

This item was submitted to [Loughborough's Research Repository](#) by the author.  
Items in Figshare are protected by copyright, with all rights reserved, unless otherwise indicated.

## Manufacturing and the Great War

PLEASE CITE THE PUBLISHED VERSION

PUBLISHER

© Wayne David Osborne

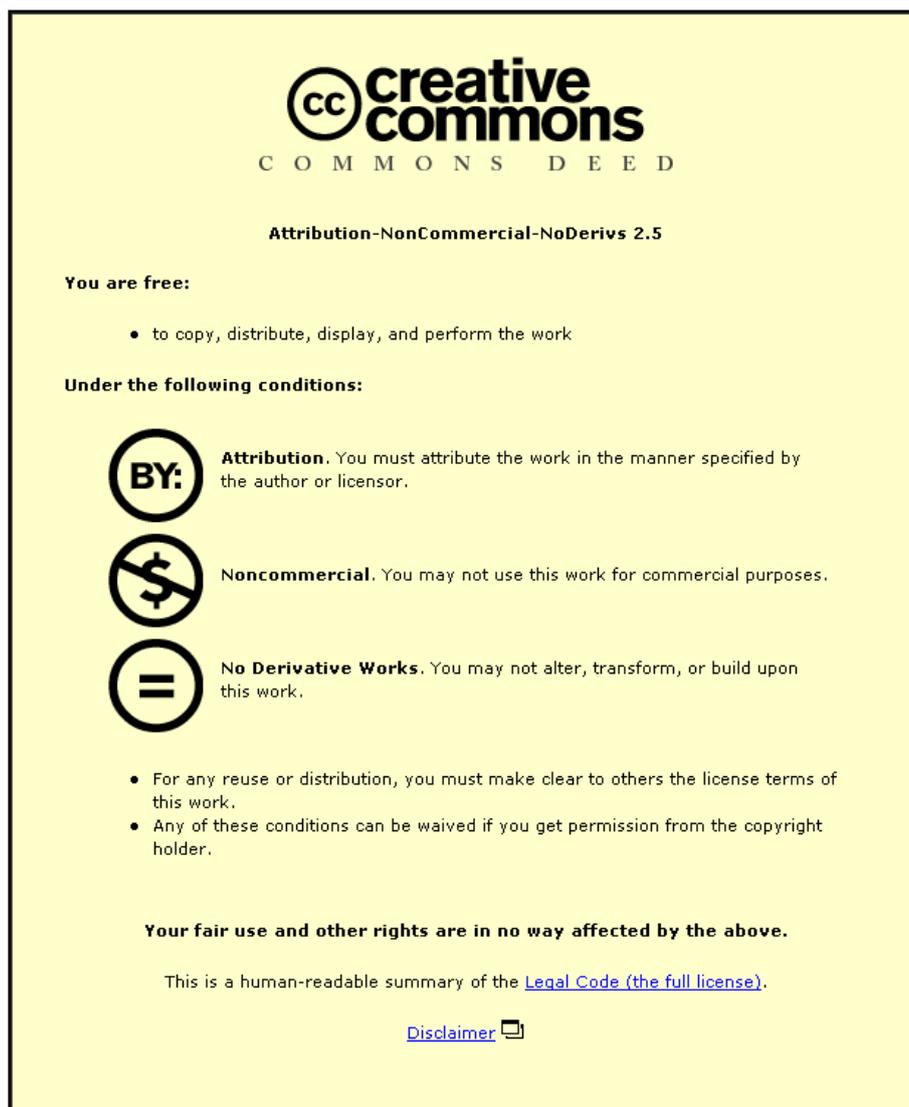
LICENCE

CC BY-NC-ND 4.0

REPOSITORY RECORD

Osborne, Wayne D.. 2019. "Manufacturing and the Great War". figshare. <https://hdl.handle.net/2134/12550>.

This item was submitted to Loughborough University as a PhD thesis by the author and is made available in the Institutional Repository (<https://dspace.lboro.ac.uk/>) under the following Creative Commons Licence conditions.



For the full text of this licence, please go to:  
<http://creativecommons.org/licenses/by-nc-nd/2.5/>

# Manufacturing and The Great War

---

By  
Wayne Osborne

A Doctoral Thesis  
Submitted in partial fulfilment of the requirements  
for the award of  
Doctor of Philosophy of Loughborough University

Loughborough University  
Department of Mechanical and Manufacturing Engineering

June 2013

© by Wayne Osborne 2013

## **Abstract**

In manufacturing and army terms, Britain was not able or geared up to deal with the Great War. It was able to cope with a small, short war on the continent as part of a larger coalition but not the global crisis that came about. Britain's research and development before the Great War had been in the Royal Navy. The army had been neglected. At the outbreak of the war it had been planned for the navy to carry the burden of the conflict but this proved to be an erroneous course of action. Very early in the war it became obvious that the armaments industry was unable to provide the munitions to prosecute the war to a successful conclusion. The government had to set up the Ministry of Munitions in order to co-ordinate the manufacturing 'ramp up', mobilise and train the nation for total war in order to meet the requirements of the armed forces to fight the war and solve the crisis.

After leaks to the press and political manoeuvring, the Ministry of Munitions was set up to take away the responsibility of the War Office to manufacture, procure and supply munitions. It was a masterstroke. The workforce was increased by the introduction of semi-skilled labour and many of them being women they brought with them the need for welfare reform in the factories. Those reforms had a positive effect upon the male workforce and productivity in general. Semi-skilled workers were trained by educational establishments throughout the land and many modern universities, like Loughborough owe their very existence to the Great War. Loos was fought and lost on War Office contracts, Arras was amply supplied by Ministry initiatives and the 100 Days campaign of 1918 was made possible by massive, British manufacturing output. In essence, British manufacturing won the Great War. The war was a crisis solved by manufacturing.

The thesis focuses mainly upon the primary source document that is the Official History of the Ministry of Munitions, war diaries and publications written at the end of in in the years after the Great War.

## **Acknowledgements**

The completion of this work gives me great pleasure; just finishing it is an achievement for someone who had to leave a secondary modern school with little in the way of qualifications. I would like to thank the following for their help, advice, encouragement and kindness over the last few years while I have worked on this Thesis; Helen Osborne, Keith Case, Jenny Clark, Bob Young, Nigel Williams, Abigail Osborne, Clare Osborne, Anne Hatliff, David Williams and the late Derek Thornhill, friend, Royal Naval engineer, and lathe designer.

In memory of my father, David Osborne. A railway engineer who would have been very surprised but very pleased. Without him, I could not have begun this journey.

# Contents

<b>Chapter 1. Introduction .....</b>	<b>9</b>
1.1. Broad overview of the research area.....	9
1.2. Research question .....	11
1.3. Scope of research.....	12
1.4. Aims and Objectives (of research).....	13
1.5. Statement of the use of primary research materials.....	14
1.5.1. The Official History of the Ministry of Munitions.....	14
1.5.2. Published Literature .....	16
1.5.3. Unpublished Documents from the National Archive .....	16
1.6. Structure of thesis .....	17
<b>Chapter 2. Military Procurement prior to the Great War .....</b>	<b>19</b>
2.1. Introduction .....	19
2.2. The Royal Navy, the Main Weapon of War. The Army, a Police Force .....	19
2.3. The Historical Enemies and a New Enemy .....	21
2.4. New Warship Design .....	22
2.5. The Battle of Tsuchima .....	22
2.6. The Genesis of the Dreadnoughts.....	24
2.7. The “Conversations” .....	25
2.8. Research and Development Before The War.....	25
2.9. Conclusion .....	28
<b>Chapter 3. Munitions Manufacture – Government and Politics.....</b>	<b>30</b>
3.1. Introduction .....	30
3.2. Artillery .....	30
3.3. Artillery Ammunition .....	32
3.4. Production in early part of war .....	35
3.5. Orders from America.....	37
3.6. Factories .....	38
3.7. Machine Tools.....	41
3.8. Materials.....	42
3.9. Politic and Manufacture – the Shell Scandal .....	42
3.10. Ministry of Munitions .....	47
3.11. The Ministry .....	49
3.12. Conclusions .....	51
<b>Chapter 4. Supply Logistics – The Battle of Loos, 1915 .....</b>	<b>54</b>
4.1. Introduction September 1915. The Battle of Loos .....	54
4.2. Sea Ports & Railways .....	55
4.3. Assembled Artillery at Loos .....	58
4.3.1. Super Heavy and Heavy .....	58
4.3.2. Divisional Artillery .....	59
4.4. The Battle.....	59
4.5. Conclusions .....	63
<b>Chapter 5. The Workforce .....</b>	<b>66</b>
5.1. Introduction .....	66
5.2. The need for workers and union opposition.....	67
5.3. Government intervention.....	69
5.4. The King’s Squad.....	71

5.5.	National Roll-out .....	72
5.6.	Recruitment.....	72
5.7.	Failure of National Scheme.....	74
5.8.	Workforce Data .....	76
5.9.	Involvement of Private Companies and the Admiralty.....	77
5.10.	Quality of Volunteers.....	78
5.11.	Reality of Scheme.....	79
5.12.	Recruitment Problems .....	80
5.13.	National Registration.....	80
5.14.	Assessment of National Scheme .....	81
5.15.	Conclusions .....	82
<b>Chapter 6. Instructional Factories and Training Courses.....</b>		<b>87</b>
6.1.	Introduction .....	87
6.2.	Thinking about Plugging the Skills Gap .....	89
6.3.	Volunteers.....	89
6.4.	Factory Training .....	90
6.5.	Initiative by Educational Establishments.....	91
6.6.	Government and Ministry Control. ....	91
6.7.	Finance for the Project.....	93
6.8.	Reports On Work Already Undertaken .....	93
6.9.	Pushing on with the Project .....	95
6.10.	Leicestershire and Schofield.....	96
6.11.	Scheme for training semi-skilled workers for munitions work at Technical Institutes.....	99
6.12.	Loughborough Technical Institute.....	101
6.13.	The Training Courses .....	102
6.14.	The Syllabus .....	103
6.15.	Success for Training .....	105
6.16.	Optimism and Dissent in Government and Educationalists.....	106
6.17.	Conclusion .....	107
<b>Chapter 7. Supply Logistics – The Battle of Arras .....</b>		<b>110</b>
7.1.	Introduction .....	110
7.2.	Shell Production Ramp-up 1916-1917.....	111
7.3.	Supply Issues.....	115
7.4.	Plans .....	117
7.5.	Build up to the Battle.....	118
7.5.1.	Assembled Artillery at Arras and Ammunition Allotments.....	118
7.6.	Forward Planning.....	120
7.7.	The 17th (Northern) Division and the Build up.....	120
7.8.	Equipment required for the Troops and Supply.....	121
7.9.	Supply on Foot and Hoof .....	122
7.10.	The Battle.....	125
7.11.	Conclusion .....	127
<b>Chapter 8. Worker Welfare .....</b>		<b>130</b>
8.1.	Introduction .....	130
8.2.	Ministry of Munitions action on Welfare .....	131
8.3.	Innovations for the Female Workforce.....	132
8.4.	Welfare Supervisors.....	134
8.5.	Development of Welfare Supervisors .....	134
8.6.	Good old Lil' .....	136
8.7.	Welfare Duties .....	137
8.8.	Welfare Innovations for the entire Workforce .....	139

8.9.	Male Welfare .....	140
8.10.	Trades Unions.....	141
8.11.	Medical, Housing, Canteens and Messrooms .....	142
8.12.	Towards the end of the War and after .....	143
8.13.	Conclusions .....	144
<b>Chapter 9. The Situation in 1918. To the Armistice .....</b>		<b>147</b>
9.1.	Introduction .....	147
9.2.	The Workforce and Unrest.....	147
9.3.	The Embargo Strike of 1918 potential catalyst or damp squib? .....	149
9.4.	Shell Manufacture, Conventional and Chemical, 1917-1918 .....	152
9.5.	German Spring Offensive 1918 .....	155
9.6.	The 100 Days to the End .....	159
9.7.	Conclusions .....	163
<b>Chapter 10. Conclusions and Further Research.....</b>		<b>165</b>
10.1.	Conclusions .....	165
10.2.	Further Conclusions.....	166
10.3.	Lessons Learned .....	168
10.4.	Further Research .....	170
10.4.1.	Future work .....	170
10.4.2.	Standardisation .....	171
10.4.3.	Materials and resources .....	171
10.4.4.	Transport and Supply .....	171
10.4.5.	The workforce.....	172
10.4.6.	Unions .....	173
10.4.7.	Education .....	173
10.4.8.	Inspection Process .....	173
10.4.9.	Research and Development.....	173
10.4.10.	The Military .....	174
10.5.	Concluding remarks.....	174
<b>References and Select Bibliography.....</b>		<b>178</b>

## Tables and Figures

Fig 3.1.	18-Pound Shell Orders & Delivery up to 31-12-14 : High Explosive .....	33
Fig 3.2.	18-Pound Shell Orders & Delivery up to 31-12-14 : Shrapnel .....	33
Table 3.1.	War Office Planned Daily Ration for 1915 .....	34
Table 4.1.	Super-Heavy & Heavy Artillery at Loos .....	58
Table 4.2.	Divisional Artillery at Loos .....	59
Table 6.1.	War Munitions Volunteers, 1915 .....	74
Table 7.1.	Artillery assembled for Arras .....	119
Table 7.2.	Permitted rate of ammunition expenditure for the first 2 days of bombardment – Arras .....	119
Table 7.3.	Stores and equipment typically carried by the pack mules in the division in April/May 1917 .....	123

# Chapter 1.

## Introduction

### 1.1. Broad overview of the research area

The Great War battlefields of France are punctuated by cemeteries, the final resting place of thousands of men. In the gentle countryside of Picardy, known to the British as the Somme, the cemeteries nestle in the corners of fields, alongside roads, in towns, villages, hamlets. Some are big others small; they are all well-kept, neat and tidy, as good as the day they were opened and they are everywhere. Beneath each headstone lies a story about a life cut short by mechanised warfare; killing on an industrial scale.

Walking in the fields around these cemeteries, sharp eyes will begin to notice lumps of rusty iron. Close inspection will reveal the detritus of a war long since over. Then one will notice that there are shells, grenades and bullets everywhere, sometimes piled on the side of a track by farmers, sometimes lying in furrows, under leaf mould in ditches, piled in pyramids in farmyards. Boot soles and corned beef tins are also part of the detritus. The British Army 'swept' these battlefields numerous times after the war, more unofficial 'sweeps' were done in the 1930s, each an attempt to clear away the lethal rubbish left by the war. Every year the earth gives up more of the 'iron harvest' as it is known in France. So many shells had been stored and fired during the war that the army could not properly clean up. When one realises that objects manufactured at the start of the 20<sup>th</sup> Century are still emerging from the ground one has to ask, how big was the manufacturing effort that produced them, that produced so many shells and so many bullets? Each 18-Pounder and 4.5-inch shell and each live 0.303 round that comes to light today is a testament to the huge manufacturing effort of the British nation in that time. Each brass shell fuse and lead shrapnel ball that one picks up now

is the physical representation of mighty output by industrial powers striving to win a war. If there is a story for each dead soldier, there is a story for the industrial artefacts as well.

Working from the research done for my History MA into an infantry division during the Great War [1] it had become clear that such a large force of 12,000 men (and the British Expeditionary Force possessed many of these divisions), could not take to the field and operate without a massive logistic operation. That logistic operation could not take place without a huge industrial manufacturing output to provide the enormous amount of munitions that the B.E.F and its armies, corps, divisions, brigades and battalions would need to fulfil the primary function, that of a fighting machine. What then was the process behind victory in November 1918 apart from infantry fighting in the trenches of the Western Front and in various theatres of operations throughout the world? At the heart of the British part in this victory was the ramp up in industrial manufacturing and its continued growth and output. Manufacturing almost failed in the early days of the war but it rallied and became one of the best weapons that the British held. The main question was therefore, what did British manufacturing do to redress the balance and ramp up production?

The aims and objectives of this research were to discover and chronicle some of the story about that ramp up of munitions production during the Great War. The conflict was a crisis that affected many nations around the globe, what methods did the British use to try and resolve the crisis in their favour? There were numerous 'false starts' and failed attempts to ramp up munitions production to an acceptable level but that was because of two factors. Firstly, despite warnings from some, manufacturing industry and Government failed to grasp the scale and, in the early months of the war the rapidly changing nature of the crisis and the early attempts to ramp up production

failed. Demand simply outstripped supply. Secondly, the manufacturing industry, one of the keys to the successful resolution of the crisis, was initially unaware that it had to play such an important role. In previous years, wars or 'police actions' had been small affairs, fought out on foreign shores and using small amounts of munitions and supplies. The manufacturing processes and skill base for mass production was not in place because it had no need to be. There was a fairly small munitions manufacturing base for a very small army and a large navy and the navy got the lion's share. What Britain possessed in this area, in terms of the army, was *just* enough. Therefore, the main aim of this research was to examine what was attempted and what was successfully done in government, in the factories and with the workforce to ramp up munitions production to a level that where supply could outstrip demand?

## **1.2. Research question**

The Great War has a huge amount to tell us, it contains advice for the future. How did the British nation manage to go from an inability to manufacture all of its military requirements in 1914/15 to manufacturing and supplying so much as the war progressed? In 1918, after the German Spring offensives the Allies were 'on the ropes'. Yet, the material losses of March/April 1918 were absorbed and recouped. Stores were plentiful, a testament to manufacturing work that had gone on in the years before. What else was needed was produced by a huge manufacturing effort in mid-1918. An effort that could not have been made without the infrastructure and systems that had been put in place earlier in the war. Within a few months of coming close to losing the war on the battlefield, the Allies, supplied in the main by British manufacturing, went on the offensive and won the war with a mobile operation more akin to the end of World War Two than the Great War of common memory. What part did

manufacturing and the civilian population play in the victory of 1918? Yet, in truth, this work can only be a beginning; the subject is so vast there is still more to do.

The research is based upon the examination of the collection of primary source documents the *Official History of the Ministry of Munitions*, [2] the *Official History of the Great War*, [3] war diaries and publications written about the period. Three subject areas are examined; the state of manufacturing at the beginning of the war and what was done in the country to improve matters and deal with the growing shell crisis of 1915. The attempt to deal with a skills crisis in munitions manufacturing through a voluntary system of Industrial labour. The workforce and training courses for semi-skilled and skilled labour that was brought into the expanding factories. An examination of welfare reform for women, its implementation and how that benefitted the workforce as a whole. Shell production throughout the war. Unrest at home and reverses in 1918. Three battles are briefly examined, the Battle of Loos, The Battle of Arras and the 100 Days.

### **1.3. Scope of research**

After touching briefly upon the years before the war the research covers the period from 1914 to 1918. Considering the size of the conflict and the research area to be covered, artillery weapon design and procurement, like that of warships, is covered only briefly. They all deserve PhD research of their own. The focus for the research has been on British munitions production and the human element of munitions manufacturing with some reference to supply to the front line. How the workforce was assembled, recruited, trained and their welfare needs met. Also, because this research is about war material production it has been necessary to briefly examine three campaigns of the Western Front in order to see the impact of increased manufacturing production

at the 'sharp end'. The manufacturing ramp up was the British response to the crisis of the Great War and after a stumbling start it went from strength to strength, to deliver the goods to the Armed Forces which enabled them deal with and end the crisis that by 1918 had become practically global.

#### **1.4. Aims and Objectives (of research)**

The aim and objective of this research is to examine the historical documents already mentioned to find out some of what was done to ramp up British manufacturing for munitions production. Because of the historical nature of this research part of the aim and objective is to provide a narrative that can give the modern reader an understanding of some of the events of the Great War which may be translated to the current time.

1. To set the scene by briefly examining the situation before the war. This is covered in Chapter 2.
2. To examine what the British did to improve the pre-war system of munitions manufacturing in the Great War. The objective were the causes for the setting up of the Ministry of Munitions. These aims and objectives are covered in Chapter 3.
3. How was the workforce mobilised to make maximum use of its potential? Were there problems along the way and how were they dealt with? How was the skills gap dealt with? Chapters 5 and 6 examine these aims and objectives.

4. What training was there available for new workers coming into the workforce and how was it developed by educational establishments and the government during the war? Chapter 6 examines these aims and objectives.
5. How was the workforce treated and their welfare needs met? Did this ensure that manufacturing production went smoothly? This is covered in Chapter 8.
6. Did the increased manufacturing output have an effect upon the military prosecution of the war? Seen through the battles of Loos in 1915, the first part of the Arras in 1917 and the 100 Days in 1918. Chapters 4, 7 and 9.
7. How in 1918, after the reverses and material losses of the German Spring Offensive and the growing war weariness of the home workforce, did the British manage to manufacture and supply the war munitions to allies and provide enough to feed the 100 Days Campaign? These aims and objectives are dealt with in Chapter 9.

## **1.5. Statement of the use of primary research materials**

### **1.5.1. The Official History of the Ministry of Munitions**

This research has come from an in-depth study of *The Official History of the Ministry of Munitions* [2]. The twelve volumes of *The Official History of the Ministry of Munitions* [2] provide primary source documents written during the Great War. This twelve-volume set was originally compiled and written for British Governmental use only. Realising that there existed a useful resource in terms of personnel and literature that could provide advice for the future, a decision was taken to collate the history of the Ministry of Munitions. It was important to do this while it was still functioning and the

personnel were still alive and in some cases in post. It was compiled by the Historical Branch of the Ministry of Munitions from papers, committee minutes, circulars, office notes, correspondence, instructions, reports, pamphlets, statistics, cables, memoranda, catalogues, hand books and brochures from across the wide range of the war munitions industry from 1915 to 1922. All of which was primary source material. It was published by His Majesty's Stationery Office in the 1920s and the publication run was very short, secret and restricted. It was only reprinted in 2008 by the Naval and Military Press and the Imperial War Museum for sale to the general public. All of the original documents are now held at The National Archives, Kew and are catalogued under the range MUN 5. The set of volumes remains in the shadow of its better known sibling, *The Official History of the Great War*, [3] which was compiled for use by the Staff College but was more widely published and not as restricted. *The Official History of the Ministry of Munitions* [2] is a hybrid of technical/statistical manual and social document (because the human aspect of manufacturing cannot be ignored) and contains information on all aspects of industrial mobilisation in wartime. It charts the ramp up of the British industrial and manufacturing response to the prolonged and escalating world conflict. The work of the Dominions and the Allies in the field of munitions and war equipment production is mentioned but only briefly.

These volumes have been by far the most useful primary source documents for the research. However, they are not easy to read and no one would attempt to read the set for pleasure. Indeed, the set of volumes are almost "impenetrable". Written by different people, the styles differ and some are difficult to read. To gain any understanding of the works one must read and re-read the sections to understand that it is actually an important set of books. With perseverance, one can. It was not the remit of the un-named authors to provide entertainment but plain facts. The volumes

provide a narrative for all aspects of manufacturing for a military purpose during the Great War and much technical and statistical data is provided. As a collection of historical documents, because of its previously classified and impenetrable nature, it has remained, until now, largely unused by academics and researchers.

### **1.5.2. Published Literature**

Other books of varying types have been used in the research. Certain volumes of *The Official History of the Great War* [3] (written and compiled by the Committee of Imperial Defence's Historical Section, under the Editor-in-Chief, Brigadier-General Edmonds, between 1923 and 1949) have been useful. Once again, they are not entertainment but nor were they written as such. They were written to help train staff officers for future wars. They contain some useful statistical data and maps. There is a definite (and inevitable) bias towards the army and, in the early volumes, against civilian manufacturing and Edmonds cannot help, as most historians cannot, putting forward his own view of matters.

