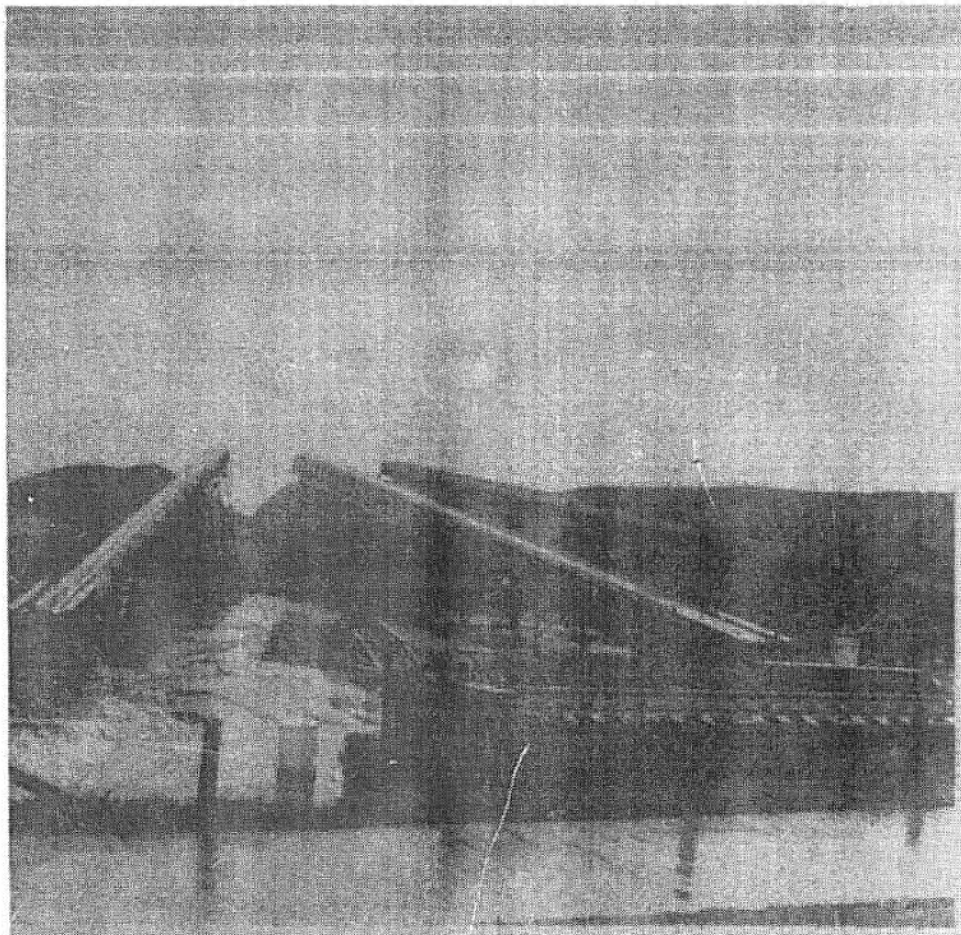
ARRANGEMENT OF BREECH UNIT OPERATED WITHOUT COMPRESSED AIR

FIG. 4.

FRONT CATAPULT - NORMAL RAMP WITH AIR INJECTION TYPE OF BREECH UNIT AND TEST WEIGHT READY FOR LAUNCHING.

REAR CATAPULT - MODIFIED RAMP WITH AIRLESS INJECTION TYPE OF BREECH UNIT AND TEST WEIGHT READY FOR LAUNCHING.

FIG. 5



THREE T AND Z STOFF CATAPULTS AT THE BOSAU EXPERIMENTAL STATION OF WALTHER WERKE.

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