Defence Science Journal, Vol.1, No.2, January 1950, pp. 205-2012

ARMAMENTS AND MACHINE TOOLS

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Introduction.

It is a great pleasure to me to say a few words to you about armaments and machine tools and I am at the same time thankful to the Director General of Ordnance Factories that he has honoured me in nominating me and thus giving me an opportunity to take part in this conference.

Important points have been discussed in brief for the consideration of Defence Science Conference as under :—

Use of Small Arms.

1. I shall start now with the use of Small Arms in the Army :

Pistol.

(a) After the first World War (1914-18) Germany had developed pistols-system walter of 9 m/m bore with automatic ejection and loading of barrel fed from a magazine of 8 rounds housed in the hand grip of the pistol. This pistol has superseded the century old Revolver which we find still in use in some Armies. Because of its simplicity and being handier in use, the question of manufacture being simple which cannot be ignored while giving consideration to the introduction of this weapon in India when we are going to establish manufacturing such weapon right from the start.

Machine Pistol.

(b) Short barrel 9 m/m bore-machine pistol has proved in the last World War to be a wonderful weapon, which has been proved efficacious specially in the street fighting. In some cases this weapon has superseded the use of Rifle and Machine Gun. This weapon was designed to consume the same ammunition as that of pistol.

Rifle.

(c) For the last 50 years there had been practically no major development in Rifles. During the middle part of the war 1939-45, however, there had been a tendency in the continent to develop a self-ejecting and loading Rifle with* a magazine accommodation of 10 rounds. There happened to be many critics for and against this gun, some say, there is a likelihood of wastage of ammunition being a much faster weapon, whereas others are of the opinion that the soldier has been given an opportunity

Ref Swiss E. 22 m/m SL. Rifle SK46. Swiss F. 92 m/m LMG type SK46. Proceedings of the Ord. Board, 8 Feb. 49 No. 35,609. 10 lbs. 4 oz. 5 rounds.

to aim at his target while ejecting and loading the Rifle by hand (as is the case in present Rifles). Anyhow, I would like to leave this controversy to individuals to come to their own conclusions.

Machine Gun.

As is known to every body machine gun is nothing but a defence weapon, but due to developments made shortly before and during the 1939-45 war it has found its use in the offensive warfare as well.

In 1942 Germany had developed a machine gun to supersede their 1934 model having a firing capacity of about 1,500 rounds with the help of chain magazine containing 250 rounds. Most of the components of this gun were manufactured by pressing and forming and not by milling, which is the present practice. By this method the material consumption figure could be reached to 52 per cent of the raw starting material i.e., 48 per cent material was wasted, whereas in the present milling process of part manufacture the material consumption figure was reached to only 25 per cent or in other words 75 per cent of the material is wasted.

This efficiency or wastage figures show—

(1) quick production.

(2) less cost and consequently lightness of the gun with the increased strength.

Due to the lightness of this gun it has found its place in the offensive warfare to some extent. Suggestion may be made for development of such guns in this light, which is of a vital point of economic interest.

Ammunition.

2. (a) The design and construction of ammunition also plays a very important part along with the weapons. Here again the perfectness of fuses cannot be ignored on which the ultimate action of the ammunition more or less depends.

Fuse 20 m/m.

(b) Normally 20 m/m machine gun is meant to combat low flying aeroplane, but it had been experienced that often the bullet pierces through the wing causing not much damage, so in the later part of the war some developments have been achieved with the help of sensitive fuse mounted at the tip of the bullet. This bullet was designed to explode with the slightest disturbance, even on a canvas wall, causing major damage to it. It had been observed that sometimes the fighter plane wings were covered with canvas.

Fuse with Armour Piercing Projectile.

(c) Now I wish to mention about a very tiny fuse having a giant-like action. This fuse is screwed at the back of the armour piercing projectile being fitted with hardened steel tip. The dimension

of this fuse is in the neighbourhood of 1¼" long and ⅞" diameter. This small fuse is in use with the projectiles irrespective of the size of the shell.

Development tendency of Army & Naval guns.

3. (a) After the 1914-18 war the tendency was to increase the caliber of the gun, whereas just before the 1939-45 war due to the improvement in impetus of the shell the tendency was to decrease the caliber of the gun with increased firing capacity of the gun. Here by the word firing capacity of the gun, I mean to say the gun can fire so many shells per minute.

This practice was not only confined to land guns but at the same time extensively practised in the naval guns. With the increased velocity of the shell and improved accuracy of the gun (i.e. of the projectile) the practice to decrease the caliber etc. was universally adopted.

Anti-Aircraft Gun.

(b) In the last war 1939-45 the mobile anti-aircraft gun with table mounting and long range had played very important role. This gun served more or less as an universal gun.

