

Preliminary Report of A Feasibility Study of Biopsy Dart
Sampling During the 11th IWC/IDCR Southern Hemisphere
Minke Whale Assessment Cruise, 1988/89

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INTRODUCTION

A feasibility study to investigate the effectiveness of biopsy darts to collect skin samples from southern minke whales was recommended by the Scientific Committee of the International Whaling Commission (IWC) in 1988 (IWC, 1988). The study was conducted during the 11th IWC/IDCR Southern Hemisphere Minke Whale Assessment Cruise (Kasamatsu, Ensor, Mermoz, Shigemune, Nakanishi, Zorin, Silva, Newcomer and Ohwada, 1989) from the research vessel Shonan Maru (displacement 916.96 tons and length 70.55 meters). This paper presents results of the feasibility study.

MATERIALS

Biopsy Darts and Other Equipments

Darts

Three types of biopsy darts were developed and made in Japan based on the design of Amos and Hoelz (1988), and incorporating aspects of design from Lambertsen (1987), Mathews, Keller and Weiner (1988). Details of the darts are shown in Figure 1 and Plate 1.

Cross Bow

A "Thunderbolt" crossbow manufactured by Barnett (UK) and arrows were purchased in Japan for the study. The crossbow was one of the most powerful commercially available models (230 pounds prod). The arrows had a total length of 50 cm and were made of aluminium with plastic vanes.

Retrieving equipment

Two types of fishing rods and spinning reels (open bail model), and two kinds of fishing lines (nylon monofilament lines and tetron triplefilament lines, of tensile strengths #5, #10 and #20) were prepared for retrieving the arrows and darts. The arrows were tethered by the fishing line to a spinning reel on a fishin rod mounted at the front of the bow. The line was attached to the arrow in either of two places (just behind the darts, or to the tail end of arrows (see Figure 1).

METHOD AND RESULTS

Test Firing Trials

A test firing of the equipment was conducted prior to the main study. the test firing was conducted on 28 December 1988, near the pack ice edge, under good weather conditions. During the test, performance of two kinds of rods and reels were compared and trials were made using two types of lines (nylon and tetron) each of three different tensile strengths (#5, #10 and #20).

A total of 10 arrows were fired from the gunner's bridge (forecastle deck), height 6.5 meters above the sea surface. Four of the test firing were successful, but during the remaning six tests the lines became entangled; two of these tangles resulted in broken lines (#5 and #10 strengh lines).

Tangles of the line itself occurred in four cases and around small rings on the rod in two cases. Tetron triplefilament lines (which were lighter and thinner than nylon lines of the same strength) were more inclined to tangle than the nylon monofilament lines. Following the test firing an alternative method of retrieving the lines and arrow without using the fishing rod and reel was developed by the crew of vessel (see Plate 3).

Additional test firings were conducted on 1, 3, 6 and 9 January, 1989 while the vessel was drifting. A total of 14 test firings were conducted. The proportion of test firings which resulted in tangles was much reduced during these tests with 35% of the trials resulting in tangles (60% in previous test firing). Because of the time involved in retrieving the lines and arrows in the modified system, another system using the fishing reel without the normal fishin rod was developed (see Plate 4).

The modified system was tested during a preliminary sampling

experiment on a minke whale on 12 January during normal research. A group of two minke whales was selected for the test since their behaviour suggested that these animals would be easy to approach. Four arrows were fired from the forecastle deck during 27 minutes of chasing. Firing ranges were between 15 and 30 meters. The result of two of these trials was tangled lines while on the other two trials no such problems occurred. However, it was thought that use of fishing line greatly influenced the flight of the arrow and as a result the two arrows fell about one meter short of the whale at ranges between 20 and 30 meters. As a result of this experiment it was thought that the effective firing range of this system was less 15 meters.

Main Study

The main trials of biopsy dart sampling were conducted on 22-24 January at near the pack ice edge between 85°E and 97°E. A total of 58 schools of minke whales (112 whales) was sighted during this period. Solitary animals and long diving animals were not selected for the experiment due to the difficulties in approaching them and the resultant low chance of trials. Eleven schools were chased, it was possible to approach whales from seven of these schools to within optimum firing range (less than 20 meters).

A total of 14 arrows were fired from the forecastle deck at these 7 groups of minke whales during a total of chasing time of 5 hours 30 minutes.

Verdicts were one hit, five ricochets and eight misses. It was observed that most of these misses resulted from arrows falling short of the whale by 50 cm to a few meters. In the case of the hit, which was clearly seen and heard, no tissue sample was obtained. The 'hit' was thought to be 'hit but part penetration'.