It has been necessary to examine a number of other published works in order to give context, depth and sometimes meaning to the text. Some of these publications were written before the war, at the time of the Great War and in the space between then and now.

### **1.5.3. Unpublished Documents from the National Archive**

A number of war diaries from the W0 95 range have been used. When writing a military history these documents are invaluable, they have been less so in the writing of this Thesis. Largely because they do not talk about manufacturing, but rather the somewhat unconscious use of the manufactured goods. The diaries that have been

used have been examined and quoted to illustrate historical points. In general, the war diaries of the B.E.F vary in scope from the thorough and in-depth to the very brief. They like the documents that make up *The Official History of the Ministry of Munitions* [2] were written at the time and these were official, legal documents. One difference with the war diaries is that often they were being written while in the line or as the units had just come out of the line. The diary keepers were exhausted and had other things on their minds. Sometimes someone had to take over the job at short notice to replace a man who had been posted, wounded or killed. Some diary keepers were diligent, others not. Where one might expect the war diary of a divisional quartermaster to contain statistics and returns concerning supplies, one often does not. Also, many documents did not survive life (and death at the front). While some documents were destroyed by enemy action, others met their end in the bonfires at the French ports as the units straggled to their troop ships on demob after the armistice.

## **1.6. Structure of thesis**

Being a piece of research that examines manufacturing in a historical context this thesis appears in the form of a book rather than a report. As far as possible a narrative has been used that adheres to the timeline of the crisis. This is because developments occurred in time and were often in a progression. It also makes it easier for the author to write and the reader to read. It is intended to reveal some of what has been forgotten, it is intended to teach, to generate debate, to demonstrate the place of honour that British manufacturing had in the Great War and it is intended to entertain.

The thesis is divided into ten chapters, eight of which examine a different but interconnected aspect of munitions production. In chapter two, the thesis will examine first the situation before the war with reference to the Royal Navy and the small British

Army. Military procurement and the research and design done in the years leading up to the conflict. It touches upon warship design, briefly examines the Battle of Tsuchima which changed military thinking before the Great War and the seminal arrival of the Dreadnought.

In the following chapter the work done prior to the setting up of the Ministry of Munitions and then the work done by the Ministry of Munitions is examined. This is followed by a chapter that briefly covers the Battle of Loos 1915 and the supply logistics for that battle. The next chapter looks at the workforce and how the shell and workforce skill shortage was dealt with. This leads into a chapter about the involvement of educational establishments, the creation of training syllabi, inevitable Ministry control, the setting up of instructional factories to train workers and the increase of skilled training courses.

As a counterpoint to the Battle of Loos the logistics and supply build up for the Battle of Arras of 1917 is examined next, using the 17<sup>th</sup> (Northern) Division as an example. Worker welfare and the inception of the welfare supervisor in factories is covered in the next chapter. It looks at the need for the role, its development and the training that these supervisors had to have to prepare them for life on the factory floor. The penultimate chapter looks at munitions production up to the end of the war, against a backdrop of social and industrial unrest and a crushing German offensive. It also briefly examines the phenomena of "The 100 Days" the final campaign of the war that defeated the central powers. The chapter asks the question, how was it that the British were able to fight a fluid battle more akin to 1944 than the Great War after losing so much manufactured material during the German spring offensive of 1918. The final chapter deals with the conclusions of the research.

## **Chapter 2.**

### **Military Procurement prior to the Great War**

#### **2.1. Introduction**

The old cliché is true, when Britain declared a state of war with Germany on 4 August 1914, most people really did think that it was going to be over by Christmas and there was no reason for many to doubt that. All wars since the Napoleonic Wars had been short and fought on distant shores. British power rested in the Royal Navy, not the thinly spread, small army that served more as a police force than an instrument of war. Because of events and current thinking in the early years of the young century it was in the Royal Navy that research and development was carried out. In the light of what happened in the Great War, it was a blind alley. Steel leviathans would not win the war; infantrymen fighting in the mud and trenches of the Western Front and in other far flung theatres of operations would do that; supported by rapidly developing aircraft, hitherto unknown weapons, a burgeoning manufacturing base and supply infrastructure.

#### **2.2. The Royal Navy, the Main Weapon of War. The Army, a Police Force**

Since Trafalgar, Britain's Royal Navy had dominated the oceans and the world. The navy was a diplomatic tool and the instrument of domination of trade routes; the protector of Empire and commerce. Yet in the time since Trafalgar, the navy had slowly been neglected. After all why spend money on armed services in times of peace? By the last quarter of the nineteenth century the line of battle had been cut from 100 sailing 'wooden wallers' each mounting 60 to 100 guns to twenty-seven steam powered

ironclads, these being classed as capital ships or 'line of battleships', with 2 or 4 turret mounted guns. All of these ships had assorted weapons, were of an experimental type and not standardised. France and Russia could match this poor force with a combined fleet of thirty-six of the same. In 1885 when required to send a squadron into the Baltic the Royal Navy could only scratch together a motley collection of old coastal vessels and iron clad ships. The rest of the 'fleet' was doing service around the Empire; the expedition to the Baltic, in response to a Russian threat to India via Afghanistan was a poor showing[4]. It was realised in the corridors of power that something had to be done to restore British Naval prestige therefore under pressure from high profile figures, the public and the press Parliament passed the Naval Act of 1889. This marked a turnaround in Royal Naval fortunes as far as capital ships were concerned and was the opening shot in a cold war arms race.[5]

The British maintained the two fleet standard, that is it should be able to engage and defeat two fleets at once.<sup>1</sup> Lord Hankey<sup>2</sup> said, "The organisation of a nation for war depends upon its external policy." [6] British policy was to protect her economic sea routes and to do this she needed the navy; the navy was large and kept that way for foreign policy reasons. On the other hand, the army was small, kept that way to defend the ports across the Empire. The near disaster of the Boer War showed how disorganised the British Army actually was, and how much reform and reorganisation was required. Haldane<sup>3</sup> had begun the reforms shortly after the Boer War and it was decided that in another war Britain required a regular army Expeditionary Force of 100,000 men. It was known as well that spending on the Royal Navy had to continue and it must still take precedence.[7] The Territorial Force, raised from civilian

---

<sup>1</sup> Nelson had defeated the combined French and Spanish battlefleets at Trafalgar and since then this had been the standard.

<sup>2</sup> Lord Maurice P. A. Hankey. In the Great War, Secretary to the *Committee of Imperial Defence*, a senior civil servant, student of history, Royal Marine officer and in World War Two a government minister.

<sup>3</sup> Richard Burdon, Viscount Haldane. Secretary of State for War 1905 – 12.

volunteers, would defend the homeland and if required support the regular army. Government believed that the Territorial Force would have adequate numbers of volunteers for this but they were sadly deluded. By 1913 the T.F. was 66,000 men and 1,400 officers below establishment [8]. The T.F, as it was known, had its own artillery arm but was equipped with old guns; 15-pounders and old Boer War 5-inch howitzers. Its only heavy artillery was old 4.7-inch guns. It was assumed that the regular Expeditionary Force would be needed for a short war and the protection of assets in India or the Egypt. In these early years, the War Office and General Staff were re-organised and plans for swift mobilisation were drawn up. During a conversation with the Kaiser in August 1906, in which His Majesty cheerfully discussed an invasion of Britain, Haldane realised that the Germans would attempt to get at Britain via the northern French and Belgian ports. The conversation confirmed to Haldane the necessity of having the B.E.F ready for swift mobilisation to keep those ports safe. Without these reforms and plans, the B.E.F would not have been able to deploy to Europe as quickly as it did in 1914 [7].

### **2.3. The Historical Enemies and a New Enemy**

For years, the British assumed their enemies would be France or Russia or both at the same time. Admiral of the Fleet, Lord Walter Kerr, First Sea Lord identified Germany as the new enemy and in 1904 Admiral Sir John 'Jackie' Fisher<sup>4</sup> his successor, began the process of modernising the Royal Navy to meet the new enemy. Along with the unpopular process of scrapping old ships and the re-organisation of port and coastal defences, he began the *Dreadnought* programme that absorbed vast amounts of money, time, manpower-hours, resources, research time and raw materials.[9]

---

<sup>4</sup> Admiral of the Fleet, Sir John 'Jackie' Arbuthnot Fisher, 1<sup>st</sup> Baron Fisher of Kilverstone G.C.B, O.M, G.C.V.O.

## 2.4. New Warship Design

Fisher said that he first thought of a fast, big gun ship in 1900 while in Malta and he discussed the idea with W. H. Gard, chief constructor of the Malta dockyard and Sir Philip Watts, the Royal Navy's chief designer. Vittorio Cuniberti had designed four battleships mounting two 12-inch and twelve 8-inch guns for the Italian Navy but had his design for something bigger was rejected by his homeland. In 1903 his article calling for a 17,000 ton vessel carrying twelve 12-inch guns appeared in *Jane's Fighting Ships* [10] and immediately interested the naval theorists. The American and Japanese navies were interested and in 1904 the US Navy approached Congress for two battleships each carrying eight 12-inch guns.<sup>5</sup> America moved slowly but the Japanese laid down two 20,000 ton vessels in spring 1905, both carrying four 12-inch guns and twelve 10-inch guns. On 22 December 1904 Fisher set up a naval design team, the Committee of Designs and their task was to provide the drawings for a new battleship, or more accurately to implement the Fisher's wishes. On 3 January 1905 Fisher informed the Committee that the new ship was to be fast and carry a number of big guns. [4] In Britain Later that year the world was given a master-class in of the use of the latest naval technology and how a single naval encounter could end a war when the Japanese engaged the Russians in the Straits of Tsuchima.

## 2.5. The Battle of Tsuchima

The Battle of Tsuchima, 27 - 28 May, brought the Russo-Japanese war to an end and caught the attention of the naval powers. The Russian fleet<sup>6</sup> sailed around the world to get to Vladivostok, join up with a squadron there and engage the Japanese Navy in

---

<sup>5</sup> U.S.S Michigan and U.S.S South Carolina were laid down in 1906.

<sup>6</sup> Eight battleships, 3 Coastal Battleships, eight cruisers and nine destroyers commanded by Admirals Zinovy, Rozhstvensky, Nikolai Nebogatov and Oskar Enkvist.

battle. Detected before they could get into Vladivostok the Japanese fleet<sup>7</sup> brought the Russian fleet to battle and practically annihilated it for the loss of three small torpedo boats. Fighting in its home waters and with a large numerical advantage the victory seems obvious but the true reasons for victory were technological.[4]

Japanese crews were all battle experienced and their gunners practiced their art far more often than their Russian counterparts; the Russian fleet was badly led and poorly manned.<sup>8</sup> The Japanese fired High Explosive shells that proved more effective than the Russian Armour Piercing rounds, largely because the Russian ships were carrying inflammable paint and coal on their decks. Japanese ships were equipped with the very latest Barr & Stroud coincidence FA 3 range finders, those on the Russian ships were over twenty years old and only capable of ranging to 4,000 yards. Both sides had wireless radio sets but whereas the Russians used foreign sets that were complicated to use and maintain the Japanese were equipped with sets of their own design and manufacture. Despite the poor visibility excellent radio communication allowed the Japanese fleet to keep a close eye on the Russian vessels. Manned by tired crews and slowed by dragging weed the Russian ships were in a poor state after their 18,000 mile journey. The Japanese opened fire at long range surprising the Russians who had expected a fight at close quarters. They returned fire as the ranges decreased and scored hits from about 7,000 yards but the Japanese reply from about 6,400 yards was devastating. Russian ships scattered and over the course of the next twenty-four hours were destroyed by fast battleships firing at long range and harried by small, mobile and agile torpedo boats. [4]

---

<sup>7</sup> Four battleships, twenty-seven cruisers, twenty-one destroyers, thirty-seven torpedo boats and auxiliary ships commanded by Admirals Togo Heihachiro, Kamimura Hikonojo and Dewa Shigeto.

<sup>8</sup> On their long journey via the North Sea and Atlantic to fight the Japanese they engaged British trawlers believing that the trawlers were the enemy fleet...

Before the battle navies around the world had armed their battleships for close quarters combat in the line. Ships had batteries of varying size, 6-inch, 8-inch, 10-inch and 12-inch and speed was not a factor in the big warship design. Tsuchima changed that and naval theorists realised that fleets would now engage at long range and speed was of the essence. It also reinforced the belief that navies would be war-winning weapons and it was believed that a war would be won by one, decisive naval battle.

## 2.6. The Genesis of the Dreadnoughts

*H.M.S Dreadnought* was laid down in October 1905 and launched on 10 February 1906.<sup>9</sup> Displacing 17,900 tons and with a speed of 20.9 knots, she carried ten 12-inch guns and was capable of firing eight of those guns as a broadside. *Dreadnought's* appearance sent psychological shock waves around the main naval powers. Overnight their fleets, including the Royal Navy, were, apparently,<sup>10</sup> rendered obsolete by the arrival of this new weapons platform.

So began an arms race as serious, deadly, clandestine and as costly as the cold war nuclear arms race later in the century of conflict. The Germans built warships and the British responded by building more ships.

Gun sizes grew and so did the ships. German manufacturing production had grown by 85% by 1914 whereas Britain's had only grown by 40%. German steel production by 1914 was double that of Britain's [11]. Britain's finances were severely stretched at the

---

<sup>9</sup> The 47,430 ton *H.M.S Hood* was the culmination of the *Dreadnought* programme. An Admiral class Battlecruiser she was the last one to be built. Laid down on 1 September 1916, launched on 22 August 1918 and commissioned on 15 May 1920. She was sunk in action by the *Bismarck* on 24 May 1941.

<sup>10</sup> The original design was flawed, as with all prototypes there were problems that needed ironing out. She was fast and well-armed but the mid-ship wing turrets were liable to cause structural damage if fired at a certain angle, so their arc of fire was reduced. The spotting tops were liable to be obscured by smoke from the funnels and the intense heat they emitted caused discomfort to the men there and obscured their view. So heavy was the ship that her armour belt was below the waterline and useless. Over time testing, research and the use of data from the serving dreadnoughts led to bigger ships with better configuration and even bigger guns.

start of the 20<sup>th</sup> Century. The Boer war had been costly and increased national taxation was not paying that debt off. There were arguments about how many ships the British should build but money was still found for the navy and in 1904-05 alone, the government spent £41 million on warships.[11] In the years before the war a battlecruiser cost about £220,000 to build and a battleship about £2,500,000 [11]. The appetite for big warships was undiminished, despite the cost. As a consequence British shipyards, like John Brown on Clydebank were soon constructing the new giants and these yards continued production throughout the war.

## **2.7. The “Conversations”**

In December 1905, a group of naval and military officers began meeting in London. Their agenda was the possibility of going to war with Germany on the side of the French. Fisher was against deploying the B.E.F to the Continent. Convinced that the army was a tool, subordinate to the navy and not a war-winning weapon he withdrew the naval representative from the meetings. Without naval support, the sub-committee soon ceased to meet but the notion of a war on the Continent against Germany alongside France had gained momentum. In 1906, Foreign Secretary Grey<sup>11</sup> agreed with French proposals that the General Staffs meet and begin the secret ‘conversations’ that would see Britain allied to France and ensure that Britain, Empire and Commonwealth, would go to war in 1914.[7]

## **2.8. Research and Development Before The War**

While money and resources were spent on the navy the army, by contrast, was kept short of money and resources. Even the high explosive shell was considered

---

<sup>11</sup> Edward Grey, 1<sup>st</sup> Viscount Grey of Fallodon, K.G., P.C., F.Z.L., D.L. Foreign Secretary 1905 – 1916.

experimental in 1914 and from Boer War experience shrapnel was the shell of choice. Despite the work being done on naval gun design and technology, procurement of big guns for the army was virtually non-existent. The 18-pounder field gun was in production and would be the mainstay of the Royal Artillery for the war; it was a good design even though it lacked the power to destroy trenches and earthworks. Similarly, the 4.5-inch howitzer had been designed and had gone into production before the war broke out. Instead of being equipped with a number of different types of weapon, these were standardised and as such were going to be so useful in the coming war. They allowed for production line manufacture with standard parts and they fired standard shells. This would allow for mass production by semi-skilled workers during the war. Crucially the standard military small arm had been developed and was already in use, the Short Magazine Lee Enfield rifle or SMLE.

The 18-pounder Quick-fire was the ubiquitous field gun of the British Expeditionary Force. First produced in 1903 the weapon entered service on 3 June 1904. It had been conceived from the artillery experience of the Boer War and the appearance of other Q.F guns on the Continent. Various experimental field guns were produced for testing but none completely fulfilled the required criteria. They all had good points and the 18-Pounder was the product of a collaboration between Armstrong, Whitworth, Vickers and the Ordnance Factory. By the time that the B.E.F embarked for France each division had three brigades of 18-pounders and one of 4.5-inch howitzers. Pulled by a limber and six horses the 18-pounder gun was quick to deploy and in the hands of a good gun crew could fire three rounds a minute.

Those rounds were shrapnel shells, consisting of a hollow body packed with 374 metal balls, a detonation charge and a timer fuse cap. When the shell detonated and the cap blew off the balls exploded from the shell in a cone like a shotgun blast and was

effective up to 300 feet from the detonation. Shrapnel had proved to be effective during the Boer war against troop concentrations. Dispersing them and forcing them to take cover. Shrapnel shells were very useful as fire barrages to be laid between friendly and hostile formations. Experiences of foreign armies also bore this data out. High Explosive or H.E for the field guns was only in the experimental phase in August 1914.[11]

Unfortunately, little work had been done on heavy guns or heavy howitzers. Machine guns were slow to manufacture and arrive at the battalions and even then they were doled out at two per battalion. In some cases battalions had to purchase their own guns and they were also expensive to buy. In 1914 Lieutenant-Colonel Weston Jarvis personally bought two for his battalion [13]. The private purchase price of a Maxim machine gun in 1912 was in excess of £64.00 [16]. Hand grenades were virtually non-existent. Shortly after the war began the need for hand thrown bombs became obvious but the troops were forced to make their own from whatever they could find in makeshift factories behind the lines. When it came to war with Germany the British expected that their main contribution would be the navy. The B.E.F would hold the French left flank in what most military planners believed would be a short land war.

New artillery weapons were arriving at regular army bases prior to the outbreak of war. Orders for 13-Pounders, 18-Pounders, 60-Pounders and 4.5-inch howitzers had been placed in 1904-5. Deliveries of the 13-Pounders and 60-Pounders had been completed by 1907 and the 18-Pounders by 1909. Production of the 4.5-inch howitzer began in 1908 and the first deliveries were made during the period 1910-11; deliveries were still being made at the outbreak of war.

The Ordnance Factories delivered a few 6-inch and 2.75-inch guns in 1911. Two 9.2-inch guns were delivered in March 1913 and a single 9.2-inch howitzer was delivered in

June 1914, the former manufactured by Beardmores and the latter by Vickers. Later in the war big gun production would outstrip this early effort.[14]

## **2.9. Conclusion**

The British Nation that went to war in August 1914 was one that believed the Royal Navy was going to be the main weapon in her hand. It was engrained in the national psyche and in Governmental policy that the Royal Navy would fight and win the war in a battle or series of battles like Trafalgar and Tsuchima. Some like Kitchener, knew that the conflict was going to be an infantry war and that a huge number of soldiers were going to be needed but even he had no idea of the scale to which the artillery would grow nor the amount of shells that would be required to continue the conflict. The armament companies were not ready for the size and length of the war and their cosy relationship with the Government was not adequate for the task of production and supply. The workforce and the skills base was not ready for a war of this magnitude. The nation and the army were not prepared for the war that they would have to fight. Who could expect them to be? The Royal Navy was ready to fight a war that apart from the Battle of Jutland failed to materialise but that was not the fault of the Royal Navy. Despite talk of side-shows and “cigar-butt operations” the war was destined to be fought and ultimately won on the ground in Europe. That was to be in the uncertain future and most did not know on 4 August 1914, that the world faced its biggest crisis to date. At the outset, British manufacturing and supply were able to cope with the requirements of the B.E.F, after all the planning was for a short conflict. Major-General A. Forbes said “Never was an army better fitted out for the work it expected to undertake than the four divisions and the cavalry division that embarked in August 1914”[17]. He was undoubtedly correct but this force was only part of the B.E.F and tiny compared to the force that was to come into being in 1915/16. Very

quickly, as the material demands of the army increased and manufacturing began to encounter problems with demand and supply. In fact, the armaments industry could not cope with demand. Lord Kitchener, realising that the war would last much longer than most did, added to the problems of manufacturing and supply by calling for volunteers for the army. They came and their enthusiasm threatened to swamp the already struggling war effort and cause a crisis of their own. There were no uniforms, weapons, equipment or accommodation for these volunteers and Kitchener was informed at the time that the manufacturers could not complete their existing orders for the B.E.F, let alone fulfil new ones. A huge industrial and manufacturing effort was required if the war was to be fought and won and it needed to be co-ordinated. Crucially, as the war developed into a huge siege, artillery came to the fore as the best weapon to prosecute the fight and British stocks of shells, never large, began to dwindle. There were to be numerous attempts to get a grip of the situation, to ramp up output and create some kind of stability but as the crisis spiralled out of control these attempts were doomed to be inadequate until the Ministry of Munitions was set up in 1915. Even then, despite what Mr Lloyd George would like to record, the Ministry did not always get it right, right from the start. Thousands of volunteers would come forward to work in the munitions factories that sprang up around the country and their volunteering effort was just as worthy and as important as that of the Kitchener Volunteers. There was a huge workforce and a great manufacturing potential in the country and it had to be trained, harnessed and put to work. Prime Minister Asquith said in the House, on 6 August 1914, “We have a great duty to perform, we have a great trust to fulfil, and confidently we believe that Parliament and the country will enable us to do it.”[15] The following chapter deals with the issues of Government and politics of munitions manufacture and the formation of the Ministry of Munitions.

## **Chapter 3.**

### **Munitions Manufacture – Government and Politics**

#### **3.1. Introduction**

This chapter examines the shell crisis and what the government tried to do to get the manufacturing industry to try and solve that crisis. It examines the reason for and the creation of the Ministry of Munitions. The powerful governmental body that was set up to oversee and co-ordinate the manufacture of munitions. When the Great War stagnated during the race to the sea and the opposing forces sought to consolidate their flanks, territory and gains and trench warfare became the norm the B.E.F soon realised that shrapnel was no use against earth works, trenches and strong points. The war was going to be a siege dominated by artillery. The call went out for more shells and the call went out to the War Office for H.E but there was little or none to be had. Even so, if stocks had been available the 18-pounder was not capable of pulverising well-made defences and trenches. That was the job of big howitzers and big guns and there was a dearth of them. The call, spearheaded by Lord Kitchener, the Secretary of State for War, for men to join up had also placed a huge burden on manufacturing that in 1914 early 1915 it could not cope with.

#### **3.2. Artillery**

In August 1914, the British Army had the following field guns at its disposal, 996 18-pounders, 185 13-pounders, 144 4.5-inch howitzers and 38 60-pounders. When the six divisions of the B.E.F were sent to France in August 1914 they took, 324 18-pounders, 36 13-pounders, 108 4.5-inch howitzers and 24 60-pounders. The remainder of the total were left in reserve and for training. This total did not include the obsolete

weapons available to the Territorial Force; approximately twenty 15-pounder Q.Fs, 228 15-pounder B.L.Cs, 80 5-inch howitzers and 88 4.7-inch guns. It is worth noting that in both cases of the modern and obsolete ordnance the heavier the weapon the fewer there were [14].