In the later part of the war Germans had used twin barrel 12.7 cm. (5" caliber) gun with ¾ full automatic operations i.e. closing, firing and ejection of cartridge. The setting of the time fuse was manipulated automatically with the radar mechanism mounted at the side of the gun. This 12.7 cm. gun has a firing range of 12,000 m. i.e. 36,000 ft. in the altitude. Although with the rapid development of the aeroplanes and with its tactical use, some are of the opinion that anti-aircraft gun might not find its use in the true sense as is normally understood, I would like to stress that such semi-heavy gun having an exceptional firing capacity and having a large impetus may sometimes substitute artillery, anti-tank gun and coastal artillery. This gun, having been mounted, as has already been mentioned, on 4 wheels and on a turntable and thus having practically no dead angle, will in the long run supersede artillary like 25 pdr. gun. Artillery might not find much use in the future there being extensive use of tanks in the modern warfare.

Substitute material in Rifle.

4. (a) Now, I would like to say a few words about the substitute material used in Rifle, fuses, cartridge, bullets (small arms) etc. I believe, some of my colleagues are aware of the difficulty in obtaining Walnut timber required for rifle furniture specially after the partition of India. Walnut is the timber used by almost every country. Some countries have also experienced the same difficulty and have tried to solve it, and have satisfactorily solved the difficulty by using synthetic phenolic resin bonded plywood. The time has come now, that we should exert ourselves to look for such plywood furniture that has already been successfully experienced by other Governments.

Fuse.

(b) Brass is the material that was and is used exclusively in the manufacture of fuse components in some countries.

India being very rich in Bauxite i.e., aluminium ore deposits and very poor in copper, in my opinion, we should try to establish the manufacture of the fuse components out of aluminium alloy as already being done in some countries. Components out of aluminium alloy allow to be die cast (both gravity and pressure) and extruded conveniently, other machining facilities over brass and have proved to be very efficient. The technique of die casting for aluminium alloy has become very popular in the branch of aeroplane engine, motor car and other high speed engines where high speed together with lightness is a decisive factor, but surely not neglecting the function and durability of the components.

Ammunition.

(c) Similarly the bullet envelop for small arms and the cartridges both for small arms and heavy fuses were and are made of brass. The question of substitute material in this branch has been solved by other countries by steel plates. Although we have not experienced yet much difficulty in obtaining brass to meet our requirements, with the expansion of India's armed forces the question of substitute material cannot be ignored.

Development of Tanks—General

5. (a) If we watch the development of Tanks after the World War No. I to the present, the development made in the weapon with the position of its mounting is quite interesting as also the fact this weapon with its positions and its capacities had played an important part in last war. The development made in tanks are as follows :

(i) Gun mounted very low having 15° side ways movements either way, weapons all in one direction.

(ii) Anti-tank gun mounted on the tower having hydraulic of 360° and having flame throwers and other two having machine gun mountings.

(iii) In addition to (ii) two more machine guns were mounted having facilities to combat low flying aeroplanes. In the continental warfare the use of K.W. 15, a. 52T tank mounted with a 15 cm Howitzer on the revolving tower was used. Some call this not as a tank but an armoured self-propelled artillery.

British and German tanks were designed and constructed with rivetted plates and later on with welded plates, whereas the American tank model "General Lie" was manufactured from steel castings, probably this action was undertaken on the quick manufacturing point of view.

Of all the tanks used in the last war the Model T-34 may be praised which had a cruising speed of about 25—30 miles/hour fitted with a long barrel anti-tank gun of 75 m/m caliber. The Germans developed their "Tigar" from this model. The latest American model "General Patten" conforms to that of T-34 from appearance but with extensive weapon mountings.

The latest tanks have automatic serpent like movements when desired actuated through double universal gears. The general design of tanks follow these points :—

(1) firing capacity
(2) min. dead angle
(3) max. cruising speed with flexibility and distance.

The design of Tank Engine has a bearing on the tank's cruising and combating capacity, where the space with weight plays an important part. In this connection I may mention for general information that the Americans have designed a Tank engine which weigh about 0.9 lb./H.P. which is a remarkable achievement.

Machine-Tools.

6. (a) Now I would like to say a few words about the machine tools :

In one word it may be said that the potential strength of a Nation can only be increased on the establishment of Machine Tool Industry both light and heavy.

With the use of correct type of machine tools the manufacture becomes easy and perfect. In case of mass production special machines play an important part (specially in the case of Defence Industries). These special machines cannot be obtained by import. So the question of establishing a big special machine tool manufacturing plant under the Ministry of Defence is very important. To design and establish manufacture of such machineries generally take time and particularly, the tradition required for the same, cannot be ignored.

I take this opportunity to suggest to the delegates to this conference to make a concrete proposal to the Ministry of Defence for an early establishment of such a factory, to make this factory grow up to a strength of at least 10,000 workmen gradually in the course of next 5 years.

Experts say, "From the Machine Tool Making capacity of a country the potential strength of that country may very well be understood". So, I want to emphasise to this conference the need for the establishment of such a factory as early as possible.

Gun boring.

(b) In this connection I would like to cite some example to justify my above statement.

Gun boring is done on a special boring lathe where the barrel rotates and the steady tool brings the feed.

Gun honing.