A considerable number of ricochets probably resulted from the wrong orientation of arrows at point of impact (see Fig. 4) although it was requested that the vessel approach the whales as close to parallel as possible. Following these sampling trials the shape of the darts was modified (see Plate 2).

Because of the low number of opportunities and problems with the equipment during the period allocated for the feasibility study (22-24 January) it was planned to conduct further trials in the remaining research period in the Antarctic. It was possible to conduct only one further trial using the modified darts and this was on 12 February during the transit from the research area to home port. Details of each trial are presented in Table 1.

Discussion

This feasibility study represents the first attempt of biopsy dart skin samplings from southern minke whales in the Antarctic

although a preliminary study to assist in the development of the biopsy dart had been previously carried out using a minke whale carcass (Kato, Hiroshima, Fujise and Ono, 1988).

Assessment of the feasibility of the biopsy sampling experiment was considered inconclusive because of insufficient number of trials conducted. The low number of trials partly resulted from the limited period available for the research. From this study several problems were identified in relation to conducting biopsy dart sampling of southern minke whales in the actual conditions of Antarctic.

One major problem was insufficient power of the cross bow (although one of most powerful commercially available models was used). Use of fishing line for retrieving the darts greatly influenced the flight of the arrow and this effect was more pronounced than expected. Although a floating arrow system, which did not require the line (thus eliminating the effect on the flight of the arrow and the problem of tangles) was considered before the survey, it was felt that use of the system was not practical in use of large vessel and condition in the Antarctic.

The flight of arrows was greatly affected by wind, especially when the research vessel moved upwind at half or full speed. This was also a result of insufficient of power of the cross bow. An alternative system for firing darts (e.g. use of rifle or speargun) should therefore be tested in future.

Another major problem was tangled lines, a problem which was also identified during previous studies (Amos and Hoelzel, 1988). Line tangles resulted from 5 trials (20%) during the main experiment period (22-24 Jan. and 12 Feb.). Such a percentage of failure, from one cause alone, was substantial, especially considering the relatively low number of chances when southern minke whales could be approached within the effective firing range. However, this problem may be resolved by further modification of the equipment.

Southern minke whales are more difficult for research vessels such as the Shonan Maru to approach within the effective firing range of the biopsy darts compared with other larger slow moving species or species in coastal waters (e.g. right and humpback whales). Similar difficulty against minke whales has also been observed by Amos and Hoelzel (1988).

It is also difficult to position the research vessel parallel with the whales hence ensuring that the arrow, at point of impact, strikes perpendicular to the whales skin. Most of the arrows were hence fired when the vessel was not positioned parallel with the whales (see Plate 5) which probably contributed to the high number of ricochets because the impact of the dart was not perpendicular to the whales skin (see Figure 4). It was thought that shape of darts should be further modified to help alleviate the problem of ricochets.

Finally authors believed that the biopsy dart skin sampling is one of useful method to collect some biological informations such as information on identification of individuals, gender and abundance without killing of targets although some another informations (e.g. age and maturation) can not be obtained. It is requested that the problems encountered during the survey would be resolved as soon as possible and that some experienced person for biopsy dart sampling would be on board the IDCR sighting vessel to further test the feasibility of the biopsy sampling against southern minke whales in the Antarctic.

Acknowledgments

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Reference

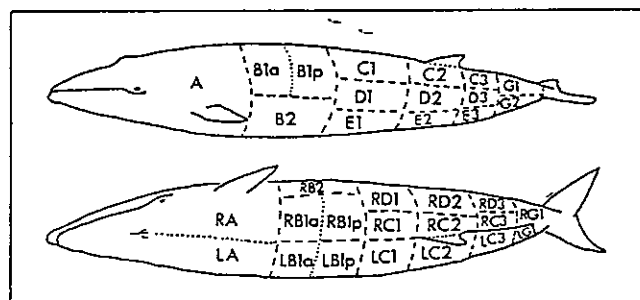
- Amos, B. and Hoelzel, A. R. 1988. DNA Fingerprinting cetacean biopsy samples for capture recapture population census. Paper SC/A88/ID29
- Kasamatsu, F., Ensor, P., Mermoz, J., Shigemune, H., Nakanishi, S., Zorin, A., Vera da Silva, Newcomer, M. and Ohwada, A. 1989. Report of the 1988/89 IWC/IDCR Southern Hemisphere Minke Whale Assessment Cruise, Area IV. Paper submitted to 41st annual meeting of Scientific Committee of the IWC.
- Kato, H., Hiroyama, H., Fujise, Y. and Ono, K. 1988. Preliminary report of the feasibility study on southern minke whale under the Japanese proposal to the special permit. Paper SC/40/Mi 18.
- Lambertsen, R.H. 1987. A biopsy system for large whales and its use for cytogenetics. *J. Mamm.*, 68(2):443-5
- Mathews, E. A., Keller, S. and Weiner, D.E. 1988. A method to collect and process skin biopsies for cell culture from free-ranging gray whales (*Eschrichtius robustus*). *Marine Mammal Science*, 4(1):1-12