Sixteen 6-inch guns were scraped together from coastal defences around the country and work went ahead to put them on railway mountings. Only one organised brigade of twenty-four 6-inch, howitzers existed but these numbers were later augmented by a further 80 weapons gathered from around the globe. The heaviest weapon in the armoury of the early B.E.F was a single 9.2-inch howitzer, a prototype that had only been approved for production in June 1914, which had undergone trials in July and on which a favourable report had been submitted on 4 August [18]. However, at the outbreak of war there was no ammunition for the weapon, therefore *Mother*, as it became known, could not be sent out until ammunition was available [14]. When it did get to Europe, in October, [18] it was Britain's only heavy howitzer on the Western Front until February 1915 [14]. So successful was the weapon that sixteen others were immediately ordered and research and development was undertaken on a Mark II version [18].

Shell output was catered for and planned by the War Office, adhering to the existing pre-war standards. Orders were placed with the recognised armament companies, or 'the Trade'. These were the Royal Laboratory at Woolwich, Armstrong Whitworth, Vickers, Beardmore, Cammell Laird, Firth, Hadfield and the Projectile Company. The orders were also placed for both the standard and obsolete guns that the army had in its arsenal to replace weapons lost or worn out in battle. Unfortunately, in both cases, what was ordered was not enough and not forthcoming with any great urgency.

The Royal Ordnance Factories were few and with the exception of Woolwich Arsenal, small. The Enfield Small Arms Factory, Waltham Abbey's Gunpowder Factory and a cluster of factories at Woolwich (the Arsenal) making artillery pieces, shells and other types of ammunition and the Royal Aircraft Factory at Farnborough. The older Ordnance Factories were not geared towards bulk manufacture; they specialised in the skilful production of small amounts of munitions but they *were* set up to deal with change in military requirements. Even so, like other elements of the 'Trade', this small set up could not cope with the demand placed upon it by the B.E.F. let alone the needs of the expanding armed forces [19].

### **3.3. Artillery Ammunition**

By 31 December it was obvious to all that they were in for the long haul. The war had not ended by Christmas and it was going to go on for some time. The B.E.F had gone to war with ample supplies for the Continental campaign it had planned to fight on the left flank of the French Army. However, the war's appetite for supplies and munitions had been voracious and stocks were rapidly dwindling.

The following graphs [Fig 3.1 and Fig 3.2] show orders and actual deliveries of 18-Pounder rounds up to 31 December 1914.

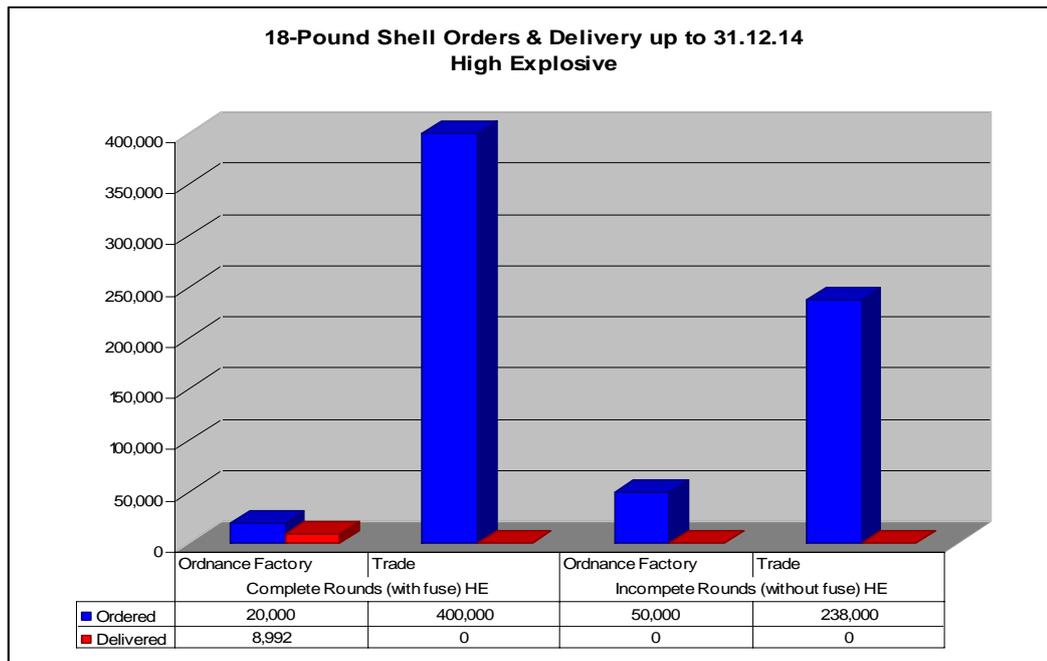


Fig 3.1. 18-Pound Shell Orders & Delivery up to 31-12-14 : High Explosive [11]

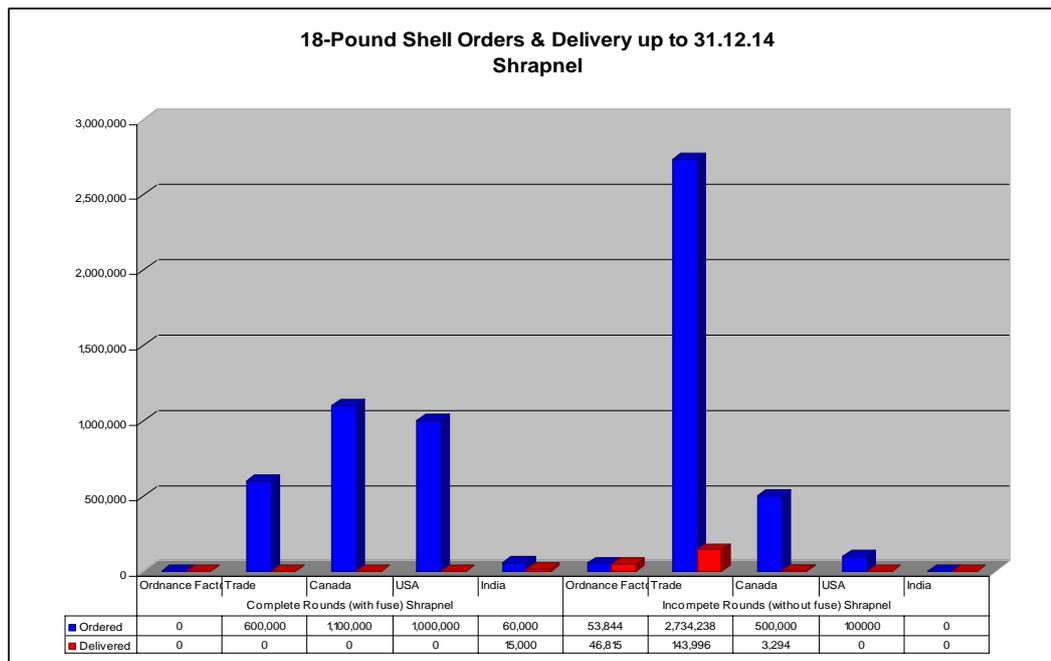


Fig 3.2. 18-Pound Shell Orders & Delivery up to 31-12-14 : Shrapnel [11]

The graphs show just how bad things were. Chief of producers was the Ordnance Factory, which prided itself in craftsman-like work but output was too slow and too little for this kind of war. Certain factories only produced parts for shrapnel rounds not complete rounds. Indeed not all of the ‘Trade’ firms made 18-pounder ammunition and tended to specialise in the production of certain types of round. Of these firms

only Vickers, Armstrong, Camel Laird and the Projectile Company produced 18-pounder shrapnel rounds and they also produced other types of ammunition. The lack of H.E is explained by its experimental nature. No one was tooled up for it except for the Ordnance Factory and the vast majority of the munitions workforce was not trained in the processes required for production.

The requirement for artillery ammunition was ruled by the gun programs that worked on the basis of a daily ration of shells per gun in combat. The experience of the first six months of war on the Continent proved the original daily ration to be wholly inadequate and the old pre-war plans and thinking were discredited. The original War Office planned daily ration for 1915 was:

	<b>Jan 1915</b>
18-pndr:	17 rounds
4.5" How:	17
6" How:	15
8" How:	15
9.2" How:	12
12" How:	5

*Table 3.1. War Office Planned Daily Ration for 1915 [14]*

This ration was only theoretical, the reality was that in February 1915 the ration for the 18-Pounder was ten shells a day and the 4.5-inch howitzer eight shells a day and that ration was falling.

At the start of the war the gunners used very little High Explosive; instead they used shrapnel for the 13 and 18-pounder field guns, the 60-pounder and the 4.7-inch guns. The gunners had to use shrapnel because that was all that was available. Nonetheless, G.H.Q, perhaps not understanding the manufacturing situation in Britain, still requested that 50% of the shells supplied be shrapnel and the other half H.E [14].

Orders for 'field gun ammunition was initially shrapnel, the first contracts for 18-pounder H.E were arranged in October 1914, H.E orders for the 13 and 15-pounders were arranged later. Thirty percent of the shells ordered for the 4.5-inch howitzers and 60-pounders were H.E. Demand for H.E rose sharply and by early 1915 it made up the bulk of orders placed. In September 1914 "substantial output of light and medium shell had been ordered for delivery during the last two or three months of 1914 and the early part of 1915." [14]. Unfortunately, there was a problem. Despite the initiatives and effort no one had lived up to their promises and by May 1915 only a third of the 6,000,000 shells scheduled for delivery by that month had been actually been delivered [14]. A 'ramp up' of production was needed.

The number of guns being manufactured increased slowly. Nevertheless the new guns would need more shells, putting more strain on the overloaded manufacturing system. By the end of June 1915, there were 1,798 18-pounder field guns available to, or serving with the British Army [14]. While some were already with the divisions on the Western Front, a large proportion had gone to the Kitchener divisions that were going out to the front between June and July. Some 802 guns had been produced since the outbreak of war [14]. These had been the product of War Office orders and some had been pre-war orders. It may seem a decent number but it was not enough, guns in service would wear out and need repair, particularly the smaller calibre weapons, and they were destroyed in action either by premature detonations or by enemy action. Yet more Kitchener divisions were being raised and they too would need to be equipped.

### **3.4. Production in early part of war**

Very early in 1914 it had been recognised that other companies who were outside the 'Trade' would have to be mobilised. It was hoped that this could be done by sub-

contracting work and it was assumed that the recognised manufacturers would train the new firms and organise their production. To this end the War Office was prepared to financially assist the 'Trade' if they enlarged their operations by buying in more plant, enlarging their buildings and sub-contracting work to outside firms. It was also hoped that other, private companies could be found to undertake orders for the production of the simpler types of munitions and become direct contractors to the War Office. In September 1914 invitations to tender for work were sent out, but firms outside of the 'Trade' found themselves in competition with the 'Trade' and it was difficult to secure a contract. By the end of 1914 only four new firms had contracts, J & P Hill, Dick Kerr, Rees Roturbo, and Babcock and Wilcox [14].

At the end of 1914 deliveries of the orders placed since September had not materialised and blame was attributed to a number of factors. Events outside the control of the 'Trade', they said, had introduced factors that they could not regulate. The 'Trade' stated that difficulties in obtaining new plant and the increase in sub-contractors had caused them problems. A shortage of plant and the inability of sub-contractors to keep up to delivery promises forced the 'Trade' to continually revise their delivery schedules [14]. Whatever the reasons, even with their experience, the 'Trade' were unable to produce what was needed; they could not cope in their present, pre-war, state.

A skilled work force, or the lack of it, was a major cause of delay to the delivery of the contracts. A number of armament workers had heeded Kitchener's call and joined the colours. That pool of workers had not been that large in the outset but the loss of key workers had hampered production. On 21 December 1914 the 'Trade' held a conference to debate the expansion of output. Their analysis was stark; they could not promise to increase output because any future increase would be dependent upon the

availability of labour. They did conclude that the current policy of organising the new firms through them was the correct one to have been adopted [14]. The key to increasing manufacturing output was an increase in the workforce and more firms making munitions, guided by the 'Trade'. Yet the crisis continued to get out of hand, it became too large the 'Trade' to handle or control. Demands for munitions from the front, largely H.E for the 18-pounders and 4.5-inch howitzers, increased and it was vital that new sources of production be found. Thanks to the appointment of new sub-contractors some experience had been gained outside the recognised group. At the end of the year the Board of Trade held exhibitions of shells and fuses for smaller engineering companies in an attempt to bring them on-board and by May 1915 nine new companies had become direct manufacturers of munitions with government contracts [14].

### **3.5. Orders from America**

Other sources of manufacturing were needed and the British government looked overseas. Two weeks after the declaration of war, the Bethlehem Steel Company of the U.S.A had offered the supply of weapons and munitions to the War Office. Canada set up a Shell Committee in September 1914 and by the end of that year over 1,000,000 18-pounder shells, complete barring the fuse, were promised. In October the War Office place an order with the Bethlehem Steel Company for incomplete 18-pounder and 4.7-inch shrapnel shells, shortly afterwards an order was placed for complete 18-pounder shells. At the end of the year more American companies were in possession of War Office contracts, Washington Steel, Ordnance Company and E.W. Bliss to name three. This now gave a theoretical new capacity and the War Office proceeded to place very big orders for delivery at the end of 1915 and the beginning of 1916. Unfortunately, these orders were not fulfilled on time. Canada promised a large monthly output of

complete 18-pounder shells, in April 1915 a contract was arranged for 5,000,000 complete rounds 18-pounder shrapnel, H.E and 4.5-inch H.E. These contracts were not fulfilled on time either. American contracts were even bigger and were for quantities of 12-inch, 9.2-inch, 8-inch, 6-inch, 5-inch, 60-pounder and 4.5-inch H.E. [14].

### **3.6. Factories**

Events were perhaps getting beyond the armament companies. Firms outside of the 'Trade' saw the need for action and, for those that wanted them, the chance of obtaining government contracts. So they began to act on their own. In January 1915 private engineering companies in Leicester had discussed the idea of working together as a co-operative to maximise the output of small firms in the area unable to produce a complete article but nevertheless able to produce elements of the finished product. This was a very sensible approach to manufacturing in a crisis. In March 1915 the Leicester co-operative received their first contract from the War Office to manufacture between them 4.5-inch H.E shells. The scheme was rolled out across other parts of the country and by May over twenty co-operatives had been set up. Orders placed later by the Ministry with the co-operative manufacturing groups soon amounted to an output of 9,500 4.5-inch shells a week by the autumn of 1915 [14].

The success of the National Factories largely depended upon support from the Armaments Output Committee. This committee under Mr. Booth and Sir Percy Girouard had been set up on 31 March 1915 and had developed into a central department organising the supply of munitions. It arranged for representatives of the Co-operatives to visit Woolwich Arsenal to see the whole process of shell manufacture and to get any advice or help that they may require, certain other members of the

'Trade' also opened their doors to the Co-operatives. Armstrong Whitworth actively helped the Co-operatives with advice about manufacturing processes, providing lists of machinery they might require and details of factory layout. The Armstrong Whitworth Elswick works became a training centre for co-operative foremen and machine operators [14].

The National Factories were divided into three main categories; shell, projectile and filling. Building of some factories had begun before the Ministry of Munitions had come into being and were taken over by the Ministry. 'National' meant that they were administered by the Ministry of Munitions and run by management appointed by and who reported to, the Ministry. They were Nationalised factories as opposed to the private armament firms. That said the National factories were often built near the private armament factories and the latter had a hand in their building and administration. 'National' was a partnership between the private and public sectors.

Some National Shell Factories were set up in converted buildings and their priority was the production of light, field gun shells [19]. These were controlled by the Armament Committees that sprang up in the industrial areas of the country. Leeds led the way by proposing to concentrate a co-operative of manufacturers in one factory, under one roof to stream line management, production and inspection. Their scheme was given the green light in May 1915 and the Armley Road Factory was established in buildings intended to be railway carriage shops; additional buildings were added by the Ministry. A month later seventeen factories of this type had been given the go ahead by the new Ministry. By December 1915 instructions had been issued for thirty more. By summer 1916 the programme of the creation of National Shell Factories was regarded as complete [19]. Conception and completion of this programme had been remarkably swift. Rather than build new ones most of these facilities were set up in converted

buildings. They benefited from being set up in areas where the skills base, both management and shop floor, existed. Factories of varying sizes were set up all over the country, one of the Dublin factories bucked the trend of making light shell and was set up for the specific manufacture of 9.2-inch ammunition. Some of these factories showed an ability to adapt; when the need for light shells dipped they were quite capable of turning their operations over to producing heavier types. If some had an enduring fault it was in their layout because of their hasty construction or conversion. The Dundee Factory had been exceptionally well planned and laid out and this contributed to the factory's swift ability to swap production to different types of shell [19].

In the summer of 1915 the Ministry of Munitions began the programme of building the National Projectile Factories. While the National Shell Factories made light shells these massive, Government sponsored,<sup>12</sup> purpose built factories were devoted to the manufacture of heavy types of shell [19]. Plans for eleven factories were laid in September 1915 and by the end of the war fourteen Projectile Factories were operating in England and Scotland. These factories, like the filling factories, were set up for work on a bulk scale and the repetitive tasks required of the workforce meant that skilled labour was not needed on a large scale and supervision could be kept to a minimum [20].

The empty munitions produced by the National Factories, the trade and imported from abroad needed filling therefore the National Filling Factories were built in a parallel programme to that of the Projectile Factories. These were divided into three distinct

---

<sup>12</sup> When it was realised that an expansion of heavy shell output was required a meeting was convened in July 1915 to discuss the situation. Existing armament factories could not really be extended and the big companies refused to condone the idea of setting up National Factories that were beyond their control. It was decided, therefore, that the armament companies would build and control new factories that would have a connection with their existing works but construction and plant costs would be met by the government.

types. 01/ Filling shell, cartridges and minor parts and this was the largest type. 02/ Filling Trench Warfare munitions such as bombs and grenades. 03/ Filling Chemical munitions [19].

In the summer of 1915 it was decided that four factories, Leeds, Liverpool, Georgetown and Gloucester would fill and assemble Q.F,<sup>13</sup> either shrapnel and High explosive and make up B.L<sup>14</sup> cartridges. A scheme was proposed and accepted for the construction of five more factories, Chilwell, Morecambe, Banbury, Newburn and Otley, where empty heavy shell bodies could be filled with High Explosive. Six more factories Coventry, Perivale, Southwark, Hayes, Abbey Wood and Cardonald would assemble and fill various types of munitions [19]. All of these factories had one thing in common, they would need workers.

### **3.7. Machine Tools**

The Armaments Output Committee also tackled the shortage of machine tools for the production of shells and fuses. A machine tool branch was set up on 27 April 1915; it limited the export of required machinery and collected the details of machinery that was required. Large orders were placed in America for machine tools and an amount of machinery was requisitioned as it arrived in the country. The question of hydraulic machinery was discussed and specifications for presses for the National Factories were supplied courtesy of Armstrong Whitworth [14].

---

<sup>13</sup> Quick Fire.

<sup>14</sup> Breach Loading.

### **3.8. Materials**

Steel for the manufacture of shells had not been a problem in the first twelve months of the war but by spring 1915 there were signs of impending shortages of brass rod and copper bands. Copper tubes were required for driving bands on the shell body and brass rods were needed to manufacture cartridge cases. A joint group from the Admiralty and the War Office began to examine the procurement of materials and in May, a raw materials branch was set up. Therefore, by the end of May 1915, there was already a central body overseeing the manufacture of munitions by the recognised group and a number of co-operatives and National Factories had been established [14].

### **3.9. Politic and Manufacture – the Shell Scandal**

On 7 January 1915, Kitchener reported to the Government that the munitions situation was not so bad and that production of rifles was on target, the second and third New Armies would be equipped by 1 April 1915.<sup>15</sup> It was a false picture because all was not well in the ‘Trade’. Quite apart from the fact that they could not cope with demand, the Unions were resisting ‘dilution’. They were blocking the semi-skilled and un-skilled workers that the ‘Trade’ was trying to employ. The threat of strikes loomed large and the government was considering powers to take over any munitions factory affected by a strike. The ‘Trade’ was not helping matters by charging high, peace time prices for what products they could manufacture. In February, Prime Minister Asquith launched an enquiry to look into the question and the Chancellor Lloyd George got himself involved as chair of the Armaments Committee.

On 5 March a meeting was held and the question of rifles arose again. It was obvious that the New Armies would not be equipped by 1 April. The estimate had been to

---

<sup>15</sup> Each ‘New Army’ of volunteers was made up of 100,000.

deliver 105,000 rifles by March but only 63,000 had arrived and of them 20,000 were not new at all. New estimates for the deliveries were not good, only 100,000 could be expected by September 1915. Lloyd George and Kitchener were soon at odds with each other and Asquith had his hands full trying to avoid trouble between the two [4]. At the meeting was the powerful civil servant Colonel Hankey, Secretary of the Committee of Imperial Defence and of the War Council. He listened and watched. On 6 March Hankey wrote to the Prime Minister after the meeting. Among other things he said

*My suggestion to the solution is to have a committee of nominees of the principal armament firms, who should themselves elect a chairman. Above the chairman there should be a president nominated by the Government; he should be a Cabinet Minister unconnected either with the Admiralty or the War Office. He would make it his function to adjudicate between the importance of Admiralty and War Office claims and to stimulate production of war material by every conceivable means. [4]*

It would appear that the first seed of the notion of the Ministry of Munitions had been sown. The proposal was not taken up immediately by the government but Lloyd George liked the idea [4]. The government and the 'Trade' were struggling to cope and the army was struggling to fight the war because of a serious lack of munitions and equipment.

Soldiers wrote home but the War Office Censor saw their letters first and anything that could give comfort or aid to the enemy, or lower morale at home, was removed. War Correspondent Colonel Repington of *The Times* knew that from October to December 1914 the army had consistently asked for more H. E. and that none of these increases were granted but of this the general public knew nothing [21]. Some soldiers wrote to the newspapers but their words were censored by order of the War Office [22].

Everyone knew that the Kitchener Men were training with no weapons and had no uniforms but the public were starved of official facts about the fighting army. Rumours were rife about shortages of shells and big guns. Even the government, if it was to be believed, did not know the scale of the problem on the front line [21]. Despite the War Office's attempt to contain the truth, rumours circulated around the country. On 20 April, Asquith made a speech at Newcastle where he stated that the army had a good supply of shells; there was no truth in the rumours. G.H.Q in France was incensed. The truth was that the army in the field was short of shells and guns. Despite the War Office gun programme and the shell ration table for January by April the 18-pounders were down to three shells each a day, shrapnel only, no H.E, and other guns were similarly rationed [23]. There were simply not enough shells for the guns to fire.

The problem about munitions had become a badly handled powder-keg that exploded just after the Battle of Aubers Ridge. Observing at Aubers Ridge on 9 May had been *The Times'* war correspondent Colonel Repington, a close friend of Sir John's. The British bombardment of the enemy trenches had been too short and had largely comprised of shrapnel because of the lack H.E. Consequently, the British attacked undamaged defences, protected by machine guns, effective, well-supplied artillery and paid the price. The failed battle cost a shocking 11,500 British casualties. Repington had been monitoring the situation and he had attempted to see Kitchener in person, on more than one occasion, to ask what the position was with reference to munitions and ordnance. Kitchener had refused him an audience. General Macdonogh, who had been summoned to London from France to explain an army request for H.E., told Repington that after Kitchener had verbally abused him he was informed that he, Macdonogh, was unfit to be a General Staff Officer and anyhow; British troops should

be able to take enemy positions without artillery support... [21]. Perhaps Kitchener's grasp on the nature of the war was not as tight as the nation believed.

