A.O.R.S.6. (Infantry weapons and tactics).

This section was formed in January 1943 and attached to School of Infantry, Barnard Castle. It conducts trials to determine accuracy and operational effectiveness generally of infantry weapons of all kinds. It also investigates the value of various aids to infantry operation.

The section has done a certain amount of work on the accuracy and tactical handling of various bullet weapons, and much work to determine the best type of H.E. Grenade. Lethality trials of 3" Mortar, 2" Mortar and shrapnel mines have been carried out, also accuracy trials of mortars. The use of white phosphorus as an anti-personnel weapon has been investigated.

Questions relating to night operations have had the Section's attention, as also has street fighting, in which methods of blowing holes in walls were devised, and assessments of lethality of various weapons against troops in houses were made. A large part was taken in the first trials of the PIAT.

A number of minor investigations have been carried out, including the Infantry Sledge, visibility of officers, blowing slit trenches, wheelbarrow carrying equipment for 3" mortar, visibility of mortar flash at night, the 3" mortar Star bomb, and questions relating to sniper sights.

Some aspects of this work are shown by charts and models, but it is unfortunately not easy to show the results of this branch of operational research in a demonstration of this nature.

AORS 6

INTRODUCTION

1. This Section, one of the Sections of A.O.R.G., was formed in January, 1943, and located at the School of Infantry, Barnard Castle. While not under the control of the School, except for purposes of discipline, it has always acted in very close co-operation with it.

The major projects that have been undertaken by the Section are set out below.

BREN, STEN, RIFLE, etc.

2. The Section has done a certain amount of work on the accuracy and tactical handling of various bullet weapons. This work was summarized in A.O.R.G. Memo. No. 125 (up to May 44). Most of the trials, however, have been on quite a small scale as the Section has never had the facilities possessed, say, by the Small Arms School at Bisley, for carrying out large scale firings on properly appointed ranges. It has, in fact, endeavoured not to overlap with the work that has been done and is being done at Bisley. Most of the trials have been held in order to get a preliminary insight into the working-out of some new idea.

The principal questions that have been investigated are as follows:-

(a) Comparison of Sten with Rifle and Bren. Working on the provisional theory that, with semi-skilled troops, full use is not made of the accuracy of the Rifle and Bren and that the Sten might prove a better weapon for such men, some trials were carried out to get some idea of the relative efficiency of the weapons. In particular, attention was paid to the possibility of using the Sten at longer ranges (up to 300 yds.) and it was verified that the lethality of a Sten bullet at 300 yds. is amply sufficient. See A.O.R.G. Memo. No. 128.

(b) It was suggested that random traversing fire might be a better proposition than aimed fire when defending a prepared position against groups of enemy advancing at short range. See External Memo. No. E8/13.

(c) The improvement in accuracy caused by using tracer instead of ball when firing from the hip with Bren and Sten was investigated. See Internal Memorandum No. 6/16 and A.O.R.G. Memo. No. 134.

(d) An attempt was made to investigate the relative merits of fast-firing and slow-firing LMGs. See A.O.R.G. Memo. No. 126.

(e) An investigation was made in order to find the optimum rate of rapid fire from a rifle. It was found that, for targets equivalent to standing men at 200 yds., the faster the rate of fire, the more targets were hit. A.O.R.G. Memo. No. 131.

In addition to the above 'major' investigations on bullet weapons, several minor points have been considered such as 'Crack and Thump', zeroing of Bren gun, cartridge shot for TMC, etc.

MINES

The Section has not done a lot of work on the question of mines. A general appreciation of anti-tank and anti-personnel mines was written in the early days of the Section (A.O.R.G. Memo No. 31) and some calculations made on the probability of casualties to tanks in minefields (Internal Memo. No. 6/4). Then a study was

made on the lethality of the British anti-personnel mine (the 'Shrapnel' mine), but this is dealt with in para. 6.

Recently a proposal to use electrically controlled mines as an aid to the defence of a prepared position has been engaging the attention of the Section and trials are still in progress.