Table 1. Results of firings of biopsy dart arrows during the 11th Southern Hemisphere Minke Whale Assessment Cruise.

Date	Weather		Sighting number	Verdict	Firing distance (meter)	Position struck	Remark
	Wind speed (knots)	Sea state (Beaufort)					
12 Jan.	10	3	006	Miss	25	-	(1)
	10	3	006	Miss	30	-	(1)
	10	3	006	Miss	35	-	(1)
	10	3	006	Miss	20	-	(2)
22 Jan.	00	0	020	Miss	25	-	(1)
	00	0	020	Miss	30	-	(1)
	00	0	020	Ricochet	20	LC1	
	00	0	034	Ricochet	15	RD2	
	00	0	034	Miss	20	-	(1)
	00	0	034	Ricochet	15	LD3	
	00	0	052	Miss	25	-	(1)
	00	0	052	Miss	25	-	(2)
23 Jan.	14	4	012	Miss	25	-	(1)
	14	4	012	Ricochet	15	RC1	
24 Jan.	08	3	002	Hit	12	LC1	
	08	3	002	Miss	20	-	(2)
	05	2	004	Ricochet	16	RD3	
	05	2	006	Miss	14	-	(3)
12 Feb.	07	3	007	Miss	25	-	(3)

Remark; (1) fell a few meters short of the whale,
 (2) became entangled,
 (3) affected significantly by wind.

Codes of struck positions;