On 12 May Repington wrote an article for *The Times*. The Field Marshal had obligingly furnished his friend with up to date, statistical data about the poor state ammunition supply in France and Flanders [24]. Repington always said that he had operated alone but Sir John later admitted to helping him and Hankey was in no doubt that G.H.Q France had initiated the article and he disapproved of it. It was he wrote, "the dangerous expedient of stimulating public opinion on the subject." [4]. Hankey was wrong. The public had a right to know and it was a good job that Sir John had blown the whistle and that Repington had written the article.

On 14 May his report appeared in *The Times* and even though it had been censored it received the full glare of national scrutiny. Repington's article contained a short sentence stating that the lack of H.E had barred success, somehow the censor had missed its importance [21]. The army in France and Flanders was critically short of shells, it was official, and it was in the public domain. The War Council met on this day; it was the first meeting since 6 April. Sir John also sent Brinsley Fitzgerald<sup>16</sup> and Freddie Guest<sup>17</sup> to show the same documents seen by Repington to Lloyd George [24]. Lloyd George said that it was from this time, when he saw the data, that he became fully aware of the true facts surrounding the state of munitions manufacture and supply [22]. It is almost incredible that the Chairman of the Armaments Committee could admit to this. He had also discovered from Sir John's representatives that the War Office Censor was gagging officers who were writing home and, crucially, the

---

<sup>16</sup> Lieutenant Arthur Henry Brinsley Fitzgerald, 1<sup>st</sup> Irish Guards, later 22<sup>nd</sup> Knight of Kerry and 5<sup>th</sup> Baronet of Valencia.

<sup>17</sup> Sir John's Aide-de-Camp whose task it was to liaise with the War Office and the political establishment. He was a former Liberal MP, a popular backbencher and Deputy Chief Whip. After active service in East Africa, illness invalidated him out of the army in 1917 and he returned to politics. He became Lloyd George's Chief Whip in that year.

department was keeping military reports about ammunition and guns from the Armaments Committee and the P.M.

On 18 May, Lord Kitchener was forced to tell the Lords that there had been a delay in the manufacture of the war materials. He explained that the situation was unprecedented and the demand upon the manufacturing industry was unlimited. As for demands upon manufacturing, he had more than helped to place the unlimited burden upon industry by asking for volunteers to join up. So many joined up that they could not be armed, clothed or housed and many of them were miners, railwaymen, armaments workers and a myriad of others needed for manufacturing to function properly. The government could not go on. Asquith informed the House on 19 May that there was to be a Coalition Government [22]. It was truly the end of the Edwardian way of muddling through; the establishment had finally awoken to the full impact of the crisis of total war. There was no one single reason for the fall, unless it was a singular inability to effectively run the war. Of which the Dardanelles fiasco, Fisher's resignation as First Sea Lord, the shell scandal, the treatment of foreigners and the infrequency of meetings of the War Council were all parts. The shell scandal was perhaps the most emotive reason and despite what Winston Churchill said about the importance of Admiral Fisher's resignation, the most serious.

Lloyd George knew that the key to victory was the production of Munitions and that the victory was to be fought for on the factory floor and on the home front as much as in the trenches at the front. The man who provided, or appeared to provide, those munitions and solved the Shell Scandal would become very powerful. To mobilise the nation to total war he would need extraordinary powers and authority, more than the Chancellor of the Exchequer had. First of all the control of munitions manufacture had to be wrested from the War Office. On 19 May in his role as Chair of the

Armaments committee, using the intelligence provided to him by Sir John, he wrote a letter to the P.M about the subject [22].

### **3.10. Ministry of Munitions**

Lloyd George pointed out to Asquith that in order for the committee to function properly *all* information about the production and supply of explosives should be given to the committee. It would appear that the War Office had failed to pass on all information in its possession and it had not informed the committee of the problems concerning ordnance and munitions at the front. Lloyd George told the P.M that the War Office had withheld from the committee and apparently the P.M, two recent reports from G.H.Q in France, one concerning ammunition supply and the other concerning ordnance supply. If it was true, wrote Lloyd George, that these reports had indeed been kept from the P.M as they had been from the committee, he hesitated to think how the public would react if they found out [22]. It was a veiled warning to the P.M; the public outcry could destroy political careers and Asquith was well aware that he had made the speech in Newcastle in April. Lloyd George then said that eight months before he had tried to alert the Government to the need for private engineering firms to produce H.E, just as was done in France. Private manufacturers were being kept out of the process. He told Asquith that he could not continue as the Chairman of the Armaments Committee under these circumstances. Besides the Committee had no executive power, it could only advise and it was for the War Office to act. The War Office, had not acted [22]. The unspoken point in this part of the letter was this; the Government needed a department that *would* act.

Asquith listened to Lloyd George, he valued his advice and during this time of upheaval in the run up to the creation of the Coalition, from 19 to 26 May, he was very close to

Lloyd George. Lloyd George was not going to let the subject of munitions drop and was determined to keep it in the foreground and not let it get subsumed by the Dardanelles, Fisher or the treatment of Foreign Nationals by Britain [22]. On 26 May, on the day that the new Coalition Cabinet was unveiled, Asquith announced in the press that he had decided to set up a new Government department called the *Ministry of Munitions* and Lloyd George had been put in charge of this body [22]. It would have the task of “mobilising the national resources for the production of munitions.”[22]. The new ministry would be backed up by government acts and supported by D.O.R.A and her sisters, the Defence of the Realm Act and its amendments.<sup>18</sup> It would become an immensely powerful entity. Through this powerful legislation the Ministry,<sup>19</sup> that some people feared would be a dictatorship and Lloyd George intimated that it would be (perhaps in hope), [25] gained rights and powers over materials, land, factories, equipment, employers, wages and profits. Some good work had been already done but so had some bad. What was needed now, to fight and win the war was hard, professional co-ordination and operation, not Edwardian amateurism.<sup>20</sup>

---

<sup>18</sup> D.O.R.A was introduced on 8 August 1914 and was amended as the need arose during the war. It was a wartime piece of legislation, with caveats, designed to cease to exist once the war was over. It did give those who wielded it, such as the Ministry of Munitions, great power. Just about anything could be achieved by using D.O.R.A and it made most people uneasy, not in the least politicians and landowners. It could mean imprisonment without trial, displacement, conscription, requisition and limited drinking time. It was used to stop the buying of ‘rounds’ for instance. D.O.R.A. may have perished after the war but parts of the act were kept in ‘suspended animation’ should she be needed again. Her death grip on British Licencing Laws was not completely relinquished until 2005.

<sup>19</sup> The important acts governing the Ministry were as follows: The Ministry of Munitions Act, 1915. The Munitions of War Act, 1915. The Munitions of War (Amendment) Act, 1916. The Munitions of War Act, 1917. The Defence of the Realm Consolidation Act, 1914. The Defence of the Realm (Amendment) No. 2 Act, 1915. The Defence of the Realm (Amendment) No. 3 Act, 1915. The Defence of the Realm (Acquisition of Land) Act, 1916. The Billeting of Civilians Act, 1917. Patents and Designs (Partial Suspension) Act, 1915. The Munitions (Liability for Explosions) Act, 1916.

<sup>20</sup> A number of politicians lost their jobs when the coalition cabinet was formed. Churchill, the Dardanelles hanging around his neck like a stone, was among them. He packed his kit, including a tin bath, and went to France hoping for a Brigade to command. He was given a battalion. Remarkably, Kitchener survived. Lord Northcliffe who had been receiving a stream of letters from the front referring to the shell scandal but who had been blocked from publishing by the official War Office censor laid the blame for the debacle at the feet of Kitchener and was determined to drive the man from office. Kitchener was still popular with the population and Lloyd George had to advise Northcliffe to tone down his campaign against the Secretary of State for War. Kitchener was the man who called up the New Armies, laying the foundations for the finest Army the British would ever possess, but he was guilty of not being able to handle the War

### 3.11. The Ministry

Ultimate victory or ultimate defeat depended upon the supply of munitions and war material. It was soon established that it was impossible to place any limit on the financial cost of that production and supply. Very soon after the outbreak of war the War Department and Admiralty were, in the main, freed from Treasury control. As long as expenditure was vitally necessary and in the public interest Treasury sanction was not required. The same freedom was extended to the Ministry of Munitions. The sizes of manufacturing and production programmes were then dictated by the military requirements and not by cost. The 'Trade' soon discovered that while high prices charged for small production runs in peacetime were acceptable to the government; high prices for enormous production runs were *not* acceptable. Under Lloyd George the Ministry of Munitions placed large, long term orders and deliberately over ordered. In the case of the manufacture of big guns and howitzers ordered in 1915, the order was spread over two years with delivery initially expected in 1917. Long-term orders enabled the Ministry of Munitions to induce contractors to undertake extensions to orders which would provide earlier deliveries. Therefore, the Ministry of Munitions had no financial constraints and orders and manufacturing were stimulated by what was required not by cost. In peacetime cost often tempered and modified what was required and indeed delivered. The Ministry of Munitions had an ability to roughly estimate what was required and shape demand.

A distinctive feature of the organisation was the employment of 'experts' in chief executive positions. It was what became known as the "Business man system"[25]. Previously the Government had only employed these men as advisors, now the Ministry of Munitions utilised their talents. A team of experienced civilians were

---

Office. Lloyd George professed that none of this was really his concern, all he was bothered about was the production of munitions and he had got his way.

required for what was a civilian task, manufacture and distribution of goods on a massive scale. The team included; Sir George Gibb, general manager and director of two great railway operations, the North-Eastern Railway and the Underground Railway in London. Mr. George Booth, ship-owner and director of the Bank of England. Major-General Percy Girouard, formerly director of military railway traffic in Egypt and South Africa, a former administrator of Nigeria and East Africa and since 1913 a director of Armstrong, Whitworth & Co. Mr. G. H. West of Armstrong Whitworth & Co, director of the firm and shell shop manager, with unrivalled knowledge of shell production. Mr. Alfred Herbert head of the heavy machine tool company, Alfred Herbert & Co Ltd, of Coventry. All of these men were used to big schemes and could 'get things done', they were the "men of push and go". Lloyd George, in the opinion of many, breached protocol and tradition when he appointed them to senior Civil Service posts but Lloyd George as ruthless as ever, believed that Civil Service tradition could not stand in the way of the management of the crisis. Girouard became Director-General of Munitions Supply with Booth and West below him as departmental heads. Herbert had control of machine tools. There were many more men in this team, one of whom was Eric Geddes,<sup>21</sup> another railway man from the North-Eastern. The others were ordnance works men, ship builders, weapons manufacturers, distillers, a designer of public works, and an investments man [25]. Government 'traditions' were upheld when the Secretariat, Finance and Contracts Departments were concerned, skilled and competent civil service staff filled these posts. The Inspection and Design Departments were staffed almost entirely by the military. Another arm of the Ministry was staffed almost entirely by scientists. Lord

---

<sup>21</sup> Major-General Sir Eric Campbell-Geddes, G.C.E., G.B.E., P.C. Worked on the Baltimore and Ohio Railroad, U.S.A and the North-Eastern Railway, U.K. Deputy Director-General of Munitions Supply 1915 – 1916. Director-General of Military Railways and Inspector General of Transportation to the B.E.F. First Lord of the Admiralty, 1917. Minister of Transport, 1919. Chair of the *Committee of National Expenditure*. Chairman of Imperial Airways.

Moulton<sup>22</sup> was made Head of Explosives Supply Department and Sir Richard Glazebrook<sup>23</sup> was made Head of the National Physical Laboratory.

Under Lloyd George these men were allowed a free rein and could do business by personal interview. While a useful situation this also caused trouble between departments as these men often, and quite naturally, put their own departments first, ahead of the greater good of the cause. To begin with all that mattered was the swift production and supply of munitions but as the manpower pool and the source of materials dwindled a check had to be placed upon the different department's activities. In essence, in the early days, 1915, it was actually impossible for a department to over produce. As time went on it became necessary to be aware of the needs of other departments, all ordering equally important products. During the latter days, under successive Ministers of Munitions the word "Co-ordinate" became almost an obsession within the Ministry.

### **3.12. Conclusions**

The number of artillery pieces available to the BEF at the outbreak of the war were adequate for the operation that it originally faced in France. Heavy weapons were in woefully short supply but research and development of these weapons was relatively new at the outbreak of war. *Mother* was the only 9.2-inch howitzer available to the British in 1914 and that gun could not go out to France and Flanders until ammunition had been manufactured for it. Production of replacement guns by the armament factories was soon found to be inadequate for the needs of the army in Europe and for

---

<sup>22</sup> Mathematician, John Fletcher Moulton, Baron Moulton, G.B.E., K.C.B., Q.C., P.C., F.R.A. S., F.R.S. Director-General of the Explosives Department, Ministry of Munitions. 1917 tasked with the production of poison gasses. Personally visited every munitions factory in the U.K. A correspondent with Charles Darwin and in early years a supporter of Prime Minister Gladstone.

<sup>23</sup> Physicist, Sir Richard Glazebrook, C.B., K.C.B., K.C.V.O., F.R.S. Bursar of Trinity College 1895. Principal of University College, Liverpool, 1898. Director of the National Physics Laboratory, 1899 – 1919. Director of the Department of Aeronautics, Imperial College London.

those units being raised and trained at home. The adaptation of older weapons was not good enough to meet the requirements of the army.

Stocks of shells were also considered adequate for the job in hand but very soon demand outstripped supply and manufacture. Orders placed by the War Office with the armament factories and foreign firms for both high explosive and shrapnel shells were not fulfilled simply because the companies were not capable of doing the work causing the now infamous 'shell scandal'. At the time shrapnel shells were the common shell and high explosive shells, costly and difficult to manufacture were rare. The latter is what the army wanted. Production of shells continued to be poor into 1915 and the artillery fighting in the war had the number of shells reduced drastically by April 1915. The War Office continued to place orders for more shells and more guns but the manufacturers could not fulfil those orders because the problem was far too big for them to handle.

The significance of the crisis of the war dawned slowly in some quarters but this was because nothing of this scale had been experienced before. Muddling through in that Edwardian, British way was the route to take if the war was to be quickly lost. The War Office had followed its procedures and had tried to provide what the army needed. The 'Trade' and foreign orders just could not cope with the demand. A hard, professional attitude was needed and the nation needed to be geared to total war, whether that be on the battlefield or on the factory floor.

Setting up of the Ministry of Munitions was just as important as Kitchener's call for volunteers. Both projects launched by controversial characters, Lloyd George and Kitchener, would ultimately give the British Army the tools it required to win the war. Even so, in 1915 the Ministry of Munitions, like the Kitchener recruits, could not bring or even promise victory that year. There was a long way to go and Lloyd George may

well have been referred to as a wizard but he could not magically produce the required materials overnight. These were but the foundations of the victory that would come in distant 1918. It would not be Lloyd George who made the shells, it would be the workers in the factories. Nonetheless, in September 1915, the British Army was about to fight a huge battle and although the Ministry was set up it was not operating yet. The Battle of Loos was going to have to be fought with equipment and ammunition from inadequate War Office procurement. In the next chapter provides a brief examination of the Battle of Loos and supply logistics in 1915.

## **Chapter 4.**

### **Supply Logistics – The Battle of Loos, 1915**

#### **4.1. Introduction**

##### **September 1915. The Battle of Loos [26]**

This battle was the result of a French - Anglo offensive that had begun in May. The British had attacked at Aubers Ridge and the French attacked with eighteen divisions at Lens and Arras. These attacks were all failures but General Joffre's enthusiasm was undiminished and he planned another offensive, reasoning that the enemy must have been weakened and in autumn, he planned to attack a bulge in the German line. In theory the double assault, one towards Champagne and the other in Artois, would collapse the German salient, allow the allies to cut German communications and drive them from French soil. The French would attack in Artois at Vimy Ridge; the British would attack at Loos, near Lens [27]. Despite the heaviest bombardment of the war so far, French élan and bravery was no match for well dug-in German machine guns and the attack at Vimy Ridge failed after ten days of bitter, localised fighting. Closest to success was the British First Army at Loos, the Germans had not expected them to attack.

Loos was important to the Germans, although situated in a hollow it was an outpost to the dominating position of Hill 70. A considerable defensive line had been constructed on the village's western edge, known as the "Loos Defences". It was a continuous line of trenches with concrete machine gun emplacements. Strong points defended the entrance of the Vermelles Road to the village.

Even at the outset, the British High Command knew that they did not have the supplies, artillery ammunition, heavy guns and trained men to approach this operation with any confidence. Lord Kitchener had ordered that the battle go ahead to support the French despite Field Marshal French and General Haig's concerns. Kitchener, a military man himself, made the decision to fight at Loos from a political standpoint; he took the decision as Secretary of State for War, not as a soldier. Even though, it was to be hoped, that he knew what his officers were telling him was true. The B.E.F was on French soil and very much the junior partner in numbers and equipment and he felt obliged to allow the French to dictate terms.<sup>24</sup> Sir John French declared that the operation would cost many lives and Sir Douglas Haig pointed out that the British did not have enough in the way of guns and munitions to take part in the operation, but both were over-ruled by political expedient [26][28]. It was a shame that both men were not in such accord when the battle was joined.

## **4.2. Sea Ports & Railways**

The British ports at the time of Loos were Boulogne, Dieppe, Rouen and Harve. The French had allotted Calais to the Belgians but by May 1915, the British were given permission to share that port and it was operating as a British port by June. Dunkirk was considered far too close to the front line and the French were not happy for the British or Belgians to use it, its capture while operating as a supplying port would be a blow to national prestige [29]. Very early in the war vessels came into the ports and were unloaded straight onto waiting trains. Soon this became impossible. In Boulogne a civilian railway company, the South Eastern and Chatham Railway Company, had

---

<sup>24</sup> Edmonds wrote that Kitchener had a long-term strategy in place for dealing with the French (as opposed to the enemy). Edmonds believed that Kitchener knew that the British would be far more prepared in terms of men and equipment by 1916 – 17. Only then would Kitchener be in a powerful position to negotiate with the French and dictate the course of Allied strategy.

been brought in to run the port and unloading.<sup>25</sup> The army soon took over the S.E.C.R.Cs operation on the grounds that civilians did not know how to run the operation in military fashion and were only capable of running on commercial lines [29].

By 1915, the B.E.F had been organised into two Armies each with a Line of Communication. First Army was supplied by the ports of Harve, and Rouen with Abbeville as the regulating station. The vast sidings at Abbeville were laid by British railway troops.<sup>26</sup> Supply railheads for the battle were as follows: IV Corps and divisions at Chocques (3 miles west of Béthune, the Hazebrouck - Béthune line). I Corps and Second Division at Béthune. XI Corps and divisions, Lillers (on the Hazebrouck - Béthune line. The Cavalry Corps and the 1<sup>st</sup> and 3<sup>rd</sup> Cavalry Divisions at Aire (on the St. Omer – Armentières line). The 2<sup>nd</sup> Cavalry Division at Arques. Ammunition railheads for the First Army were at St. Venant and Lapugnoy. The 2<sup>nd</sup> Cavalry Division's ammunition railhead was at Strazeele [26].

The Director of Railway Traffic wrote a report about the first eighteen months of the war. His report noted that ammunition trains gave a good deal of trouble in the early months of the war. During 1915, only small amounts of ammunition were available at the depots and therefore only small amounts could be delivered to the railheads. The increasing demand for ammunition and the small amounts available meant that more ammunition trains had to run in order to maintain supply. These extra trains caused delays, congestion on the lines and complicated timetables. Ammunition caused problems up the supply chain as well. When the ammunition arrived at the destination station, it was often just dumped there causing storage issues [29].

---

<sup>25</sup> They flattened areas for hard standing storage, built hangars for covered storage, laid sidings and provided seven of their own tank engines for shunting duties.

<sup>26</sup> Second Army was supplied by the ports of Boulogne and Calais with Calais operating as the regulating station. The sidings here had been laid by French railway troops with British railway troops' assistance.

Traffic to the units at the front, between ports, to depots and other establishments and to the railheads was mainly carried by rail. The roads carried motor vehicles and horses for the remount depots. Ambulance convoys carried the wounded to base hospitals by road. Sometimes heavy ordnance travelled by road because at this point in the war big guns were difficult to load onto a train or unloading at the destination was going to cause a problem.<sup>27</sup> This undoubtedly significantly slowed the deployment of the few heavy weapons the British possessed.<sup>28</sup> Some supplies were carried forward on the inland waterways, returning barges carried wounded men [29].

After much confusion in the supply process during the early phase of the war it had been decided that regular supply trains would be made up with certain types of supplies loaded into wagons for each division. Therefore, a batch of wagons would be loaded at the port and then sent on to the regulating station. At the regulating station other wagons, containing different stores and munitions, could be added to make up the train. Trains were then marshalled so that all wagons for one division were in one train. It was usual for the stores for two divisions to make up one train [29].

Reinforcements could move forward on foot and by bus but trains could also be used to deliver much needed troops and tactical trains were first used in 1915. These were empty made up trains standing by at a railhead ready to transport reinforcements to the front. For the Battle of Neuve Chapelle there were seven such trains. A single train was capable of carrying a battalion, machine guns and horses. They were only intended to be used over short distances because the battalion transport had to follow by road.

---

<sup>27</sup> Sometimes destination stations lacked the equipment and facilities for offloading.

<sup>28</sup> Movement of the big guns was not the only problem. The big weapons had to be dismantled to be transported and then when they reached their destination they had to be literally re-assembled. These guns often had to be set up on platforms that had to be constructed before the gun was re-built. Then and only then could they begin the process of zeroing on targets. Road transport of big guns was not ideal; rail transport was the best option having greater haulage ability and being faster. The problem lay in a lack of suitable, specialised rolling stock.

The trains were stabled at Béthune, Berguette, Hazebrouck and St. Omer. These trains could get moving in four hours and be in position to entrain troops in six. They could entrain and detrain at any station and in-between if no horses had been loaded. After Neuve Chapelle the number of tactical trains was reduced to five capable of collectively transporting a single brigade.<sup>29</sup> These trains were stabled at St. Omer and Hazebrouck. Henniker says that this latter arrangement was the norm for 1915 but later in the year, probably for the Battle of Loos, a tactical train system was introduced capable of moving one whole division [29].

### 4.3. Assembled Artillery at Loos

The tables below show the artillery assembled for the Battle of Loos.

#### 4.3.1. Super Heavy and Heavy

15-inch Howitzer	3
9.2-inch gun	2
9.2-inch howitzer	12
8-inch howitzer	16
6-inch gun	13
4-inch gun	1
60-pounder gun	28
4.7-inch gun	34
<b>Total</b>	<b>109</b>

*Table 4.1. Super-Heavy & Heavy Artillery at Loos [26]*

---

<sup>29</sup> At this point in the war four battalions.

### 4.3.2. Divisional Artillery

6-inch howitzer	36
5-inch howitzer	8
4.5-inch howitzer	136
18-pounder QF	604
15-pounder BLC	26 (plus 10 in reserve)
13-pounder QF	8
Anti-Aircraft gun	8
2.75-inch gun	6
<b>Total</b>	<b>842</b>

*Table 4.2. Divisional Artillery at Loos [26]*

**Overall total 951 guns**

### 4.4. The Battle

General Haig's First Army was to fight the battle. Sir Henry Rawlinson's IV Corps attacking with the 15<sup>th</sup>, 1<sup>st</sup> and 47<sup>th</sup> Divisions, had to capture the German front line between the Vermelles – Hulluch road. Sir Hubert Gough's I Corps attacking with the 7<sup>th</sup>, 9<sup>th</sup>, and 2<sup>nd</sup> Divisions was ordered to push through the German front line between the Vermelles – Hulluch road and the La Basse canal. The reserve, under the direct command of the Commander-in-Chief, Sir John French was the Cavalry Corps consisting of the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> Cavalry Divisions and the XI Corps consisting of the Guards, the 21<sup>st</sup> and 24<sup>th</sup> Divisions. XI Corps advanced on 20 September, the divisions were billeted around Lillers. The Cavalry Corps, less the 3<sup>rd</sup> Cavalry Division, which had been assigned to the First Army and was at Bethune, was concentrated around Théroouanne. French was to retain personal command of the reserve until General Haig, First Army Commander, decided that he needed it. Haig had told French that Lillers was too far away for the reserve to be placed and Foch agreed with him. French disagreed and said that he would retain XI Corps at Lillers. A little later, Haig repeated his worry about the reserve and said that they should be at Noeux Les Mines, closer to the main attack. French said that two divisions from XI Corps would be assembled in

that area by daybreak on 25 September. Haig thought that he had won the argument. He was wrong. According to Edmonds French intended to keep the XI Corps together and under his own command until the battle developed.

