

Artillery Development,
14 November 1932.

To

Dr. Griessmann.

By request of Prof. von Eberhard we enclose
herewith the copy of a memorandum of his of March 1930 concerning
the problem of mortar rockets, with postscript attached.

signed: Tbg.

(Tubbesing)

1 enclosure.

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DOCUMENT BOOK I MUELLER No. 1
Exhibit No.

Memorandum on the mortar rocket problem.

With regard to the question of a rocket with great accuracy of fire, a very good solution of the problem had already been provided by the Unge'aerial torpedo. (See appendix). The Unge rocket was a projectile of from 7,7 to 9 calibre length, the centre of gravity of which lay in the foremost third of the projectile so that, in the case of a projectile following the trajectory tangent almost exactly, the resultants of atmospheric resistance should have cut the axis of the projectile fairly close to the centre of gravity. Should any great deviation occur force would be applied to a point much further towards the rear so that, just as with an arrow, the projectile would be forced back into the proper plane. The powder gases were emitted through nozzles which caused the rocket to rotate.

A centring ring at the centre of gravity is said to have improved firing accuracy considerably.

In the target graphs for 4400 meters and 3000 meters reproduced in the document the very slight dispersion of a very large number is obvious, while only a few rounds were a considerable distance from the target.

The 10 cm)	17 kg
20 cm) torpedo	134 kg
30 cm) weighed	420 kg

In order to obtain similar results in a cheaper way the causes for these relatively favourable results must be examined.

With a rocket the propelling force is operative during a large part of the flight of the projectile. Even with the most careful production methods, however, it is impossible to make the resultants of the motive force pass exactly through the centre of gravity; it will, rather always cause a rotating moment round the centre of gravity. The effect must be that the trajectory is altered by this rotating moment in an unpredictable and, therefore, uncontrollable manner.

- 2 -

If, however, the rocket is caused to rotate this rotating moment will continually change its direction and, finally, will only cause a sort of spiral movement round the trajectory tangent; so the rotation of the rocket is absolutely necessary for its precision. The question is now; how rapid must the rotation be? The unge rocket was relatively short and blunt. It required relatively rapid rotation for stable flight.

Presumably the more like an arrow the rocket is made, the slower the rotation needed. For an arrow to fly well a long, thin, light rod, with the tail-piece (the flight) attached to the end, must be attached to the heavy point.

Presumably a rocket will fly well if the front portion is heavy and is formed in such a manner that the atmospheric resistance is easily overcome, that is a slender point tapered off at the rear end. The exhaust vents should not be placed too far from the centre of gravity so that, even if the manufacture is bad, the resultants of the reaction forces do not cut the curve too far from the centre of gravity.

The steering fins at the end of a long, light rod. How must they be set? In any case, not parallel to the rod but obliquely in the direction of the twist. If they are inclined sufficiently they, themselves, will impart the necessary rotation to the projectile. Because, for manufacturing and other reasons, it would seem advisable to avoid oblique jets which, obviously, would cause the rotation much better.

Finally the question of the firing apparatus and the Unge centering rings

- 3 -

- 3 -

With Unge the centering ring undoubtedly improved firing accuracy. But the explanation that Unge gave for the cause of this improvement appears to me to be too far-fetched and artificial.

When the torpedo was ejected from the launching apparatus, it was, as Unge observed, deflected. No wonder, for the torpedo, no longer supported under the centre of gravity, and attracted by gravity, began to fall whilst the rear part was still supported and thus a twisting tendency was produced. And as its velocity at this moment was still very low the deviation could be considerable and this had a different effect with every projectile because the speed of rotation altered in relation to the friction, that is varying rotatory effects were caused. The important^{thing}/about the centering ring was, however, in my opinion, that it lay in the region of the centre of gravity. Thus, as soon as the rear part was no longer supported in the barrel by any type of centring device, the projectile was only supported in the barrel at its centre of gravity, that is, as it traveled forward under support, no rotating moment round a transverse axis was imparted to it by gravity. And at the instant at which the centring ring leaves the muzzle the whole of the rocket projectile is, at that moment completely free.

The effectiveness may be improved if the centring ring is sharp-edged and the axis of rotation can be made to coincide with the centre of gravity axis, but this does not seem to be important.

On the other hand it is important that the ring should give support immediately under the centre of gravity. So actually it should be constructed so that it can be adjusted according to the elevation of the barrel and then fixed in position.

All these considerations are naturally qualitative, not quantitative. And extensive experiments will be required to achieve good results.

Signed: von Eberhard.

- 4 -

DOCUMENT BOOK I MUELLER No. 1
Exhibit No.

9 November 1932

S u p p l e m e n t :

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Furthermore it is advisable for the following reasons,
not to allow the rocket to operate from an initial velocity of 0
but to impart to it a certain initial velocity by firing it or
by means of a catapult. As the rocket is operated solely
by the propelling force, the same quantity of propelling charge
is required to increase the velocity from 0 to 40 meters as
from 100 to 140 meters. In the latter case, however, the energy
increase obtained with the same quantity of propelling charge
is many times greater than in the former case. It is, therefore,
advisable to use means other than the propelling charge of the
rocket to provide the small amount of energy required for
launching.

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I hereby certify that the above memorandum was taken from
Krupp File

AK / K G C - 952.

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Nuernber., 11 March 1948

signed: H. L i n k .

Attorney.