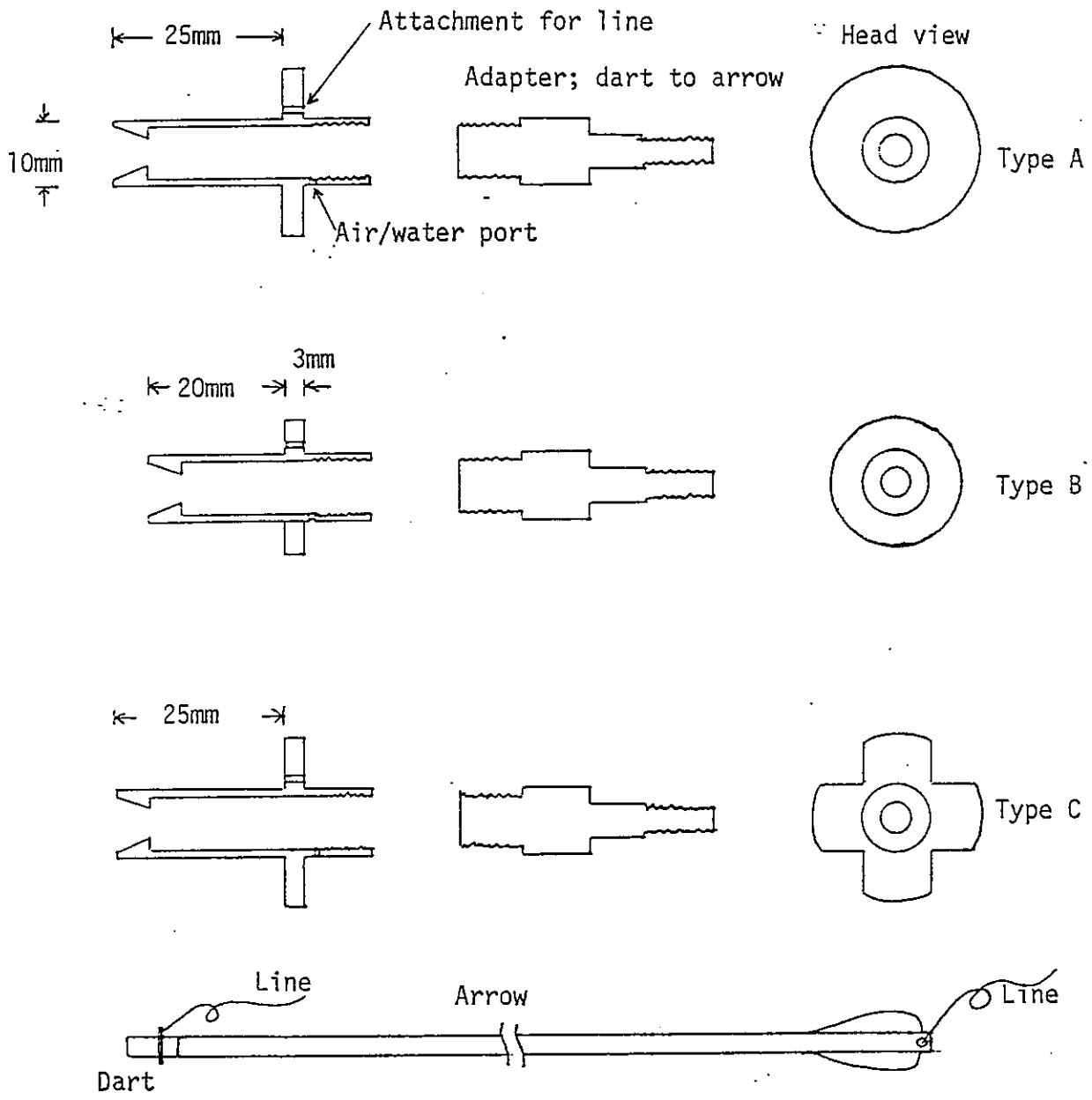


Figure 1. Biopsy darts developed and used for the feasibility study of the biopsy dart sampling.