All the big guns and howitzers that could be spared had been given to the First Army. It had been noted that the 18-pounder field guns and 4.5-inch howitzers of the R.F.A, divisional artillery brigades, alone were not good enough to destroy enemy positions. One hundred and ten 'super-heavy' and heavy guns and howitzers and 841 other lighter guns and howitzers formed the artillery support. Ammunition for these guns was limited and had been amassed by strictly rationing use in the previous weeks [26].

On the morning of 21 September, when it was light enough for observation, the preliminary bombardment began. It lasted for four days and the guns fired 255, 883 shells, it was less than the planners would have liked but for the time it was a big artillery operation [26]. Some of the gunners had just arrived from Britain and were inexperienced and the bombardment was spread over too large an area for the shell stocks available. The job could not be done with rationed ammunition [26]. For the first two days, the weather was dry and the bombardment threw up dust, obscuring the observers view. Shooting was inaccurate and the wire cutting operation did not go well, some pathways were cut through the wire but not everywhere.<sup>30</sup> On the last two days the weather broke and heavy rain made movement difficult. On each day, there were feints, designed to make the German infantry and artillery respond, which they did. When the German guns fired, the British opened fire upon them and then German guns promptly fell silent.<sup>31</sup>

---

<sup>30</sup> In some places the wire was on a reverse slope and difficult to spot, therefore some of the wire was still thick and intact.

<sup>31</sup> The British thought that they had succeeded in knocking them out, they had not.

Gas was to be used, apparently to make up for the lack of shells, and on the night of 24/25 wind direction was observed because gas depended upon a favourable wind. Not enough gas was available so in some parts of the line smoke was to be released. At 10.00 pm the two brigades from the two assaulting divisions from I and IV Corps moved forward to take over the front line and prepare to attack. The Germans stood to at 3.15 am on 25 September. Haig watched the wind direction closely and at 5.00 am he asked his A.D.C to light a cigarette so that they may observe the drift of the smoke. It travelled north-east. At 5.15 am the strength of the wind increased slightly and Haig gave the order to "carry on". By this time, the German troops had relaxed their vigilance believing that the British were not coming. At 5.50 am the British artillery opened an intense bombardment of the German front line and gas and smoke was released. The German batteries opened fire. They had not been silenced as the British assumed [26].

The smoke and gas hung around the British front line and it was a mixed success. It drifted into the German positions in front of Loos and in the Hohenzollern Sector it gave excellent cover to the attacking troops but failed to be a full success because there was not enough available and it moved too slowly. In the south, the gas failed to reach the German front line and in the centre, it drifted back into the British lines. On the 2<sup>nd</sup> Division front no gas reached the German lines and they had to rely upon the smoke to cover their advance. At 6.30 am on 25 September the British infantry advanced into the gas and smoke, the attack began.

The assault had begun in mist and darkness after the gas had been released. Lines of infantry followed the line in front at a distance of fifty paces. Russian saps had been dug and the British were fairly close to the German front line. Gas lingered in the British line and hindered the advance on the left by the 46<sup>th</sup> Brigade men. The old

pattern smoke helmet (gas mask) was inadequate and not up to the task. Soldiers had to keep lifting the front flap up to try and breathe because the helmets were almost air tight, others discarded them completely. As they tried to advance the British soldiers inhaled the gas and many became gas casualties.

Casualties were considered to be light in the first forty yards but the screen provided by the gas and smoke, though thick, was not good enough and two machine gun teams managed to rake the advancing lines twice before they were engaged by bombers and neutralised. These caused heavy casualties as did the German field guns that now opened a sporadic fire. Despite the losses the advance continued. The German wire had been successfully cut here and the German front line was pierced. The garrison was small and those that did not retire down the hill to Lens were killed or captured by the British troops. The smoke and gas cloud did drift towards Loos and in doing so it began to disperse nevertheless, visually impaired by the cloud, the attacking British units soon became intermingled as they advanced on the village. Still, they could see the outline of the twin winding towers of "Tower Bridge" and this gave them a direction.

By 7.00 am the British had reached the "Loos Defences" and found them abandoned by the defenders. The wire here was very thick and had not been properly cut so time was lost as the troops widened the gaps by hand. This delay gave two German machine gun crews chance to set up their weapons and bring them to bear upon the men labouring at the wire. Bombing teams were sent in whereupon they located and destroyed the machine gunners. There was some small arms fire from the houses in the village but it was reported to be inaccurate and wild. On the right elements of 44<sup>th</sup> Brigade entered the village led by bombing teams. They found a chaotic scene; the Germans had not expected their forward defences to fall so easily and were unprepared

to defend the village. A fair number had taken cover in the cellars of the village and were rounded up to be sent back to the prison cages.<sup>32</sup> Others did manage to put up stiff resistance and engaged the British in house to house fighting. Those who could took their chance and abandoning their gear they fled to Cité St. Laurent and others to Hill 70.

The London Territorials and the Scottish of Haig's First Army had rolled over the German front line and successfully pierced the second line. There were no German reserves near enough to plug the gap quickly but Haig's warning about the reserves was justified. Sir John French had kept his own reserves too far back, some sixteen miles. By the time the British reserves arrived, the Germans had managed to bring up their own reserves and plug the gap in their line. The British reserves, two Kitchener divisions, suffered heavy losses from German fire as they advanced and the battle was lost. They were green troops, straight from very basic training, they were tired and they were also hungry. These young soldiers stood little chance against the fresher German troops in defensive positions. The battle continued for thirteen days and it degenerated into what would become a familiar theme during the war until August 1918. The troops became bogged down in trench fighting, scrapping for local objectives and small portions of trench. The battle officially ended, or was 'closed down' on 8 October. Sir John French's reputation suffered greatly and his time in command of the B.E.F was numbered [27].

#### **4.5. Conclusions**

Loos was almost a great victory but ended a failure because of a number of factors. Reserves held too far back to be effective, the use of untrained and green troops, the

---

<sup>32</sup> German soldiers were still being found in the rabbit warren of cellars beneath Loos on 28 September.

lack of decent staff officers, the losses to regular officers and other ranks in the preceding months and ill-chosen unfavourable ground<sup>33</sup> all played their part. Crucially, so did a lack of artillery munitions. Sir John and Sir Douglas had told Kitchener, when the latter demanded that the attack go ahead to aid the French forces, that the BEF did not possess enough ammunition or heavy guns to undertake the operation, they were concerned about the supply and availability of war munitions. Sir John's concerns and warnings, like those of Sir Douglas Haig's were over-ruled. Brigadier-General Edmonds said, "The shortage of heavy artillery and gun ammunition put an offensive of any kind out of the question for the time being." [26]. That is in September 1915, and he went on to say, "the British Commander-in-Chief had not enough men or enough ammunition to carry out a great offensive." [26]. The preliminary bombardment had not done its job. There had not been enough guns or ammunition for the job in hand. Many German strong points were left intact as was a good proportion of the wire. Those attacking where these obstacles were complete suffered heavy losses. Where the artillery *had* done its job, the attacking infantry made good progress. Some 600,000 shells were fired into the German positions during the first week of fighting [20]. Even so, that rate of fire could not be kept up because there were not the stocks to sustain that rate. The British Army, still supplied at Loos by pre-Ministry of Munitions, War Office, contracts had not, at this point, the tools to do the job. What had been attempted in terms of increasing munitions and weapon production before the emergence of the Ministry of Munitions had simply not been good enough. The British Army had been let down by the broken promises of manufacturers and had been ill-equipped to do the job that Kitchener who in the face of all advice, ordered it to do. Sir John, attacked by comrades, politicians and even the King, lost his job as the British Commander-in-Chief. In his own phraseology, the

---

<sup>33</sup> The battle ground had been chosen by the French.

establishment had decided to “change the bowler.”[24]. It was not entirely his fault, his artillery did not have enough ammunition for the job in hand, nor did they have enough big guns. What Britain needed was more than the mobilisation of armed men, it needed to mobilise the workforce if the required shells and other war paraphernalia were to get to the theatres of war. The government’s attempts to ‘plug the skills gap’ and the lead up to dilution of the skilled workforce are examined in the next chapter.

## **Chapter 5.**

### **The Workforce**

#### **5.1. Introduction**

The over-riding mission of the Ministry of Munitions when it came into being was to provide the munitions needed by the army. The demand for munitions meant a demand for more factories and for more factory workers. These had to be recruited and trained in much the same way as soldiers were for the army. Because a large number of able-bodied young men had joined up the pool of available skilled labour had shrunk. What was done to mobilise the workforce in 1915 and what lessons can be drawn from these processes? This chapter examines a national voluntary scheme that was established in an attempt to take skilled workers from private firms and place them in munitions factories or private firms with government war contracts. Although, many realised that conscription, both military and industrial was the answer to the workforce crisis, fear of union action and public opinion forced the weak, coalition government and the Ministry of Munitions to attempt the voluntary route.

Looking around for the reasons for the shell shortage it had been discovered that there was a lack of skilled labour in the munitions manufacturing industry. Of the 1.5 million men employed in the chemical and metal industries nearly  $\frac{1}{5}$  had joined up either because they were either reservists or volunteered for Kitchener's New Armies [31]. There were men who came forward to fill their shoes but they were not, in the main, skilled hands. Skilled workers were desperately needed for manufacturing and setting up new machines, to make jigs, gauges and tools, to provide precision work for the munitions of war. The need for their skills and abilities was unprecedented for the time and would be unprecedented today. With what would become characteristic energy the

Ministry set about trying to find the men to fill the vacancies. What the Ministry would have to do is deal with the unions, change the mind-set of a nation and deal with the lack of cohesive leadership by Asquith's coalition government.

## **5.2. The need for workers and union opposition**

From early on the government knew that if manufacturing output was going to be increased to meet the needs of the war, un-skilled and semi-skilled workers had to be brought into the workforce to undertake the less skilled jobs available in manufacturing industry. The issue that lay before the government was strong union opposition to this move. The main union objection was that once the war was over the influx of new workers would cause a glut in the workforce that would bring about unemployment and a general devaluation of living standards. The government did manage to get the unions to agree to a relaxation of restrictions to their members in the Treasury Agreement of 19 March 1915 but in reality, nothing much changed [31]. The unions were justifiably worried that once they surrendered their old rules and customs they would never be restored. The skilled workers had built up a definite culture and years of customs and they were, it was no doubt, consummate professionals and highly skilled workers but they operated a closed shop principle. In industrial, mass-production there was going to be room for the skilled worker but little or none for the slow working, handcrafted artisan. Some knew that a root and branch approach was needed. On 9 June 1915, when Lloyd George was confirmed as the Minister for Munitions, Sir H. Llewellyn Smith<sup>34</sup> said that the unions had to relax their rules, customs and practices so that the workshops could be economically reorganised for effective munitions production. It was argued that the skilled hand could be freed to do their

---

<sup>34</sup> Sir Hubert Llewellyn Smith, G.C.B., Permanent Under Secretary, Board Trade, 1907 – 1919. Later Chief Economic Advisor to the Government.

skilled work if some of their other, daily tasks were given to un-skilled or semi-skilled workers [31]. The unions disagreed and instead insisted that recall from the colours was the answer to the skills and workforce issue. They pressed for the recall from the Army and Navy, skilled men who had volunteered or re-joined because they were reservists. It was even suggested that some of the Kitchener Recruits, training to go to the front, be sent to the factories to work and allowed to do some “drill and firing” so that they would be ready to fight when needed [11]. The unions argued that alongside Belgian refugees and those Commonwealth workers who could be induced to come to Britain, skilled men should be ‘combed out’ of the Army and returned to the factory floor. These workers should plug the gap in the workforce and avoid ‘dilution’.

The entry of un-skilled and semi-skilled workers into the workforce was called by the unions ‘dilution’. Something that was pure and concentrated watered down. Even in mid-1915, the unions, like so many, still did not understand, appreciate or comprehend the scale of the problem that faced the nation. Nor did they seem to realise how vital manufacturing was to the resolution of the global crisis. Fearful of the power of the unions Asquith’s government timidly agreed to follow union advice; instead of pushing forward with the necessary expedient of employing un-skilled and semi-skilled labour. At a moment where leadership and action was needed to vitalise manufacturing production, it was a mistake.

The day before Sir Hubert made his statement Lloyd George attended a meeting of the National Advisory Committee, a body set up by the government to represent workers engaged in war work for the government. He tried to impress upon them the grave situation that now faced the British Army on the Western Front. The lack of munitions posed a very real danger to the nation. He went on to say, “The entire organising capacity of the Nation must in some way or other be concentrated on supplying the

deficiency with all possible speed.”[22]. A voluntary effort would be attempted but if that failed then compulsion would be the only course of action available to provide what was required. The problem facing the Ministry of Munitions and the wider government was how to alter the national attitude. Conscription of the workforce and conscription into the Army was very much on the minds of the politicians and the newspapers in early June 1915. The Amalgamated Society of Engineers said of the idea, “Compulsory service, military or industrial, is alien to the spirit and tradition of the British people, and any attempt to force this pernicious system on the nation would create serious difficulties for the Government.”[11]. There were threats of strike action should compulsion be attempted.

### **5.3. Government intervention**

The coalition government was very concerned about public opinion on this matter and wary of the effect that it would have upon the nation. However, on 16 June, shortly after the unions had given up their right to strike, a union delegate pressed Lloyd George on what the government would now do about conscription, would it take advantage of the fact that the unions had set aside their main weapon. Lloyd George replied, “as far as I can see, there is no immediate danger of conscription, and I shall be very surprised if we do not get through without it.”[11]. For now the voluntary method both military and industrial was to be attempted. This alongside the Belgians, the attempt to ‘comb’ skilled workers out of the Army and the hoped for influx of Canadian workers would provide the skilled men required.

There had been attempts by armament committees to obtain skilled men for the munitions industry in the previous months. Soldiers, if they had been skilled men in civilian life were asked to return to the factory. Recruiting offices were asked to stop

accepting skilled men as volunteers. Workers were asked to leave private firms and go to work for government armament factories. However, these schemes were dogged by rivalry between the Admiralty and the War Office for workers for shipyards and munitions. Some private employers flatly refused to release workers, because they were unwilling to lose skilled hands, have machines standing idle and lose profits or lose out to a rival. The Admiralty had already circumvented this by offering to pay a private employer up to 150% of a worker's wage if he was released to work for the Admiralty. It was suggested that this compensation should be extended to munitions work as well. It was also proposed that private firms be forced to hand over workers who were willing to volunteer but there was no power of compulsion. It was also suggested that small private firms, which had no government war work, be arbitrarily closed down and their workforce transferred to munitions work but once again, in May 1915, that kind of power did not rest with the armament committees. As far as recruiting and the army went, recruiting officers often ignored advice about men's qualifications and some volunteering men simply refused to state that they were skilled workers, preferring instead to put 'labourer' as their civilian occupation. Some, already in the army, refused to leave their comrades in arms and return to civilian life. Gunner A. J. Heraty said of this,

*As both Abe and myself were in protected trades at that time, Abe as an electrician and me as a benzole maker, it would be possible for us to dodge the drafts and stay behind. Now I was very keen and was full of the desire to go overseas to see France and what the war was like, I talked it over with my pal Abe and won him over... We both decided, when it came to our turn on the parade ground, to tell the officer in charge that we were labourers. [37]*

#### **5.4. The King's Squad**

The notion of moving workers to where they were needed was already being mooted. In March 1915, Sir Percy Girouard had been asked to undertake an enquiry into moving skilled workers around in the Newcastle area. So by May/June there was a voluntary body of skilled munitions workers formed on the North-East Coast called the 'King's Squad' who, so long as their rates of pay were met and their accommodation and travel expenses were found, would go to whichever munitions factory in the region that needed their services. The idea for this 'Squad' or pool of workers was first suggested in Newcastle by a Captain Kelly, who worked for the War Office, in April 1915 and was set up by him at the request of the North-East Coast Armaments Committee in May [11]. He asked men to voluntarily leave private work and transfer to munitions work. The main essence of this scheme was to get men without the interference of employers or union but with their support and approval. Unions, private employers and munitions manufacturers were brought together and had the scheme explained to them and all agreed that the scheme must go ahead. Crucially the employers were told that if a worker chose to leave their employ it was the workers right to do so, it was the worker's choice. A visit by the King to Newcastle on 19/20 May, where he met and congratulated the Committee, gave the 'King's Squad' the official seal of approval and a huge amount of positive publicity. The response to the request for volunteers was good and by 22 May 2,600 men had volunteered and 350 had been placed in North-Eastern Munitions factories.<sup>35</sup>

---

<sup>35</sup> Workers were given a coupon which if they wished to volunteer they signed and handed in. On signature, they came under the orders of the North East Coast Armaments Committee and awaited a telegram that would give them their instructions, which factory to go to and whom to report to. Subsistence information was printed on the coupon and explained to workers at a meeting. When the worker received their telegram they had to report to the Labour Exchange to be issued with a travel warrant. It was a very quick process.

## **5.5. National Roll-out**

Seeing how effective this local scheme was on 25 May, Captain Kelly suggested that it be adopted by other areas. The authorities agreed and it was recommended by the National Advisory Committee that this voluntary scheme be expanded nationally. Workers could voluntarily transfer from one workshop or locality to another so long as they were skilled workers in a private firm and not already engaged in work for the government. They would be paid their skilled wage and receive subsistence allowance if they moved away from home or had to travel a long distance to their new workplace. These workers could only transfer to factories that were about to come under Ministry control or receive government contracts. The Trades Unions would report on the fitness, in terms of skills, of these workers to a committee who would then set the rates of pay for the volunteers. In these factories profits were restricted. This was an attempt to stop employers abusing the system by making big profits on the influx of new, skilled labour. The Ministry of Munitions accepted the scheme on 16 June. Yet this was dealing with skilled workers and did not seem to address the problem of unskilled and semi-skilled labour. Also there were demands upon the male workforce from the Army. Kitchener wanted the unfeasible number of 35,000 recruits a week up to 31 December. He believed that this could be achieved by raising the military service age to 45 and bringing women in to the workforce in large numbers, thereby freeing up men for military service. It was an impossible target to reach because of the recruiting needs of industry [38].

## **5.6. Recruitment**

Using the Ministry of Munitions method of placing experienced people in the right places, Mr. C. F. Rey, the General Manager of Labour Exchanges was appointed to

oversee the voluntary scheme.<sup>36</sup> The involvement of the Labour Exchange immediately worried the unions because they felt that their members would not visit a Labour Exchange to volunteer because they would associate those places with unemployment and un-skilled workers. The Trades Unions were initially given responsibility for enrolling the volunteers, but before recruiting began it became obvious that they had neither the staff or administrative machinery to do the job. There was already plenty of experience in military recruiting so consequently, town halls and Labour Exchanges throughout the land were instructed to prepare for the influx of industrial volunteers. An expensive and extensive campaign of posters and handbills had already rammed home the need for munitions workers to the wider public. The enrolment period was to last for seven days.

On 23 June, the night before enrolment began; Lloyd George introduced the Munitions of War Bill to the House. This Act was to invest the new Ministry of munitions with a vast majority of its power. It was “to make provision for furthering the efficient manufacture, transport, and supply of munitions for the present war, and for purposes incidental thereto.”[11]. As the empowering Minister Lord Curzon succinctly summed the Act up during the second reading in the Lords. It was “to organise the skilled labour of the country for the production of the munitions of war.”[11]. Lloyd George when introducing the bill to the house, playing on the fear that he knew lurked in the minds of the politicians and the public, issued a pointed warning. If the voluntary scheme failed to recruit enough workers to turn out the munitions required by the army, he told the House, then compulsion would be inevitable. The Act would give that kind of power. Lloyd George’s reassuring words to the Unions, uttered only a few days before seemed to have been forgotten. Enrolment, due to last for seven days,

---

<sup>36</sup> Originally called Director of Industrial Recruiting, then Director of Munitions Workers’ Enrolment and finally Director of Labour Supply.

began on 24 June 1915 and Town Halls and Labour Exchanges were instructed to open at 6.00 am and remain open until 9.00 pm. The War Munition Volunteer Scheme was underway.

At first all looked well and enrolment was extended by a further seven days. Some 91,027 men responded and enrolled. Even when the Bureau overseeing the scheme officially closed down after 10 July the enrolment still continued at Labour Exchanges into September adding a further 11,000 to the total. The number of volunteers, when collated, looked impressive.

Platers, Riveters, Drillers, Shipwrights	23,564
Toolmakers, Toolroom Workers, Gauge Makers	1,834
Toolsetters	193
Millwrights	1,727
Turners	7,971
Fitters	24,830
Capstan and Turret Lathe Operators	830
Skilled Metal Machinists	6,710
Other Metal Machinists	1,884
Workers in Brass and other metals	4,667
Lead Burners	256
Coppersmiths	395
Misc	27,166
<b>Total</b>	<b>102,027 workers</b>

*Table 6.1. War Munitions Volunteers, 1915 [31]*

## 5.7. Failure of National Scheme

It looked good but the scheme was in fact a failure for a variety of reasons that no one seems to have foreseen. A large proportion of the volunteers could not be transferred.

Firstly, the employers had naturally been given the right to protest against a worker seeking to leave their employment. The loss of skilled workers could spell disaster for some firms. Not surprisingly, a large number of employers protested and

unfortunately, these protests could not be dealt with straightaway. A private firm had been given the contract to classify and index the workers but when the index was checked it was found to be inaccurate. The work of classification had to be done again and was not completed until 21 July. No protests could be processed until then and therefore the workers could not move. By the end of enrolment in September 66,000 protests had been made and it was found that such were the varied, technical reasons for protest that no working mechanism existed to deal with many of them [31]. If a protest could not be adequately upheld or rejected then a worker could not move. It was also discovered that in some firms, where skilled workers were to leave other jobs in that firm would be under threat.

Secondly, it was found to be very difficult to decide the importance of other kinds of work other than munitions work. Despite its vital importance the Ministry began to realise that there was more to wartime manufacturing than producing munitions. A number of the volunteers simply could not leave their posts. For instance, exports were required to bring in revenue, textiles and food were vital to the war effort, the motor trade had big contracts for road vehicles and aircraft. Skilled railway workers were vital to the smooth running of the supply system, shipyard workers were retained because a big naval engagement was expected and their skills were likely to be needed for repair and new warship construction work. Increased merchant vessel work had not been considered because the U-Boat threat had not yet emerged. The mines could not afford to lose mechanical staff if the supply of coal to the factories and railways was to remain unhindered.

Thirdly, because such a fuss had been made in the press and by the government about the shortage of shells and fuses some workers had concluded that if they were not making shells or fuses then their work was not essential to the war effort. Some of the

workers, out of a genuine desire to help, were volunteering to leave vital war work. Moving them from their work to munitions production would cause more problems for the manufacturing effort that it would solve. Finally, in some cases, by the time that workers had been processed and allowed to move they could not. In the intervening period, the factories that they were leaving had obtained government contracts so they had to remain.