GRENADES

4. A considerable amount of work has been done on the question of grenades, the general problem being to determine the best type of HE hand grenade. This problem divides itself into the following:-

(a) To determine the lethal area of various types of grenade.

(b) To determine the relative accuracy with which the grenades could be thrown.

The principal ones considered were the 36 (Mills), 69, U.S.A. grenade fragmentary, the German stick and the Italian percussion grenade. In the case of (a), three methods were used: Static fragmentation, when grenades were exploded in the centre of concentric circles of targets made of 1-inch deal, 6 ft. x 3 ft.: fragmentation as thrown, used with the same array of targets for Italian percussion grenades which could not easily be fragmented statically: area shoots, used for the M9A1 rifle-grenade (this is described more fully in the Section on the 2-inch Mortar). The results show that the 36 grenade is considerably more lethal than the German Stick grenade, the U.S.A. fragmentary, the 69, and the Italian percussion.

In the case of (b) the principal interest was in comparing the 36 with the German Stick grenade. It was found that the stick grenade is slightly more accurate, due to the fact that the stick prevents its rolling when it has reached the ground. On the other hand, a percussion grenade of the same weight as the 36 would be still more accurate, for it would not roll at all.

From these results it was hoped that it would be possible to recommend an ideal design for a hand-grenade, taking into account also certain tactical points, such as whether a percussion or time fuse was required. It was found that the specification for the ideal grenade was very nearly filled by the new (experimental) No. 70 grenade (cast-iron percussion, weight 1-lb). All this work can be found in Memorandum No. E8/3, A.O.R.G. Memo. No. 124 and Report No. 166 (just about to be published).

In addition, a certain amount of work has been done in determining the lethality of the M9A1, the new American rifle-grenade, which is primarily an anti-tank grenade, but which was recommended as an anti-personnel weapon by Research Directorate, India (see A.O.R.G. Memo. No. 124).

Investigations concerning the No. 77 and other smoke grenades will be found in paras. 8 and 9.

LETHALITY TRIALS (3" Mortar, 2" Mortar, and Mines)

A considerable amount of time has been spent by the Section on Lethality trials. Some reasons are perhaps needed to justify the Section conducting such trials as it might be thought that the work was already covered by existing experimental establishments. This is, however, not the case, and very useful supplementary knowledge has been gained by A.O.R.S. 6's trials.

During the two years since the formation of A.O.R.S.6, the practical details of conducting lethality trials have been worked out by experience and the methods used simplified. In particular can be mentioned:-

(a) the design of a standard A.O.R.G. dummy target (due principally to A.O.R.S.7), with which only throughs need be counted.

(b) the 'area shoot' method where an array of dummy targets is used and the position and casualties caused by each effective shot are plotted.

By these means the 'lethal area' of a projectile can be worked out with far less difficulty than by older methods.

Lethality investigations have been undertaken for the following weapons, among others:-

(a) 3-inch mortar. Here cast-iron and steel bombs were compared, the superiority of the cast-iron bomb being confirmed. (A.O.R.G. Report No. 139).

(b) The shrapnel mine. A high degree of lethality was found for this weapon. (A.O.R.G. Report No. 146).

(c) 2-inch mortar. This work is not yet published but will appear shortly in a report on various aspects of the 2-inch mortar.

BASEPLATE TRIALS WITH MORTARS

6. A very simple technique devised for measuring sinkage of baseplates of mortars combined with the exceptionally soft ground to be found at Barnard Castle combined to give the Section quite a reputation as experts on the design of baseplates. The position appears to be, in fact, that no baseplate can now be considered until it has been tried at Barnard Castle.

The new 'Jowett' baseplate for the 3-inch Mortar was tried out extensively by the Section. Also various auxiliary baseplates ('collars') for both the 4.2-inch and 3-inch Mortars. See Internal Memoranda 6/9, 6/14, 6/15, 6/20, 6/21.

VISIBILITY OF PROPELLANT SMOKE

7. A considerable amount of work was done by the Section on the question of the visibility of the propellant smoke of the 3-inch Mortar. Instead of assessing marks to the smoke, as had been done by other research bodies, A.O.R.S.6 strung out observers at various ranges, defiladed the mortars, and noted only the visibility or non-visibility of the smoke. This has been referred to by the Ordnance Board as the 'Barnard Castle Method'.