Honing of heavy gun barrel is also generally done on the same type of lathe. But a much efficient and accurate work can be obtained if the job is clamped vertically and the spindle mounted with flying honing stones which are allowed to rotate fast with axial movements. The space economy, faster operation with accuracy

cannot be ignored. This type of machine was found to be in use in the continent. Rifling machine may be cited as another typical example.

Aircraft Engine.

(c) Another example of a special machine is to drill and tap a number of holes (85) on an aeroengine cylinder block by a single operation. The boring and facing of all the 6 cylinders of the above-mentioned engine by one operation is another example.

Special machines required for rough and also finished turning of shell cannot be ignored. The special machines required thereto cannot be obtained in the market unless specially designed and made. Here again, the design of shell plays an important part in the selection and design of machine.

As has been stated the importance of establishing design and manufacture of such special machine tools Dept. cannot be over emphasised. The special dept. may be authorised to deal with the development and research section of Arms and Ammunition.

Standardisation of parts.

(d) Side by side the question of standardisation of machine tools and its components such as shaft bearings, nuts, bolts, etc. and the introduction of metric system which is more or less internationally adopted cannot be ignored. Although USA was used to work in inch and foot measurement, to-day she has introduced in more than 60 per cent cases metric system and is gradually going over to this system. It is worth considering this point in this conference bearing in mind that India has no tradition in this branch and is starting from nothing in her infant stage. It is needless to stress more about the advantage of this metric system over the inch and foot measurement which is more or less experienced every day by all of us.

Fitting limits. Piece rate group.

(e) Standardisation of fitting limits to facilitate mass production.

(f) Here is another point which needs due consideration to establish standardisation of piece rate system throughout India so far as the grouping of class of labour is concerned, the introduction of which, I am confident, will solve the present labour unrest in India mainly due to dissatisfaction over wages. Rates of the same group may be allowed to vary from place to place according to local conditions. By the word standardisation I mean here, that the nature of works in a particular work-piece should be standardised and should belong to one and the same piece rate group for operation.

The latest methods of fixing the piece rate are based on the consideration of two main groups :

(a) Nature of work,

(b) Efficiency of the workman.

The sub-grouping should follow further :

(1) Nature of work

Body Strain

(i) Position of work

(ii) Difficulty of work.

(iii) Speed of work.

(2) Brain

(i) Common sense

(ii) Duration

(iii) Responsibility.

(3) Tactfulness

(i) Accuracy

(ii) Independency of work.

(4) Influence of the neighbourhood

(i) Heat, cold,

(ii) Dirt, dust, gas.

(iii) Sickness, chance of accident.

(5) Specialist training

(i) Apprentice time

(ii) Professional experience.

(6) Efficiency of the Workman.

The following two factors should be the units of consideration :

(1) Seniority

(2) Efficiency of time on : thoroughness, carefulness patience, activity, etc. and how the workman takes up the job, willingness, unwillingness, etc.

In this connection it may be further pointed out that the individual job and major group of ordnance should be specified as such and such work requires so many minutes and not on money basis. The time factor should give us more uniformity to judge the efficiency of a particular plant for the same job irrespective of the country it has been manufactured either in America, England or India.

This productive minutes would at the same time give us a good indication and guidance to judge the efficiency of an individual plan.

7. (a) It is well known to every body the difficulty experienced almost every day in the scarcity of—

(a) Artisans

(b) Supervisors and

(c) Engineers in India.

This conference may consider this question very carefully and make a concrete proposal to the Ministry of Defence.

From statistics it may be mentioned that for every 25 workmen one supervisor is required and for every 4 supervisors one Engineer is required. So this conference may very easily calculate our requirements of such hands for replacement and expansion purposes. Say for a plant having 1000 workmen, 40 supervisors and 10 Engineers

will be required. To meet with the normal replacement and consequent expansion I would suggest to give training to at least 2 per of the total strength per year in a batch of 1 per cent every 6 months. The question to train supervisors and engineers should not escape our eye.

In this connection I would like to suggest to this conference to make a proposal to the Government of India to make it compulsory for every Industrial undertaking to give training to workmen (not less than 2 per cent of the total strength) each year. By this method I sincerely hope that India in course of 10 years will be able to create some sort of standard in the nucleus of workmen supervisors and technicians. I consider this as one of vital importance for the future development of Indian Industries in the Defence and General Fields.

Establishment of a Research Institute.

8. Before I close for the day I would like to suggest to this conference the establishment of a Development and Research Institute directly under the Ministry of Defence to deal with the question of (a) development of weapons, ammunition and other scientific stores and ultimately of new weapons, (b) to deal with the substitute material and (c) other defence units requirements such as uniforms, badges, etc. This Development and Research Institute will maintain some experts in different branches and they will take extensive assistance from the University professors who will conduct experiments in the universities on the problems given by the Development and Research Institute either originated by them or from the factory or from any other source.

This suggestion of mine (has nothing new or original) is more or less common knowledge in other countries ; only problem is that we will have to give it a proper shape according to the local conditions.

In this connection I would like to emphasise that this Research Institute should remain under the direct control of the Ministry of Defence and not under any other branch for the satisfactory functioning of this Institute.

With these few words I am conveying my best thanks for your patient hearing.