### **5.8. Workforce Data**

The supply and demand for skilled workers was causing a problem as well. Even though volunteers were being recruited, no one it seems had actually tried to find out who needed whom and if that requests for labour were vital or justified. Therefore there was, in early July an attempt by the Munitions Workers Enrolment Department to ascertain just exactly which firms needed which skilled workers. It was a huge task and on 6 July, Mr. Rey met with representatives from the Admiralty, the War Office and the Supply Departments of the Ministry to ask them to supply this information to the Munitions Workers Enrolment Department. The issue of ‘attitude’ reared its head once more. The Munitions Supply Department responded in six days with the unhelpful news that in their opinion *all* work was urgent but beyond that they could not answer the questions. Perhaps they could be forgiven because they were still a fledgling department but it was not a useful response. The Admiralty’s reply was just as unhelpful and uncooperative. It took a leisurely twenty-four days to send a list of 450 firms that might need workers but the list made no reference to urgency or importance. They did add the aloof comment, “whose requirements for labour may always be considered important, if Admiralty work is a ground of application for assistance.”[31]. They promised to get in touch if any firms not on the list needed more labour.

There was no reply from the War Office, presumably because it was still smarting at having the control of munitions manufacturing and supply taken away. This lack of co-operation at the highest level was appalling and demonstrated the attitude of some of the different elements of the establishment at the time, nor did it help the situation at all. This and the lack of information highlighted the size of the problem faced by Mr. Rey's Department.

Data from firms throughout the nation had to be gathered before any sensible and economical distribution of workers could be undertaken. The equipment and machinery of the firms had to be investigated to make sure that existing skilled workers were being employed effectively and to assess production methods. Such a survey and the subsequent assimilation of the data would take months. In the meantime, the department would have to make do with the rough and ready approach of accepting direct demands for labour from the regional armament committees and the firms themselves, without the ability to assess the demands and scientifically and economically place the workers.

### **5.9. Involvement of Private Companies and the Admiralty**

Despite the publicity and despite the crisis on the Western Front and despite the evident enthusiasm of the workforce, the companies did not rush to take up the scheme. Many of the firms were uncooperative and had to be pushed by the department into asking for workers. In July, thirty-five companies, all of which were about to come under Ministry control, were contacted directly and asked how many skilled workers they needed. They hesitated to respond, all of them unwilling to accept War Muniton Volunteers from the Ministry. When pressed they reluctantly reported that between them they had a shortfall of 11,000 skilled workers. A further 270 firms,

all by then controlled by the Ministry, were contacted on 24 July by the Labour Supply Department (as Mr. Rey's department had now become known) and told how the volunteers, the Canadian volunteers and combed out soldiers might be obtained for employment. They were then asked how many of these skilled workers they could employ. The response was that these 270 firms could employ 7,064 skilled workers. On 29 July a further 1,000 firms who were about to be granted government contracts were contacted, given the same advice and asked the same question. Only 272 of these firms responded and their answers suggested that they might employ 4,368 skilled workers between them [31]. These firms which had bothered to respond had signalled that they could employ 22,432 skilled workers. Because of delays, protests and the other problems that were emerging it was far more than the Volunteer Scheme could supply.

The Admiralty Dockyards refused to get involved with the scheme citing the fact that they already had workers who had left home on their own initiative to work for the Admiralty but who did not receive subsistence allowance. They would not employ other workers alongside them who *were* paid subsistence allowance. The volunteer's subsistence allowance was virtually the same as lodging money, which was customarily paid to outworkers in some trades. The receipt of subsistence allowance for some and not for others caused little or no friction between workmates. As it turned out this was not much of a reason for the Admiralty Dockyards to boycott the scheme.

### **5.10. Quality of Volunteers**

Of course some of the volunteers were not as skilled as they claimed or skilled enough for their placements. Some 23,000 workers volunteered without their employer protesting [31]. In some cases (but not all), the lack of protest was precisely because

some volunteers lacked skills and perhaps the employers saw an opportunity to shed unproductive workers. In the scramble to try and obtain workers the department accepted sub-standard volunteers and under pressure from the Ministry for results these workers' applications were sent on to factories who needed skilled labour. Many of these applications were rejected because the workers did not have the required skills. Such rejections did not instil confidence in the companies about the Labour Supply Department's ability to supply quality workers.

### **5.11. Reality of Scheme**

In the end, by 27 September as the Battle of Loos was being fought in Flanders, only 3,768 men of the 102,027 volunteers moved employment and begun work in munitions manufacturing. It was now obvious to the Ministry that the War Munition Volunteer Scheme was not going to provide the skilled workers as quickly as required. It simply could not provide the numbers fast enough. Also, moving workers around threatened to dislocate manufacturing in other vital areas and would not provide enough workers to improve munitions production. No one had thought through the situation and foreseen the implications of the scheme. There had been no forward planning, forecasting or modelling done. Blinded by the immediate shell crisis the Ministry had been forced to attempt to act while constrained by the unions and by the national attitude to compulsion. In effect, there had been a 'knee-jerk' reaction to the crisis and to keep the physical analogy going, it had tried to operate with one arm tied behind its back. This scheme to increase munitions production was as unsuccessful as any that had gone before. The truth was that there were simply not enough skilled workers available to do the work and what skilled workers there were already worked in vital parts of industry and manufacturing.

## **5.12. Recruitment Problems**

It was one thing to rush enthusiastically into a recruiting campaign but it was another to assess where the skilled workers were to go to be most effective. The Kitchener recruiting campaign, while swamped by volunteers had an easier task. All it had to do was place men in the Army as a whole. Volunteers could be sorted and sifted after they had gone to a camp (no matter how makeshift and lacking facilities) and begun to train. Most of the Kitchener volunteers were not already skilled in their newly chosen career and had everything to learn, they were a 'blank-canvas' so to speak and needed training, moulding into what their new employer wanted. Nor were they needed as quickly in their field as the Munitions Volunteers were needed in theirs. In the War Munitions Volunteer Scheme the workers needed to be allocated swiftly and economically. Perhaps, un-skilled and semi-skilled workers, like raw army recruits, with everything to learn would be a better choice. They could be recruited, trained and sent to the factories where they were needed.

## **5.13. National Registration**

Because of this scheme and the need for skilled workers the National Registration act was passed on 15 July 1915. All adults between 15 and 65 had to register on 15 August giving their name, age, marital status, nationality and occupation. It was initially to help deal with the labour crisis, identifying workers and their skills on a national level and seeing to it that they were deployed in the most efficient way. It was feared by some that the register would be used to bring about conscription into the army and indeed the government used the data to find out which citizen was not doing their bit for the war effort.

#### **5.14. Assessment of National Scheme**

It soon emerged during the scheme how much was not known about the manufacturing firms and establishments in the country. It was simply not enough to say, there is a shell shortage, there is a skills shortage, we shall recruit skilled workers. Extensive data on the companies was vital so that sensible placement of the volunteers could take place. In the case of the 'King's Squad' this data had already been collected before the appeal for volunteers went out. Sir Percy Girouard's enquiry with the help of the Board of Trade had quickly obtained statistics, relating to firms, railways and the needs of the munitions companies for the North Eastern area. The North East Coast Armaments Committee knew which firms needed which workers and it knew which workers it had available in the pool. It was simpler for the Committee because Armstrongs dominated their area, they were dealing with one company and that company had been definite about its requirements for skilled workers. In addition, the area had a strong connection with armaments and ship manufacture for years. 'The King's Squad' dealt with a single region not an entire country. The national recruiting scheme began before the national data was obtained. The collection of that data and its processing needed, in the pre-computer age, a huge number of personnel and a large amount of time. A positive note for the scheme was that this process came about and was begun because of it. Dilution was inevitable and the influx of workers, female, male, old and young had a profound effect upon industry and factories. The government was keen that the welfare needs of women and girls were looked after in this hazardous work and the innovations brought in for them helped to shape the lives of workers in factories for years after the war

## 5.15. Conclusions

The volunteer scheme had worked in the northeast, yielding good results. Nationally, there was a fear of dilution, compulsion and conscription. Therefore, this voluntary scheme looked good. It avoided the compulsory movement of workers around the country and their removal from private firms. It addressed public opinion and union fears. It was really about *avoidance*; avoiding public anger, avoiding Union wrath, avoiding trouble for the government at home while fighting a war abroad. It was, in fact, avoiding the whole issue of the war. Even at this point, in 1915, there were some who simply could not grasp the magnitude of the catastrophe and tragedy that had befallen the old world. A few did know that compulsion, conscription and dilution must come if manufacturing was to provide what the army needed to fight the war. It was, just at this moment, that the notion of total war and the mobilisation of the nation to that end was still only dimly perceived. The scale of the situation was simply, too big. The King's Squad was only a small-scale operation, in numbers and geographically.

Why did the King's Squad work? The northeast was dominated by one munitions firm. Many of the local private firms had something to do with that munitions firm. Therefore, there was a pool of transferable skills already available. Because the munitions firm, the private firms that supplied it and the unions co-operated with the northeast Armaments Committee the Committee already had a considerable amount of data referring to skill requirements by the munitions firm and the skills available in the pool. Obstacles had been removed to allow the scheme to function as intended.

The King's Squad worked in a relatively small geographical area where there was a tradition of heavy industrial manufacturing such as ship building and working in metals on a large scale. There was also less of a cultural shift for workers moving around the area. Ways of working, accents and customs were similar. The King's

Squad was administered by the local Armament's Committee. It had local knowledge and had direct links to the regional firms involved. Therefore, the King's Squad was bound to succeed. There was a tradition of heavy industrial manufacturing, there was co-operation from and between the firms that had probably existed before the war. The employers and unions were amenable to scheme. The Committee knew what workers were needed and what workers were available. The squad came from and covered a relatively small geographical area where cultural differences were not as pronounced as they may initially have been between a Glasgow docker and a Derby railway fitter.

Why did the national version of the scheme fail to provide the same, instant results? It was too big a scheme to roll out nationally without better preparation and data collection. Many areas did not have a tradition of heavy, industrial manufacturing. Some manufacturing skills, while unique and noteworthy, did not easily transfer from private firms to munitions firms. The national frenzy whipped up by the papers and certain politicians and soldiers had 'muddied the waters' somewhat. Some workers thought that their work was not vital because they were not making shells themselves. In many cases, their work, making components for munitions, was vital to the manufacture of complete munitions.<sup>37</sup> Taking workers away from this work would cause more trouble for the munitions industry than it would solve. When the scheme was launched the Ministry was not in full possession of nationwide data with reference to skills required by the munitions industry and the skills available in private firms.

Data was being collected, compiled and indexed but the process was slow. The private firm contracted to undertake the indexing of data made serious mistakes and the index was faulty. The job had to be done again. This delayed the speedy placement of

---

<sup>37</sup> It may have been the case that some workers making small components did not know that they were making pieces for shells.

workers and denied the Ministry of the data it required for even longer. The entirety of Great Britain is, by definition, a much larger geographical area than the region of northeast England. There were massive regional differences and not every region had a tradition of heavy industrial manufacturing. Some skilled workers could not simply transfer to heavy industry. There could be (and were in some cases) regional difficulties for workers moving from one place to another.

In the long run manufacturing for the war effort would not only involve the production of shells. For instance, a skilled carpenter might work on a shell production line but he would be wasted. He would, for instance, be vital to the aircraft industry or to the manufacture of military vehicles. Although the Unions were brought onboard they did not have the infrastructure to deal with the administration of the scheme and their part in it failed very early on. This could possibly be counted as a sort of success for the Ministry as it strengthened the government hand and weakened the union one. The administration of the scheme was taken over by the Labour Exchange.

Despite using regional Labour Exchanges the national scheme was run centrally, by the Ministry instead of by local armament committees. The use of Labour Exchanges worried the unions. The firms did not always co-operate with the scheme or the Ministry. Some firms had an eye to post-war Britain and did not want to lose skilled workers, some did not want to hand workers to rivals, others feared that their businesses would collapse and others knew that if key workers left then other staff, reliant on those workers, would have to be laid off as well. On the other hand, some firms caused trouble for the scheme by using it to their advantage. They ejected certain workers who for one reason or another were not 'up to the mark' and placed them in the pool.

The scheme was initially too unwieldy and could not direct skilled workers to where they were needed swiftly enough to make a difference. It had not been modelled or thought through properly. It was a reaction to a crisis but it was not pro-active. The national pool of skilled workers had never been very large and it had been critically syphoned by Kitchener's recruiting campaign for the army. Too much had been expected of those skilled workers who were still available. On the positive side, the scheme identified the need for a national registration scheme, that while controversial and against everything the British believed in, it was vital to the prosecution of the war. An audit was set up to examine and record the skilled workers and equipment used by private firms, this paved the way for the Ministry to better understand the deployment and use of workers, plant and factories nationwide. Useful data when it came to offering war work contracts in the future. The workforce had showed a willingness to put up with upheaval and a certain amount of dislocation for the good of the nation and for that, the government could take heart. There was in 1915 public support and enthusiasm for such wartime initiatives. Some small private firms had shown their hands, some helpful and others unhelpful; that information too was useful to the Ministry.

At the outset, the scheme was not a glorious triumph for the new Ministry. Its first attempt to solve the shell crisis and deal with the skills gap at speed was a signal failure. It was one thing to say we need more shells, let us build factories. Those factories needed workers, plant and the workers who knew how to use the plant. This did lay the foundations for the inevitable and vital influx of dilutees, the semi-skilled workers who *had* to fill the gaps in the workforce for wartime manufacturing.

These semi-skilled workers had to come from somewhere. In fact, they *were* coming without the Ministry seeking them out, whether the factories and unions wanted them

or not. Men and women from all walks of life and different social backgrounds, inspired to do their best to help out in the crisis, were beating a path in their thousands to the doors of educational establishments asking to be trained as munition workers. They did not care about the unions and their objections to dilution. They simply wanted to train. Education was the answer. These new workers brought with them new factory welfare reforms, ways of working, high quality training courses and improved methods of manufacturing, improved factory facilities that had an impact upon the war and manufacturing for the 20<sup>th</sup> and 21<sup>st</sup> Centuries. Training courses and the role of educational establishments are discussed in the following chapter.

## **Chapter 6.**

### **Instructional Factories and Training Courses**

#### **6.1. Introduction**

Despite the time and money spent on the attempts to recruit skilled workers from private firms and to comb out skilled men from the army, these schemes had been an initial failure. Time and money had been wasted on ‘quick fix’ schemes. The former has been explained in detail, as for the latter, the army was loath to lose skilled men of any type. Any organisation will prize, intelligent, skilled and resourceful operatives. Also, many men were not happy to leave their comrades ‘in the lurch’; therefore they refused to be combed out. If possible, a good number employed deceit and subterfuge, often with the tacit help of their officers, to avoid the return to the factory floor. With the failure of the Ministry and the War Office’s attempts to solve the skills crisis and increase munitions production it was plainly obvious that the solution was to employ semi and un-skilled workers in the Munitions Industry. Dilution, as it became popularly known, was a manifestation of the division of labour, a principle not unknown in manufacturing in Britain before the outbreak of war, but not generally approved of by skilled workers and unions.[30]

In spite of the failure to obtain skilled workers, there *was* a latent pool of manufacturing ability, skill and energy in the country. *The Official History of the Ministry of Munitions* [2] claims that these were men alone. While it was true that men were joining the workforce from other work and professions, the volume fails to take into account other members of the new workforce. Many of the women, youngsters and some of the old people who joined the workforce became just as skilled, able and energetic as the men. Munitions work consisted mainly of repetitive operations to manufacture in large

quantities, standard articles in terms of shape, size and quality. Hence, standardised, mass production was required. Not, as had been the norm in British manufacturing before the war, variable and changing, slow output. Accuracy was still required but mainly from the skilled makers of the machines, tools, gauges and the supervisors. Craftsmanship on the shop floor was actually declining by necessity. In pre-war days, there had been comfortable markets and the “conservative habits” of the skilled worker in the workshop ensured that the production of articles could be switched as required [31]. But output was small and slow and the nation could not rely upon the conservative craftsman and his bespoke products any longer. The war demanded better and more, much more. The war machine needed standardised items, produced on a vast scale and quickly. There was really no time for craftsmanship in the manufacture of munitions. Investment, *money*, was not a bar, wage demands could be met, new machines and devices for speeding up production could be designed, tested by skilled engineers and scientists, they could be paid for, installed and employed. Training of the ‘dilutees’, the new semi-skilled workforce, could be paid for, improved and expanded. Their education was essential and through them, once trained, along with improvements in factory organisation and design, welfare, production processes, product accuracy and increased output, there was the desired revolution in British manufacturing.[31] There was a drive in the nation to respond to the crisis of the war and a vast amount of resources had to be released to solve the problem.

These new workers would have to be trained and there was not the time to put them through the traditional apprenticeships that would make them skilled workers. Such apprenticeships took years and represented effort and sacrifice on the part of the worker to improve themselves. The Ministry of Munitions defined a skilled worker thus: “the skilled man was the journey man, who had worked through the shops as an

apprentice and gained some experience as an improver.”[31]. The dilutees would have to be semi-skilled workers.

## **6.2. Thinking about Plugging the Skills Gap**

Even as the Ministry came into being and the Volunteer Scheme got underway, forward thinkers in educational establishments and in the government were considering the speedy training of semi-skilled workers for munitions work. The Technical Colleges, Institutes and schools were considered as obvious places to train the new workforce. Obviously, for a number of reasons, they could not provide skilled workers straight away. Most were not well enough equipped with modern machinery on which to train. Many that had possessed modern equipment and plant had been forced to hand it over to the new munitions factories. There was a shortage of skilled tutor/instructors because such educational personnel with industrial experience were either already involved in manufacturing in the war work factories or in the forces. In addition, because of the nature of the pre-war courses that they ran a number of the Technical Institutes and colleges had not employed such skilled staff in the first place. Among other courses, the Technical Institutes ran domestic, art, commercial and Volunteer Aid Detachment courses [36]. Another factor to be considered about the Technical Institutes and Schools was that they varied in quality as much as they varied in equipment.[31]

## **6.3. Volunteers**

Indeed, perversely, while there was a shortage of skilled workers there was not a shortage of people coming forward to do war work. The shell scandal had galvanised a large part of the nation. Professionals and tradesmen from industries and trades

suffering a downturn because of the war came forward in large numbers, much as the Kitchener Recruits were doing, to do their bit. It was to the Technical Institutes, colleges and schools that these people applied, almost literally begging for training courses. The Ministry was keen to employ these people, but wanted to give priority to those who had some skills rather than the totally un-skilled who also came forward to help, for a number of reasons. Firstly, *if* they could be trained up they would quickly fill the skills gap. Secondly, as already skilled in another field, they would not irritate the unions and after the war they would go back to their old jobs and professions and not clog up the engineering labour market.[31]

#### **6.4. Factory Training**

The problem with current training in this area was that it was based upon the traditional, slow, ponderous and lengthy apprenticeship system on the job, in the workshop and factory floor. It was well known that employers would favour those who had trained in the traditional fashion in the factory above any worker who had been on a short, training course at an educational establishment. This was despite the facts that those coming forward, clamouring to train as munitions workers were often, intelligent, adaptable and very well motivated to do the job. The educational establishments were having to turn these people away because of a lack of machinery and tutors. Not every Technical Institute had a training syllabus in place and there was a worry that even if the volunteers were trained the factories would not take them on. The Technical Schools and Institutes “could have been filled many times over in the summer of 1915” but they were not [31]. While it was trying to attract skilled men from private firms, the Ministry had been looking for volunteers in the wrong place.

### **6.5. Initiative by Educational Establishments.**

In the late spring and early summer of 1915, some Technical Institutes, Local Education Authorities and Munitions Committees took the initiative, not the Ministry. Technical Institutes at Birmingham and Aston were the first to go ahead and collaborating with the local munitions committees ran their own training courses for munitions workers.[31] They proved a point. The trainees or students turned out to be excellent material, making a deep impression upon those who did employ them. It was obvious that if only the resources could be found and attitudes in certain quarters could be changed then the nation possessed a large labour resource.

On 26 June, inspired by the work at Birmingham and Aston, Sir R. Blair informed Dr. Addison that the Metropolitan Munitions Committee of London intended to give an order for the manufacture of gauges to the Polytechnics in the area and that the local Technical Institutes would provide some training courses (for munitions workers). Blair requested that he be put in touch with someone in the Ministry who could specify what kind of training was required. He sent a report made by the London County Council to the Ministry highlighting the good work being done by the Birmingham and Aston Technical Institutes in this training area.

### **6.6. Government and Ministry Control.**

As a result, Dr. Addison decided that the best Technical Schools and Institutes should start training courses and be given contracts for small quantities of shells to allow the students to train. Other schools and institutes that were not deemed good enough would have to give up any of their remaining machinery to the National Factories.[31] This distinction could make or break an educational establishment.

Early in July the Ministry contacted the Board of Education about training. By stressing the need for skilled and semi-skilled workers and alerting the Board to the need for Technical Institutes to do the training and pointing out that there was no shortage of students the Ministry was stating the obvious. The Technical Institutes, the Munitions Committees and the Local Education Authorities already knew what was required of them.

The courses being run by the Technical Institutes were between 20 and 120 hours in length depending upon the equipment that the students were training to operate. Short courses trained students specific operations on specific machines, longer courses offered similar training along with bench work and more specific skills. The Ministry was becoming more involved and advised the Institutes to contact their local munitions factories to ascertain what type of workers were needed so that they could tailor the courses accordingly. All of the training was to be certificated and all of the courses were eligible for grants from the Board of Education. The Ministry impressed upon the Board the importance of these courses. They were to be given top priority.

The Ministry naturally had to be involved to co-ordinate the training effort; it was after all a central body with the duty of co-ordination. Such work was not to be left in the hands of the educational establishments. As with all things in the Ministry, a person was appointed to oversee the project and under him, a number of subordinates, the Labour Officers, were commissioned to carry out Mr. T. M. Taylor's instructions. Duplicating instructions already issued to the Institutes their priority was to discover the munitions industry's labour requirements, to ascertain if the companies would take workers trained on courses at the Institutes and to enquire what should be included in the training syllabi. They were to make it plain to the employers and unions that workers of "superior education" from other skilled jobs and professions would be

trained and offered up for placement. These workers, at the end of the war, would return to their own work. They would not clog up the labour market or cause trouble for industrial relations and at this point they were talking about male workers. Labour Officers were also tasked with obtaining information from the Institutes and schools themselves.[31]

### **6.7. Finance for the Project**

While this information gathering was going on the question of finance was addressed and on 17 September the Ministry, virtually free of financial control, approached the Treasury asking that the following be sanctioned: The salaries of teachers at the Institutes be paid while undertaking this instructional work. The heating, lighting and cleaning costs of the Institutes be covered. The cost of damage to the premises and equipment would be paid if required. A financial allowance be made available and met for depreciation of plant. The cost of providing, re-setting or re-assembling plant for training purposes be met by the Ministry. The Treasury had a large amount of money, granted to it by Parliament, for use “in the manner best calculated to meet the emergency.[32] Therefore, the demands were agreed on 28 September. Funding for the project, at least, was in place.[31]

### **6.8. Reports On Work Already Undertaken**

It did not take long for Taylor’s Labour Officers to return their findings about the work already undertaken and the opinions of the industry. Courses, all run at the discretion of the head of each educational establishment, had sprung up all over the country; some had been very successful and their students had been placed in munitions factories. At these institutes the courses had been well planned and well taught. The

opinion of the employers had been sought and training was up to date. Other courses fared less well. Some classes had started and then been cancelled before completion. In some cases students had been trained but had not been placed. The reasons for failure were varied. Some courses were too academic; others were not in touch with the latest working practices and machines operated by the munitions factories. Some courses failed because the quality of teaching was poor. In some cases local employers were apathetic to the work of the Institutes or simply hostile to the whole project. In all cases there had been no difficulty in getting students. The biggest problem was getting work for the students once they had completed their courses and the biggest obstacle to this was in some of the factories themselves. In some places where workers had been placed, they left because of the hostile attitude of other workers, foremen and unions. The Ministry and the educational establishments recognised that if this attitude, with some justification they called it prejudice, could not be overcome then the training program would be fatally compromised with disastrous consequences for munitions production. When reticent employers were quizzed about their attitudes they said that they thought that the training provided would be inadequate and not much use to the potential employee. Training for one operation or one machine was not desirable. In many employers' opinions, a week's training on the job in the factory was worth a month on a training course. Interestingly others said that if they wanted operatives for simple, repetitive machine work they could obtain women from textile mills who were already well versed in running machines.<sup>38</sup> These were powerful and compelling arguments that had some validity. To add to the problems the National Advisory Council pointed out that the Institutes should also be taking students from

---

<sup>38</sup> Women from textile factories were indeed poached in some areas. It must be remembered that textile production also had its place in the war materials manufacturing effort. In some respects removing women from textiles could have had a negative effect upon war production.

non-skilled and non-professional backgrounds to increase the pool of workers. The Ministry pondered the training project.