By means of this method, the superiority of NRN over NCY as a Mortar propellant was confirmed and trials showed also that the German mortar propellant is very near to NRN in smokelessness. See Report No.162.

The same methods have been applied on a smaller scale to 2-inch mortar smoke and to rifle smoke. Trials with 4.2-inch mortar propellant smoke are contemplated.

WHITE PHOSPHORUS

A considerable amount of work was done by the Section on the idea of using WP as an anti-personnel weapon. It was suggested that the 4.2-inch Mortar bomb, the 2-inch Mortar bomb, and the 77 grenade could be the agents and that their use would be very effective in dealing with enemy in slit trenches.

The Sections have been criticized by other branches in this matter, the principal criticism being that the criterion adopted for a burn of incapacitating size was much too small. The point of issue cannot be said to be settled.

The work done by A.O.R.S.6 is in Reports 161 and 163.

SMOKE

9. Apart from the consideration of WP as an anti-personnel weapon, a great deal has not been done by the Section on the question of smoke. Two short memos, 33 and 38, were produced in the early days of the Section. These were appreciations of the uses of coloured smoke.

In addition, a few trials, reported in Internal Memorandum E8/5, were made on visibility in area smoke screens, but the work was dropped when large scale trials were arranged by another Section of A.O.R.G.

NIGHT OPERATIONS

10. Questions relating to night operations have occupied a large portion of the Section's time. Two of the Officers of the Section went through the Night Fighting Course at the School of Infantry (this Course is now discontinued). A report was then produced giving a conspectus of night-fighting, with particular attention on scientific aids to night-fighting. See Report No. 165.

One particular question, that of a dusk-aiming sight for the rifle, is still under investigation.

STREET FIGHTING

11. A conspectus of street fighting is being issued as Report No. 167. A number of trials have been necessary before producing this report, principally in connection with the best methods of blowing holes in walls and the lethality of various weapons when fired against troops in houses. A portion of the Section travelled to Kent in order to extend the trials, hitherto confined to stone-built buildings, to a building made of brick.

THE PIAT

12. A.O.R.S.6 played a considerable part in the first trials of the PIAT. Some of these were trials with inert bombs against moving tanks and an attempt was made to get a figure for the average user's chances of hitting a tank at various ranges. These chances proved to be somewhat smaller than had been anticipated and led to the recommendation that PIATs should, if possible, be sited in groups of at least three. See Report No. 164.

The use of the PIAT in street fighting has also been investigated and the new WP bomb for the PIAT has been considered.

20 mm MACHINE-GUN

13. The idea of using the 20 mm machine-gun for attack on slit trenches was brought forward in the Autumn of 1943, and trials were put in hand. No ground mounting was available but a Hazard-Baird anti-aircraft mounting with a Hispano gun was modified for ground work. Experimental firings gave a rough range table and it was found possible to hit a lay-out of trenches about 200 yds. by 30 yds. at 4000 yds. range. Unfortunately, ammunition with a sufficiently sensitive fuse could not be produced, the only available types giving a large proportion of blinds on soft ground. Further trials have therefore been postponed indefinitely, pending the production of a suitable fuse. See Internal Memoranda E8/11, E8/12.

MISCELLANEOUS INVESTIGATIONS

14. Besides the above 'major' projects the Section has, in the two years of its existence, carried out a considerable number of minor investigations. Among these may be mentioned the Infantry sledge, the visibility of officers, blowing slit trenches, wheelbarrow carrying equipment for 3-inch mortars, visibility of mortar flash at night, the 3-inch Mortar star bomb, and questions relating to sniper-sights. A number of these have been in co-operation with the School of Infantry, who frequently ask A.O.R.S.6 to co-operate on problems of a technical nature.

Mention may also be made of some extensive trials of body-armour carried out by the Oxford Extra-Mural Unit and A.O.R.S.7 when A.O.R.S.6 arranged the trial ground and gave assistance.