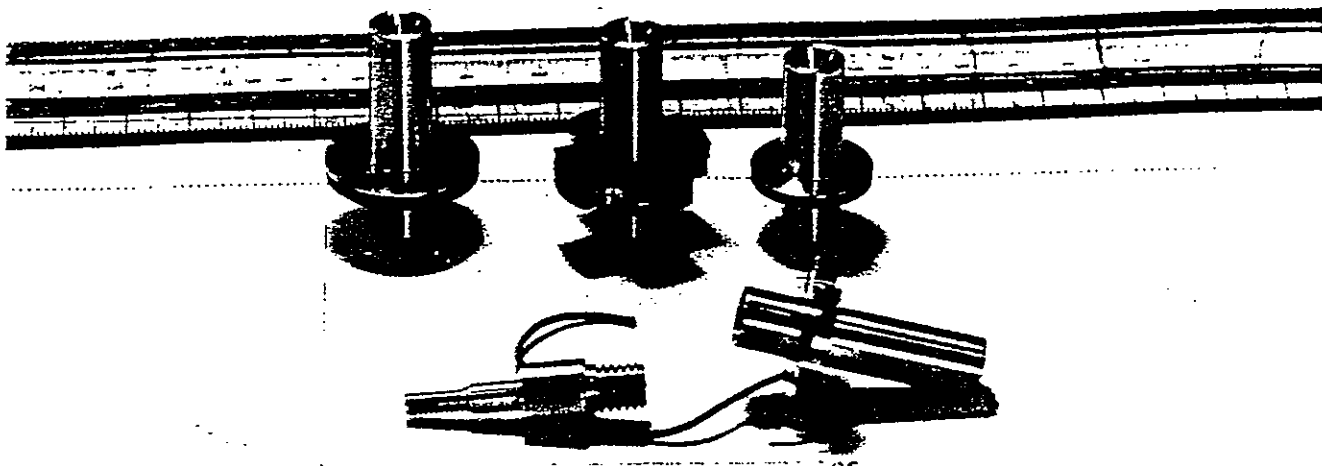


PLATE 1

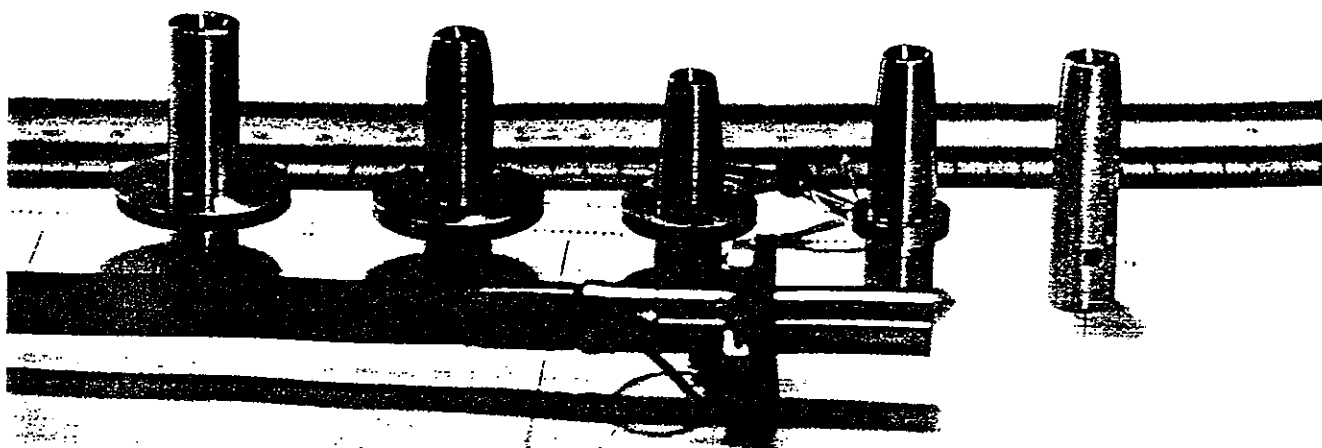


PLATE 2