### **6.9. Pushing on with the Project**

The educationalists were in no doubt. Faced with these attitudes and issues the educational authorities stuck to the principle of training. They firmly believed in its value to the national crisis. Despite opportunities offered by factories for volunteers to start straight away on the shop floor and learn there, some volunteers wanted a grounding in their new work before they plunged into factory life. Because of this the Technical Institutes and Schools said that they were the best entry point for the men and women who were volunteering to work in munitions. It was acknowledged by the Institutes and Schools that skilled men had to be the tutors and that because of their rarity they should be employed with the greatest of economy. The notion of training up non-skilled and non-professional students worried the educational establishments. They liked bright and adaptable students because (largely) they learned quickly, graduated on schedule, were less likely to produce scrap and damage expensive and valuable equipment.[31]

For the training program to run efficiently employer's concerns had to be addressed. It would take a clear thinker and energetic man like Herbert Schofield, the new head of Loughborough Technical Institute to come up with the solution. The training given and learned had to be of the highest quality and Schofield had already decided that the training given by the Institutes had to replicate that of learning on the job in the factory. There would also have to be close co-operation with the factories where the qualified students would go to work. In September 1915, when he was first

appointed,<sup>39</sup> Schofield's Institute had no useful space or machines to even attempt to train munition workers. At this point, Schofield's Institute was running its usual pre-war electrical, engineering and art appreciation courses. The only war work it was doing was clerical training for women so that they could fill the shoes of men who had joined the colours.[33] Things would change when the Ministry's memo on industrial training would land on Schofield's desk. The time when Schofield read the memo was one of those seminal moments in history that changes so much.

## **6.10. Leicestershire and Schofield**

Leicestershire was, early on in the war, one of the most progressively thinking counties, in terms of munitions manufacturing. This is possibly because, rather than being dominated by one or two main firms, the county had a number of small firms who were used to co-operation as a method of survival. As we have already seen, even before the existence of the Ministry and well ahead of the exposure of the shell crisis, a co-operative of manufacturers had been formed. In January 1915, while trying to find ways to improve the manufacturing output of munitions, the Leicester Association of Engineering Employers had been introduced to the French method of co-operative working. After consultations in February with the government and the War office, a Leicestershire co-operative of manufacturers was formed; the first of its kind in the country. It was spread out over a number of towns, including Loughborough, with the express intention of manufacturing munitions. Initially the War Office declared somewhat loftily and with a remarkable but predictable lack of foresight, to the L.A.E.E co-operative that it would only deal with existing munitions manufacturers.

---

<sup>39</sup> It appears that Schofield had the solution to the training of semi-skilled workers solved by the time that he arrived in Leicestershire. His previous employers in Kent would have nothing to do with his plans so his move may well have been motivated by finding a county that would listen to his ideas and give him the chance to roll them out.

The co-operative could go ahead if it wished but would have to operate without government or War Office help. The notions of going ahead alone, organising its own workforce and sourcing its own materials did not worry the co-operative and they went ahead regardless of government opinion. They believed that if the members of the co-operative were all ready to pool their workforce, premises, machines and skills they could succeed and estimated that they could turn out between 500 to 1,000 shells a week. Despite the initial disinterest the government soon became interested in the co-operative and by March the War Office had awarded a contract for 4.5-inch howitzer shells.[34]

Initially 54 firms made up the co-operative. Remaining in close contact with each other and centrally controlled by a committee made up of combined management staff, each member of the co-operative manufactured a part of the whole shell. They were connected by elaborate lines of communication, road, rail and telephone and the products passed from one to another, each adding their own component in the production line until at the end of the line the shell was complete. Their first order was complete by September 1915 and these were the first shells manufactured in Britain outside of the 'Trade'. By then the contract had already been doubled by the Ministry of Munitions and 18-pounder shells had been added to the product list. It was Cloud Based Manufacturing in the early 20<sup>th</sup> Century and it worked well. Co-operative working in the Cloud Based Manufacturing method was copied in other parts of the country. While some, like Leeds, took the logical next step to pool all of the members and resources under one roof the Leicestershire Co-operative did not do so. The co-operative system continued to be used in Leicestershire throughout the war, the members grew to 80 and output rose to 8,000 4.5-inch shells a week by the end of the war.[34]

Into this progressive, forward thinking industrial region that 33 year old Herbert Schofield was drawn. Perhaps the open minded and positive attitude of the Leicestershire manufacturers attracted him. The talented Yorkshire engineer and academic with skills and qualifications in optical engineering and aero-engine carburetion<sup>40</sup> had already turned down a job with Rolls-Royce, in an aero-engine research and development establishment in France.<sup>41</sup> Similarly, he had rejected a well-paid post at Repton School. He had his plan for dealing with the skills shortage and the shell crisis [39]. He had been invited to observe a training course in operation at Shoreditch Technical Institute<sup>42</sup> and had concluded that what he had seen was useless in terms of quickly providing semi-skilled workers. The women being trained were learning on inadequate equipment and being taught far too much theory that in Schofield's opinion they did not need and would not retain [33]. Initially he had been working in Kent but that county would have nothing to do with his plan. Wanting to serve his country but barred from military service on health grounds, Schofield needed somewhere fertile for his ideas to germinate. The job of Principal of the small and impoverished Loughborough Technical Institute in Leicestershire was a far cry from a post at an R and D establishment but it was what he wanted.<sup>43</sup> While professionally interested in aero-engines he felt it was his duty to help solve the immediate problem of the shell crisis. He got the job at Loughborough in September 1915 and, as they say, he "hit the ground running." [42]

His plan was "Training on Production." The factories approved of it and to this day, 'on the job training and experience' is much sought after in new workers. What was new was his for the application of the process. On appointment, Schofield

---

<sup>40</sup> Work in this field would later earn him his PhD.

<sup>41</sup> In some accounts this job was head of the establishment and in another it was a job at the establishment.

<sup>42</sup> Later Brunel University.

<sup>43</sup> It has been suggested that he had another, amorous reason for choosing Loughborough!

immediately offered the services of his ill equipped Institute to the Ministry. With no viable workshop and no machines, it would appear that this offer was not taken up. In the meantime, the Institute continued to run the evening classes and clerical training courses for women.

### **6.11. Scheme for training semi-skilled workers for munitions work at Technical Institutes.**

On 5 November 1915, the memo was circulated around the Technical Schools and Institutes.[31] Essentially the Schools and Institutes would indeed train up semi-skilled workers for munitions work. The successful courses and educational establishments had convinced the Ministry that this type of training was viable and would succeed. The main bulk of the training courses nationally would concentrate upon semi-skilled work unless Institutes were involved, as some already were, in the training of skilled workers such as gauge makers and tool setters. Although the work was to be co-ordinated and centrally controlled, the Ministry did not lay down a rigid set of regulations by which the educational establishments were to work. The differences between establishments and regions necessitated differentiation. Therefore a list of guidelines was set out that they were expected to follow.

1. No man of service age was to be taken on unless he was debarred.
2. Students were to be preferably men and women of superior intelligence who would return to their old jobs when the war ended.
3. Students who were willing to move to a different part of the country to train or work would be given priority places on courses.

4. Students joining a course would have to sign an undertaking to work full time in munitions work.
5. No one would be charged a fee because the courses were to be grant maintained.
6. Each student would have to satisfy the head of the training institute of their competency. Then they would be certificated.
7. The head had absolute power and could remove students if they failed to come up to expectations.
8. Weekly returns had to be kept in duplicate and submitted to the Ministry and Board of Education.
9. Inspections of all establishments would be undertaken periodically.
10. Applicants would be easy to find. Waiting lists would be necessary but prospective students who showed promise could be fast tracked into the system ahead of others.
11. Course length could depend upon local circumstances but no course would be sanctioned if less than 30 hours and more than 100 hours long. If courses ran in shifts then it would last for no more than a month. [31]

If the Institutes wanted to access the funds available for the training courses they had to adhere to the guidelines. Above all, there was one rule that had to be obeyed; all training had to be thoroughly practical. Two elements of the training, each dear to the hearts of the educational establishments and factories, had to be left out. There was no room for academic learning or bench work; both took too long. Small, local

committees were to be set up to advise the Institutes how to organise the training syllabi. Where female students were taken on assurances of their placement had to be gained before they began training. Heads of Institutes and their staff were encouraged to liaise closely with the factories to ensure that the best co-operation was possible. Their out of pocket expenses were guaranteed and the financial arrangements and benefits for the Institutes who involved themselves in this training, mentioned earlier, were laid out. [31] Schofield, knowing that University College Nottingham<sup>44</sup> was overflowing with student applicants to train as shell-turners, immediately saw that Loughborough Technical Institute could be part of this project and he saw the possibilities for his establishment.

### **6.12. Loughborough Technical Institute.**

Schofield admitted that his plan was not new; it had been around since the days of medieval apprenticeships and before [33]. What was new was the process and it was, in the main, what the factories required. Loughborough Technical Institute was going to train students to semi-skilled level while working on genuine production of shells. They would learn to turn shells in the manner prescribed by their future work place and on the type of machines that they would eventually use. The Institute would become to all intents and purposes a small factory whose final product would be trained munition workers. The small number of shells manufactured would be a useful by-product. It would seem that the notion of the “Instructional Factory”, and it was a title that Schofield always claimed as his own invention, had its genesis in Loughborough sometime between December 1915 and January 1916, not in September 1916 as claimed by the Ministry. [31]

---

<sup>44</sup> Now the University of Nottingham.

In December 1915, while second hand machinery was sought for the Institute's workshop, Schofield and his embryonic staff estimated that they would need thirty good engine lathes, Schofield managed forge the beginnings of a close relationship with the industry he sought to help [33]. During a visit on 20 December, [36] he was able to persuade Cammel Lairds at Lenton, Nottingham, who were typically very sceptical, to give him a contract for a small number of 18-pounder shell bodies. In return he offered to train and supply Cammel Lairds with 500 semi-skilled shell turners. This was the beginning of close contact between training establishment and factory. The students would be well trained and were guaranteed placements on completion of their courses. This was exactly the kind of integrated approach that the Ministry wanted and it worked. On 31 January, after a frantic month during which the staff created a workshop space and installed and repaired the second hand machines sourced from the local area, the first female students arrived and began training under the tutelage of Schofield and his small staff. They might not have been Hay's "First Hundred Thousand" but they were Loughborough's "First Thirty"[40].

### **6.13. The Training Courses**

To begin with, two courses, known as a double shift system, ran at the Institute. On the day course or shift, 30 students, were trained at a time. They undertook a two-week course that amounted to some 40 hours practical tuition about how to turn shell bodies on lathes. The evening/night shift, learning the same skills, was for groups of between 17 to 28 local women.<sup>45</sup> In line with the Ministry's advice there was a caveat to joining the course. The students had to undertake to go into munitions work on completion of their course. [31]

---

<sup>45</sup> The supply of local students was soon used up and the Institute began to take students from all over the country, Nottinghamshire in particular.

The courses were based upon Schofield's 'Training on Production' theory. He and his staff would have liked an educational element in the course but as he said himself after the conflict, the imperative of the war demanded that the training be intensive, practical and above all commercial [41].

Many students arrived with no industrial background at all. During 1916, to assist the training course, Schofield and his colleague J. F. Driver wrote and published a small handbook about shell turning [41]. It was intended that the students read the book and it was on conspicuous display in the canteen. Schofield and Driver said, "The great majority of these volunteers have not an elementary notion of engineering." [41]. The book is really 'turning for beginners' and seeing that no written evidence of the training curriculum appears to exist at Loughborough University this book, now reprinted, is the only surviving written documentation of the course. It is, in effect, the training course for semi-skilled shell-turners.

#### **6.14. The Syllabus**

The short course was divided into the following sections and the following is what the students did in their two-week course.

1. **Instruction about lathes.** The students were introduced to lathes and they were explained in general and simple terms. What they were for, what they did and how they worked. They were introduced to common terms and names, such as headstock, saddle and mandril, boring bar and adjustable dogs. In this phase of the course the students were introduced to three types of lathe and their uses. They were instructed from the simple to the complex; the engine lathe, the semi-automatic lathe and the automatic lathe. Students would come across these lathes in the course of their work on the

factory floor and as turners, they would be expected to be familiar with them and to use them as ordered. In the case of the latter, the students were informed that these lathes were intricate in design and required great skill to set up. By way of encouragement (or goading) they would be told that a mere boy, in a factory, once he had mastered this type of lathe could run several at once, on his own...

2. **Shell-turning.** Logically, because this is what the students were learning to do, this took up the bulk of the teaching time. It was the core of the syllabus. The students learned how to use their lathes, how to place the metal to be turned into the machine. They learned the processes of centering, boring and turning, facing and recessing. While there were other processes, it had been decided that for the semi-skilled turner these were considered enough to make them proficient. Students learned how vital cutting compound was and what it consisted of.
  
3. **General hints for good working practice.** Advice and instruction was given on care of the machines. In much the same way as a soldier was (and is) trained to look after their weapons and kit first and themselves second, the students were taught that care of the machine comes first. In this part of the course they were taught about lubrication, cleaning, what protective clothing to wear and they were warned about getting into bad habits with the machinery. Tools had to be checked to see if they were getting blunt and if so they needed to be sharpened. They were shown what to do if an emergency occurred such as immediately stopping the machine in the correct manner. Finally, they were taught to listen to their machines and if any sound out of the ordinary began then the machine had to be stopped

and the cause had to be swiftly tracked down. Considering the noise on the factory floor this skill was an important one to learn.<sup>46</sup>

4. **Instruction about cutting speeds.** The different speeds for cutting different types and quality of steel was explained in simple terms. If the book is indicative of the course then only a little time was spent on this subject.
5. **Instruction about cutting tools.** Similarly, only a small amount of time was given over to this. Different cutting tools and how to and how not to regrind them was taught as was the differences between High Carbon steel and Self Hardening steel.
6. **Engineering measurements.** The need for accuracy and the methods of measuring was taught but because of the repetitive nature of the student's work, they were made familiar with limit gauges.
7. **Measuring instruments.** The students were introduced to the different kind of measuring instruments that they would come across in the course of their work. Simple callipers, sliding callipers, different types of micrometer screw gauges, Internal gauges, and depth gauges.[41]

### **6.15. Success for Training**

The last elements of the course, from 03 to 07 appear to have been given only a small amount of time. This was because the students were training to be semi-skilled and with the exception of the General Hints section, the other sections would be

---

<sup>46</sup> In conversation with a mercantile marine engineer, he told the author that engineers on ships can recognise different sounds among a great cacophony of sound in the engine room. With practice and familiarity, the causes of strange sounds can be quickly detected.

considered skilled work for which an amount of theory and academic work for students would be involved. As has been seen there was no time for this kind of instruction and both Schofield and Driver understood the need for short cuts. It would seem that as the course progressed, the students were split into groups of six and while some were turning, others were put on boring and finishing. They rotated through the tasks [42]. The Ministry took note of the course run at Loughborough, very much approved of the programme and it was claimed that the Loughborough Technical Institute was much admired. In this way 400 women semi-skilled munitions workers were trained by the Loughborough Instructional Factory and absorbed by Cammell Laird's between the end of January and April 1916. Cammell Laird's were delighted with the quality of the workers that Loughborough produced and requested more. Based upon this success, as time and the war went on Loughborough, like other educational establishments, began to offer more and increasingly skilled courses in other fields of munitions production and aeronautical work.

#### **6.16. Optimism and Dissent in Government and Educationalists**

Almost immediately that the memo of November 1915 was read most Institutes requested machinery, equipment and staff, causing a problem. New and second-hand lathes were difficult to procure, milling machines and surface grinders impossible. Skilled tutors were just as hard to find. Nonetheless, by the end of February 1916, fifty-seven courses were up and running and 2,400 students were enrolled, mostly training to turn shell bodies. Optimistic predictions planned for 4,000 students 'graduating' a month. This turned out to be optimistic and problems placing trained students persisted in some areas. In some cases, it was because the factories were still being constructed and the workforce could not start. Some areas there was no munitions work. In others, lodging for newly arrived workers was expensive. The

Ministry noted that some employers remained prejudicial but recognised that the lack of semi-skilled workers was not the problem.[31] Skilled workers to train others, skilled workers to build, set up and repair plant and to make tools and gauges were still in short supply.

Some Institutes were capable of training skilled workers and were doing so but most were not because they lacked the right machines. Some in the Ministry doubted if the factories could train enough skilled workers in time but nonetheless they urged the factories to try. In the meantime, the educational establishments would train the semi-skilled [31]. Even before the Ministry memo was circulated in November 1915 there were those in government who thought that the project for using the training schools to provide new workers was pointless and would fail [31]. The factories, some said, would do a better job of training. It would seem that no one could agree.

## **6.17. Conclusion**

The Technical Institute's training courses were not a failure. By 31 August 1916, 22,500 students received their training certificates of proficiency and 18,000 were placed in work [31]. March 1916 was counted as the high water mark for training semi-skilled workers, a remarkably short space of time. After this, probably because they had proved their worth and convinced the Ministry (which was also growing in power) of their effectiveness, increasing numbers of skilled workers were being trained by the Institutes. During the months of June, July and August 59 % of the students graduating were women and a good number had been happy to move to another area to work. For example, the women taken from the fish-curing industry in Aberdeen who trained at Robert Gordon's College<sup>47</sup> and who transferred en-masse to the West

---

<sup>47</sup> Now Robert Gordon University, Aberdeen.

Midlands to work in the munitions industry[31]. Testimony came into the Ministry from all quarters praising the women trained by the Technical Institutes. As they fed into the workplace from the Institutes women began to prove their worth in engineering, even into the higher branches[31].

As time progressed they took more responsibility on the shop floor and some who had proved their abilities went on to train in skilled roles. Such was their impact and ability the Ministry encouraged their employment in the manufacture of shells and aircraft.[35] In fact, in manufacture of the latter, their employment was demanded. This was all music to the ears of the military, which constantly needed a supply of men for its ranks.

September 1916 saw an important change and an important departure; officially, the notion of the Instructional Factories was born. The Ministry acquired a number of factories and Institutes, Loughborough (expanding all of the time) being one, under powers conferred by DORA. Schofield, who remained in charge at Loughborough, was delighted and new courses were set up to teach skilled work. More money was sanctioned for more buildings, machines and staff and, because of the size of the new training facilities, more students could be trained. [31]

Being trained by quality staff on up-to-date machinery in a training factory, the qualified students were of high ability. Very soon, Loughborough Instructional Factory, with excellent communication with the government and the industry, was undertaking research and development on aero engines and was manufacturing high quality gauges and training students to make and use them. [31]. For Loughborough, the legacy of training students for munitions work during the Great War at the Loughborough Instructional Factory is Loughborough University.

By and large older people were found to be good enough to be semi-skilled workers but not generally good enough to be skilled workers. In contrast, the female members of the new workforce proved to be a rich vein of talent. Before the war ended women had entered higher and skilled levels of industry, becoming supervisors, tool setters and gauge makers. They tested, worked in the drawing offices and carried out scientific experiments in the laboratory [31]. The aircraft industry could not function without their skills.

In 1916, 1917 and on into 1918 the new workforce, however and wherever trained were entering the war material industries in high numbers. By 1917 shell production was at a high point and the British Army had just about all it could want to carry out operations.[14] More women were coming forward and entering the factories and the government was concerned about their welfare. The work force was increasing rapidly and they needed to be kept happy. Chances of industrial unrest could and did increase. This all had to be addressed and a new form of worker had to be found, trained at educational establishments and put into the factories. The Welfare Supervisor. In the meantime, the improved output, made possible by the increasing and trained workforce allowed stocks of shells and other war material to be stockpiled, even after the Somme Campaign. By April 1917 there was more than enough supplies and equipment for the British to launch well planned operations at Arras and Vimy Ridge. As a counter-point to Loos in 1915 the Battle of Arras is examined in the next chapter.

## **Chapter 7.**

### **Supply Logistics – The Battle of Arras**

#### **7.1. Introduction**

The level of munitions manufacturing in Britain had reached such a peak in 1916 and early 1917 that it enabled the High Command to launch the two Battles of Arras and assault Vimy ridge in spring 1917. There was war material aplenty. Plans for an Arras – Vimy offensive had been ‘germinating’ since October 1916 when a proposal had been put forward by General Joffre that the Somme battlefront be expanded. French forces would attack between the Oise and the Somme rivers, and the British between Bapaume and Vimy. Haig accepted the outline of the plan but no objectives were decided upon because everything depended upon British progress during the winter phase of the Somme Campaign and because Haig intended to capture Vimy Ridge.

The plans for the British offensive were redrawn and remodelled when General Nivelle took over command of the French forces on the Western Front from Joffre. All allied operations north of the Oise were to be but subsidiary to the great French offensive on the Aisne. The objective of the northern operations, the French attacking towards St. Quentin and the British Third Army from the Ancre River Valley to Arras to reduce the now considerable Bapaume Salient, was to attract and employ German reserves and draw them away from the main thrust upon the Aisne. This was Nivelle’s plan to defeat the enemy, provide a solution to the crisis and end the war. It was to be Nivelle’s Spring Offensive.

## **7.2. Shell Production Ramp-up 1916-1917**

From the dearth of shells in June 1915 operations by the Ministry of Munitions to improve production began to bear fruit. During the months between January 1916 to January 1917 shell production was pushed up to its climax. The peak for 18-pounder H.E ammunition was reckoned to be October 1916 and at this point demand began to diversify as the services requested differing types of shell for different roles [14]. By now certain, older, ammunition types were ceasing production as modern weapons were manufactured and made available to the forces. Notably the old 15-pounder field gun and the 5-inch howitzer were withdrawn and their ammunition was no longer manufactured. An important innovation during the autumn of 1916 was the introduction of the type 106 fuse. As home production increased American orders would be reduced but orders to Canada increased at least to the end of 1916.

One side issue of the period between January 1916 and January 1917 was the over-production of light ammunition, 18-pounder and 4.5-inch howitzer H.E shells, as opposed to heavy shells. Because of this there had to be a re-allocation of capability and capacity in the factories to satisfy demand for heavy shells. The increased demand for specialist shells required administering and caused manufacturing difficulties. Therefore, this year saw even greater centralised control of the National Shell and Projectile factories with two committees created to oversee the requirements.