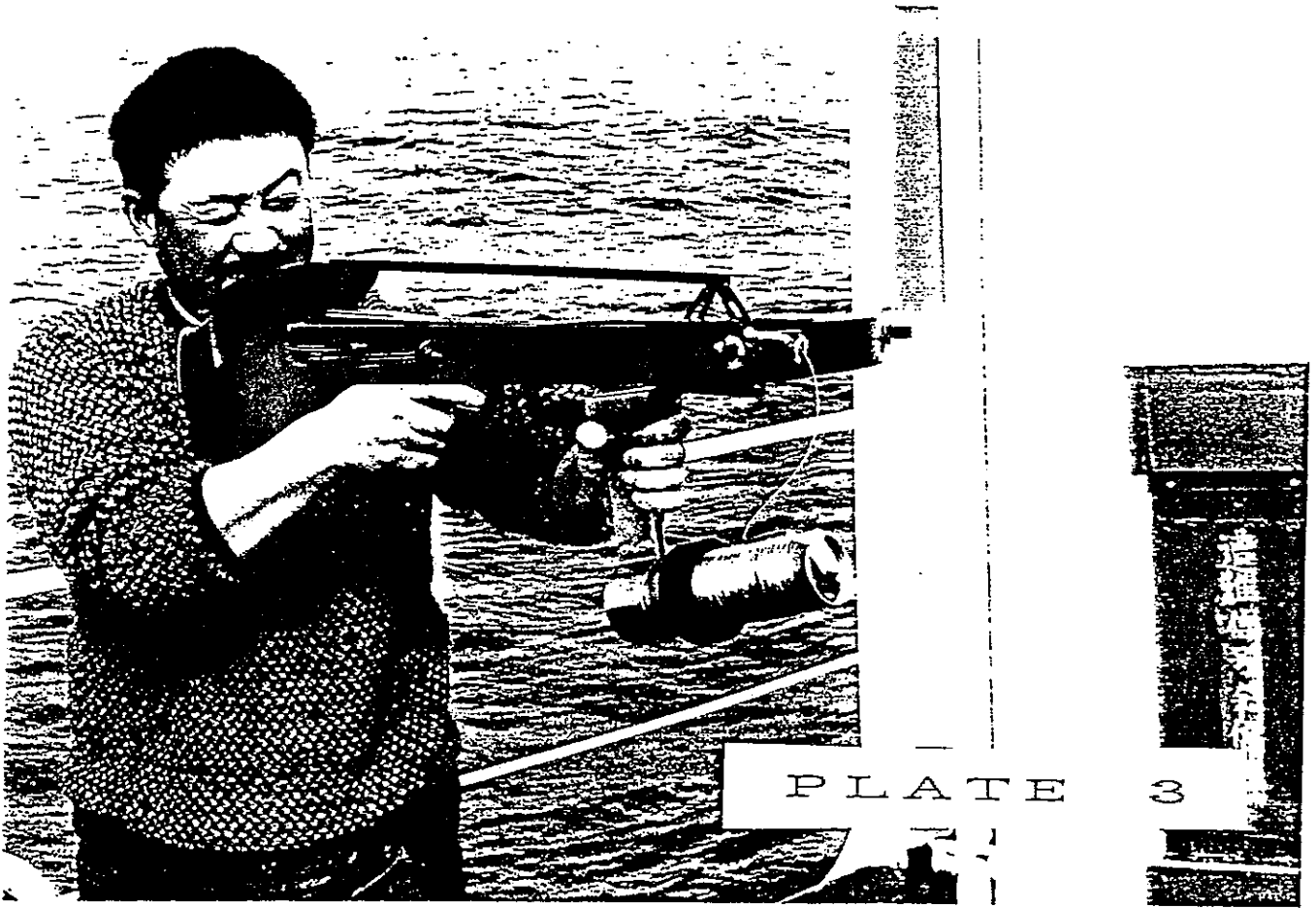


PLATE 3

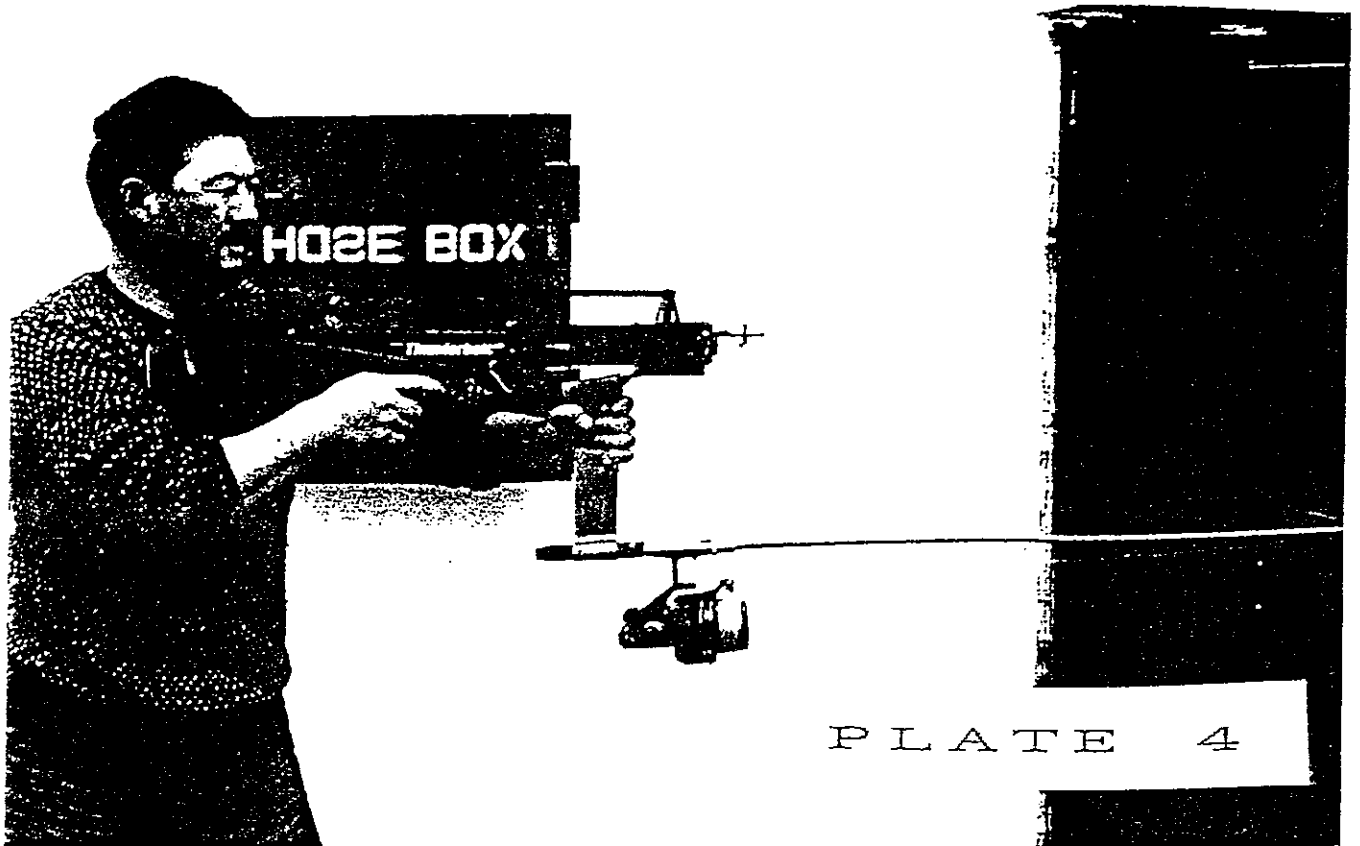


PLATE 4