With a new offensive looming later in the year<sup>48</sup> the over production of light shell was recognised in the spring of 1916 (March and April 1916). The recent French experience at Verdun had demonstrated to the British planners the value of heavy shells. Production of field gun ammunition did not seem as important as it had done in 1915. It was decided therefore to curtail this production to free up steel urgently

---

<sup>48</sup> This would become The Somme Campaign.

needed for the orders of heavier shells. The manufacture of light shells had to be decreased to increase the manufacture of heavy shells. Production of 18-pounder and 4.5-inch H.E shell was therefore reduced. American contracts for 18-pounder H.E were planned to be discontinued in July and August 1916 and some contracts for American heavy shells were to be terminated immediately. Some shops manufacturing 18-pounder shell would be re-equipped for the production of heavy shells and the first shops to be designated for the change were the smaller and co-operative ones who were the least economical and charged high prices for their production of 18-pounder H. E. ammunition.<sup>49</sup> It was hoped by the British that the discontinuation of some of the American heavy shell contracts would put some unwanted American machinery onto the market that the Ministry could then buy and import to equip the machine shops changing over to heavy shell. This would be a slow process, if the Americans did want to sell their heavy shell machinery it would have to be dismantled, transported to a port, shipped across the Atlantic, unloaded in Britain, transported to the machine shops and set up. Then the workforce would have to be trained on the new machines. Factories now had to cut production to 70,000 18-pounder shells a week. The order for 80,000 per week from Vickers and Beardmore was to be cancelled as soon as possible. Shrapnel shell was soon treated in the same manner.

It was soon decided that a national stock of six weeks supply of empty shell, ready for filling, should be maintained.<sup>50</sup> A July 1916 stock take of empty shell in transit and in store showed that there was only a little over two weeks of empty shell available. The decrease of light shell and increase of heavy shell production occupied the Shell Manufacture Department of the Ministry of Munitions from April through to

---

<sup>49</sup> National Shell factories that could not manufacture shells at an economical cost would be taken over by the Boards of Management.

<sup>50</sup> This is six weeks of shell available if manufacturing came to a halt.

September and was completed in October 1916. During this time the Shell Manufacture Department had realised that no more plant was to be obtained for starting the machine shops on new sizes of shell. Because, crucially, there was not enough labour available in the entire country to operate the existing machinery in all of the factories at full capacity. More machines would simply mean that more of the highly skilled machine tool makers would be occupied making machinery and not shells. The country had to have its factories producing shell economically and efficiently. The factories had to be operating at their best possible capacity with enough labour available to maintain day and night shifts. The Shell Manufacture Department was now faced with a problem. The plant and workforce of the factories taken off 18-pounder shell production were not suitable for heavy shell production. Some of these factories were turned over to the production of shell nose bushes for heavy shells, 60-pounder and 6-inch types.

In October 1916, almost immediately there another re-survey and re-allocation of production was proposed. Industry was again having to run to catch up with the events on the battlefield. Scarcely had the factories taken off 18-pounder shell production got used to their new work than the Somme Campaign made itself felt and the demand for 18-pounder ammunition by the army rose dramatically. This new demand for 18-pounder rounds surpassed all previous demands during the war so far and showed that the Ministry could not predict demand as accurately as it had supposed. Demand for heavy shells, 60-pounder, 6-inch, 8-inch and 9.2-inch also increased while the demand for 12-inch and 15-inch ammunition showed a reduction. The Ministry realised that weekly output of the National Projectile Factory Group should be raised from 150,000 shells to 190,000 and in the case of the factories producing heavy shells spare capacity could be found for production because of the reduction in demand for 12 and 15-inch

shells. Inevitably, the Army was not behaving as the Ministry had expected it to do so. But then nor were some of the shells.

In early 1915 the Army had cried out for H.E but the 18-pounder H.E rounds produced and sent out to the Army in the winter of 1915/16 had been disappointing. Presumably, they did not always explode and when they did, they did not do the damage that was expected. Therefore, in spring 1916, the Army changed its tune and asked for an increase in the supply of 18-pounder Shrapnel rounds. By now there were between ten and fifteen million 18-pounder H.E shells available so the Ministry asked G.H.Q to issue more H.E to the non-offensive parts of the line and urged the soldiers to accept smaller amounts of Shrapnel.

The October 1916 programme of shell production showed dividends by January 1917 and new orders placed in Canada and America boosted output of the heavy shells required. In January 1917 the Americans had orders to produce 200,000 eight-inch shells by March and the Canadians 20,000 a week by March. These contracts would help to meet a home production requirement of 80,000 per week. It was similar in the case of 9.2-inch rounds. The October 1916 programme required 63,000 per week but British home production could only manage 21,646 per week. This rose to 33,000 by June 1917 and 43,000 afterwards. Prior to June, to make up the home production deficit, 20,000 shells per week by March 1917 were ordered from Canada and a batch of 200,000 to be delivered before March 1917 were ordered from America. Demand for 6-inch rounds was very high and 295,000 per week were asked for in October 1916. By December home output was at 90,860 per week and the estimated output from the existing factory capacity was to be 141,000 a week going up to 145,000 by March 1917. While the factories were ordered to increase their output the Canadians were asked to provide 100,000 per week to make up the shortfall. Production of 60-pounder H.E and

Shrapnel was not a problem and more than enough were produced to meet the weekly requirements of 63,000 of each type a week. Because the manufacturers of 60-pounder ammunition had spare capacity they were asked to use this capacity for the production of 6-inch rounds and the Ministry footed the bill for the conversion of their machine tools and equipment to make 6-inch shells [14].

The October 1916 programme, instigated by the Somme Campaign, had set in train immense production. By January 1917 shell production had been ramped up to a very high point. An average of 2 million shells a week were being turned out for the Army and full capacity had not yet been reached. But shell production had now outstripped the production and repair of artillery pieces. Because there was some spare capacity in factories set up for shell production some were asked to undertake gun repair rather than shell production. By the time that the Battle of Arras began the British Army had more shells than it needed.

### **7.3. Supply Issues**

January 1917 saw a long freeze that caused severe problems for communications and supply. The inland waterways froze over and the hard frosts and ice damaged the already deteriorating roads. In an attempt to preserve them the French and Belgian Governments were forced to order restrictions on their use. These freezing temperatures came at the time when preparations were getting underway for the offensive. Two single-track lines served Arras and for the offensive this railway service had to be improved. Therefore, work began to double the lines [43].

During the early preparation for the planned offensive British rail requirements were estimated to be 191 trains per day travelling from the ports to the British zone. This number was assumed to rise after Zero hour of the attack. These figures were supplied

to the French Director of Railways who agreed that the number of trains could be run, providing the British completed their doubling work on the lines into Arras and that the British provided all of the locomotives<sup>51</sup> required to haul the trains.

All of this appeared to be doubtful in late January because the railways were severely congested and the progress of preparation was hampered. Haig wrote to Nivelle on 24 January informing his French opposite number that British imports stood at 150,000 tons per week and stood to rise to 250,000 per week. These imports were stacking up in and around the ports because they were not being moved and distributed. If they were not cleared and provision made for better movement of the supplies then his operation at Arras and against Vimy Ridge would have to be revised. Haig suggested that they meet. Nivelle's response was to agree to the meeting but he said that he could not see why the supply situation would affect the British offensive. At that time Nivelle had not seen Haig's plans for attack; when he did he did not like them at all.

The meeting went ahead in Calais and agreements were made concerning transport of supplies, despite Geddes' concern that French railway problems would not be solved quickly. During the meeting the French pointed out that the British had the use of more rolling stock than they themselves did. This was true because at this time the British were better supplied, fed, housed and clothed than the French soldiers.<sup>52</sup> The British countered by saying that the French could and did requisition whatever they wanted and whenever they wanted, even in the British zone. Ultimately, the British had their way and the French agreed to handle the increasing British traffic. Nivelle needed the British operation.

---

<sup>51</sup> And presumably crews.

<sup>52</sup> An ominous sign for the near future, 1917 was the year that the French Army mutinied over their treatment, conditions, mounting casualties and lack of decent supplies and kit, among other things.

#### 7.4. Plans

When the Germans quietly withdrew from the Somme battlefield to their new, previously prepared positions, the Bapaume Salient ceased to exist and the plans had to be altered once more. Third Army, under General Sir Edmund Allenby, was affected somewhat by this development. Support for their operations had been required from Fifth Army but now that army having advanced was suffering from miles of ruined lines of communication and its ability to support the Third was severely restricted. Nor were the French being helpful. For some reason, and Edmonds does not say why, their planned operation towards St. Quentin had been dropped from the general scheme; instead, they would make a minor attack upon the Hindenburg Line south of St. Quentin. It would not be enough to apply enough pressure to attract enemy reserves. The distance as the crow flies from the right of the Third Army to French forces on the Aisne was sixty miles and the forces in this sixty-mile line were not strong enough to bring enough pressure on the enemy line at any point to attract and engage the German reserves as planned. Third Army's operations now took on more importance; their assault *had* to draw in the German reserves.

Orders were issued for the British armies. Fourth Army would press up to the Hindenburg Line and take the German outposts there. Fifth Army would attack the Hindenburg Line at Quéant to support the Third Army at Arras and bring up heavy and siege guns also in order to support the Third. Third Army (orders once more modified by Nivelle) would take the enemy line running from Arras to St Quentin, taking it from the flank and rear; once this objective was secure, the Third would then move towards Cambrai, the latter being Nivelle's own modification. First Army would take Vimy Ridge; provide cover for the Third's left flank and with the capture of Vimy

Ridge gain observation over the Douai plain.<sup>53</sup> A separate corps was available to the First to exploit success towards Douai, to reinforce the Third or for the Second Army for purely defensive operations.

## **7.5. Build up to the Battle**

In the build-up to the opening of what became known as the first phase, the Battle of the Scarpe, a great deal of work was done to improve the lines of communication. Roads to the front were in a poor state of repair, damaged by constant over use and very bad winter weather. It was an almost unequal task and 'indifferent' communications continually plagued the British. Contrarily ammunition supply and food supply was not a problem according to Edmonds who then went on to say that food supply varied by division. Ammunition, both field gun and small arms was brought forward by pack animal. A sensible expedient where roads and track ways had either ceased to exist or had never existed. In addition, the gunners claimed to have more than enough shells for each battery and begged for supply to cease. Conversely, the roads continued to deteriorate and there was not enough material for repairs supplied. Supply priority was always given to ammunition [43].

### **7.5.1. Assembled Artillery at Arras and Ammunition**

#### **Allotments**

These figures represented one gun per twelve yards of front and did not include the horse artillery of the cavalry divisions.

---

<sup>53</sup> The view over the plain from Vimy Ridge and of the industrial sites therein is quite extraordinary.

18-pounders	858
4.5-inch howitzers	276
60-pounders	144
6-inch howitzers	220
6-inch guns	24
8-inch howitzers	84
9.2-inch howitzers	92
9.2-inch guns	2
12-inch howitzers	13
12-inch guns	2
15-inch howitzers	5
<b>Total</b>	<b>1,720</b>

*Table 7.1. Artillery assembled for Arras [43]*

All of these guns had ample ammunition; perhaps too much. The permitted rate of ammunition expenditure for the first two days of the bombardment was as follows:

2-inch trench mortar:	120 rounds per mortar per day (not in the night time shoot)
9.45-inch trench mortar:	50 rounds per mortar per day. (not in the night time shoot)
18-Pounders:	300 rounds per gun per 24 hours
4.5-inch howitzers:	300 rounds per howitzer per 24 hours
60-Pounders:	100 rounds per gun per 24 hours
6-inch howitzers:	200 rounds per howitzer per 24 hours
6-inch guns:	100 rounds per gun per 24 hours
8 & 9.2-inch howitzers:	140 rounds per howitzer per 24 hours
12-inch howitzers:	100 rounds per howitzer per 24 hours
15-inch howitzers:	60 rounds per howitzer per 24 hours

*Table 7.2. Permitted rate of ammunition expenditure for the first 2 days of bombardment – Arras [43]*

A major problem for the gunners was labour and storage. So much ammunition had been delivered prior to the preliminary bombardment that there were storage problems and the artillerymen were actually exhausted after unloading so much ammunition. Geddes himself, when he toured the area was asked by the gunners not to send any more shells! Such a difference from the Battle of Loos nineteen months earlier when there was not enough of anything. The preliminary bombardment beginning at 6.30 am on 4 April, which had a range of targets and objectives, was due to last four days. In the event it lasted for five days because of a request for a delay by the French and the

weather conditions which had rapidly deteriorated. “Weather very bad, driving snow settling in deep drifts. Ice cold conditions.”[44].

## **7.6. Forward Planning**

The requirements for the offensive were quite staggering and what was even more remarkable was that nearly everything that was wanted was available. Such had been the phenomenal increase in manufacturing capability in Great Britain. The main problem now would not be a lack of materials such as had occurred at the Battle of Loos but the sheer weight of materials available. The contingencies for the supply of the battle had been planned for in great detail. The planners of the Battle of Arras knew quite well that wheeled transport, motor lorries and horse drawn wagons, would be unable to get close to the fighting battalions once the battle began. Weather conditions, the state of the roads, congestion and enemy action would dictate this. While roads would be available to a certain point, wheeled supply to the front line would be impossible.<sup>54</sup> The experience of the 17<sup>th</sup> (Northern) Division leading up to the opening of the offensive and into the first phase is worth examining [44][45].

## **7.7. The 17th (Northern) Division and the Build up**

The weather had been severe since winter had begun, it had brought the Somme Campaign to an end, and successive freezes, thaws, snowstorms and rainstorms had done nothing to improve the road surfaces. In April the weather deteriorated rapidly as arctic conditions swept across northern Europe and covered the Western Front in a blanket of deep snow. Also, the roads were in constant use by vehicles of all types, it was difficult if not impossible for the engineers, pioneers and their reluctant

---

<sup>54</sup> Lorries were expensive to run. In February 1917, 27 lorries had helped to move the 17<sup>th</sup> Division from one army to another. Between them these vehicles covered 3,000 miles and used 1,000 gallons of petrol. This equates to 111 miles each and fuel consumption of 9 mpg.

infantrymen labourers to effectively repair the surfaces to a good, robust standard. Rough, running repairs were the best that could be done.

Congestion would also be a factor because a good number of units would need to move to and from the fighting and dumps would have to be supplied. The cavalry were present and were expected to take a leading role in the action, the 17<sup>th</sup> Division was to be its infantry support, the horsemen would need the roads so that they could move quickly to exploit any gap made by the fighting battalions at the front. The enemy also knew very well where the roads were and would have them 'zeroed' by their guns. Crowded, arterial routes would be a favourite target for the gunners.

### **7.8. Equipment required for the Troops and Supply**

The infantry were to carry two days iron rations, two sandbags, extra S.A.A and extra grenades. Battalion limbers would carry extra supplies. They would also carry their rifle, bayonet, entrenching tool, full water bottle, waterproof sheet, 170 rounds of S.A.A, two bombs, one ground flare and 3 sandbags. Others carried an extra pick or shovel, wire cutters, a roll of wire or pickets. On their heads they wore a steel helmet. They would also carry a three days oat ration for the pack mules and horses.

The cavalry were to carry three days rations and 212 rounds of S.A.A each. The horses carried extra machine gun ammunition and even more was carried on the pack mules. The infantry would dump rations, stores and oats at forward positions as they travelled forward. In effect, the fighting troops were to be virtually self-sufficient for two to three days, obviating the need for immediate re-supply.

## 7.9. Supply on Foot and Hoof

Supply would be required and pack animals, mules were to carry out this task. Where wheels could not go, hooves and feet could. The 17<sup>th</sup> Division QMG amassed 175 pack saddles and 220 mules for the purpose. They were divided into three subsections of 58 animals, each section commanded by an artillery officer and supported by 32 infantrymen. This meant that 46 animals were resting and available in reserve. The subsections were to remain under divisional command but could be called upon for supply by the brigades if required. It was believed that this system would be capable of supplying the battalions at the front and supply any increased demand for ammunition. As far as rations went each mule could carry forty rations in 10 sandbags. Earlier on in the year there had been worries about the animals in the division. In January they had been on  $\frac{3}{4}$  of their oats rations and even when in rest had not improved their condition. Heavy demand by the artillery for moving guns and ammunition had also caused a large number of animal casualties. The condition and health of the horses and mules would cause concern because healthy animals were vital for the smooth operation of the supply chain. At the same time there had been a general lack of vegetables for the men to eat and this had caused concern about the men's health.

### **Table of stores and equipment typically carried by the pack mules in the division in April/May 1917.**

Each point represents one animal's load.

1. Two boxes of S.A.A. 2,000 rounds.
2. Six boxes of Mills Grenades, No. 5. 72 bombs.
3. Four boxes of Stokes Mortar Shells. 12 rounds.
4. Four boxes of Hales Rifle Grenades. 80 bombs.
5. Two boxes of revolver ammunitions. 3,950 rounds.
6. Two boxes of 1 inch Very lights. 300 rounds.
7. Two boxes of 1 ½ inch Very lights. 144 rounds.
8. Four boxes of flares. 400 rounds.

9. Four boxes of 'P' Smoke bombs. 48 rounds.
10. Ten picks and twenty shovels.
11. Eight, two gallon petrol tins of water. 16 gallons, a battalion ration.
12. Four bags of rations in 10s. 40 rations.
13. Two Stokes Guns (mortars).
14. Two Tripods. Therefore two mules carry two complete Stokes Guns.
15. Two mortars for smoke shells.
16. Two tripods for the smoke mortars.
17. Six base plates for the smoke mortars. Therefore seven mules can carry six complete smoke mortars.
18. Four boxes of smoke shell ammunition.

*Table 7.3. Stores and equipment typically carried by the pack mules in the division in April/May 1917 [45]*

The quality of boots being delivered to the division was also a cause for concern. These were of poor quality in comparison with previous issues and they were arriving without hobnails and it was not always possible for the divisional cobblers to provide the hobnails. For a foot slogging infantry unit, poor boots could spell numerous problems; feet were very important. Higher echelons of command saw trench foot as an indicator of morale and 'push' or lack of it. Yet in the supply chain feet represented the last method of delivery of commodities. Mules could get to a certain point but men had to unload them and then carry the commodities into the sharp end, to the front line trench or to a shell hole. Consequently there had been strenuous efforts during the winter to prevent trench foot and a program of "foot friction fatigues"<sup>55</sup> had been instituted by the divisional ADMS<sup>56</sup> Lieutenant-Colonel Barrow. These worked remarkably well according to the AAQMG<sup>57</sup>, Lieutenant-Colonel Nicholson, and out of a nominal figure of 12,000 plus men in the division only 184 came down with trench foot during the winter. Barrow's remedy was considered far superior to whale oil and any other creams that had been prescribed. Fresh food was also part of the equation, hence the worry about fresh vegetables for the men during the winter of 1916/1917.

---

<sup>55</sup> Men were paired off and had to vigorously rub each other's feet. Avoiding this fatigue apparently brought severe punishment.

<sup>56</sup> Assistant Director Medical Services.

<sup>57</sup> Assistant Adjutant and Quartermaster General.

Pack mule transport was supplemented by the railway, this under the control of the Light Railway Battalion, and pontoons floating on the River Scarpe. The Inland Water Transport (R.E) could not repair damaged locks on the canal at Blangny and Athies but they operated pontoons above and below the locks. Lieutenant-Colonel Nicholson said that the Inland Water Transport unit could not be *induced* to repair the locks [45]. In fairness to the IWT they probably refused to undertake the work because it was a major engineering task that would have to be carried out under enemy observation and fire. It would be an easy way to lose valuable engineers and equipment. The railway and watercourses carried supplies up to the line and the very badly wounded away.

The 17<sup>th</sup> Division's main operational job was to take over and consolidate positions initially held by the cavalry, therefore tools and materials would also be needed alongside ammunition and rations. The system of supply of tools continued thus: Echelon C based in the rear would have spare tools and G.S. (General Service) Wagons would operate forward from there. It was assumed that any tools requested from Echelon C would take 48 hours to arrive in the fighting line. In fact, as with ammunition and ration supply, expected congestion on the roads would actually make the arrival of said tools and materials doubtful. Once again, supply of anything to the fighting troops during the operational phase of the battle was considered difficult to the point of nearly impossible.

Pontoon Wagons would also be available at Echelon C but were primarily for the transportation of wire and pickets. Each Pontoon Wagon would be ready loaded with 280 yards of single apron fence and 150 yards of double apron fence. Echelon A had Wagons and Ammunition Wagons. Echelon B operated G.S. Wagons.

*On 10 April, Echelon A remained with the Battalion under the command of the Battalion Transport Officer, Echelon B and C remained behind waiting for orders.*

[46]

Where roads were operational they were subject to strict traffic control and were under the eye of the Lancers. Infantry co-operation with the cavalry was vital and it was estimated that once the operation was underway and the 17<sup>th</sup> Division was moving the head of the divisional column would be 2 ½ hours behind that of the Cavalry column. Moving infantry columns could pass the Echelon A of the cavalry, the L Wagons, but could only pass the ammunition section of the cavalry Echelon A on the road in case of great emergency. If there was no emergency then the infantry would have to remain behind the ammunition wagons and therefore travel at their speed. Transport away from the rear positions was deemed to be excellent. Tactical trains and road convoys were to run regularly and punctually. They were to unload their cargoes and convey units to the rest areas in the rear.

### **7.10. The Battle**

On Easter Sunday, 9 April 1917, the first Battle of Arras<sup>58</sup> was launched on a ten-mile front by the Third Army. In this area of around thirteen square miles there were concentrated some 350,000 men. This area shrank as the reserves closed up during the first day of operations. Three corps, VII on the right, VI in the centre and XVII on the left, attacked with elements of twelve divisions near the City of Arras. They were supported by XVIII corps, two cavalry divisions and the 17<sup>th</sup> (Northern) Division. The latter three formations were tasked with exploiting gaps made in the German line to attack deep into enemy territory. A huge and well supplied artillery force, tanks, gas

---

<sup>58</sup> Called either the First Phase or the Battle of The Scarpe.

and aerial units supported the attack. It was “the most formidable” offensive launched by the British in the war to that date [43]. The British First Army attacked Vimy Ridge on the left of the Third Army with two Canadian divisions. Both attacks had a combined number of fourteen divisions, the same number that attacked on the first day of the Somme Campaign. The vital difference was that the attacking troops at Arras and Vimy were covered by a far more powerful artillery force and had far more supplies and munitions available for the operations.

On the first day, the British had mixed fortunes but by and large they were successful in their endeavours. By the evening of the following day, the British had gained most of their first objectives, a good deal of ground and for relatively few casualties. Those tanks that had not broken down, got stuck or were knocked out gave invaluable service to the infantry, attacking trenches, redoubts and crushing wire. It was not the same for the arm that they would eventually replace. The cavalry had not been needed and were not employed in their intended role, they and their infantry support, the 17<sup>th</sup> (Northern) Division remained where they were in and around Arras; men and horses waiting for orders that never came. Despite the British gains, there had not been the desired cavalry breakthrough.

Infantry fighting carried on along the line with the assault on Vimy Ridge on going and an Australian and British operation at Bullecourt. The first phase of the Battle of Arras, came to a halt on 14 April, not held by enemy action but by the need for cover, supply and rest. The snow was deep and continuing to fall, supply lines were deteriorating rapidly and the guns, munitions, rations and supplies had to catch up with the advanced line. New gun positions had to be constructed, forward medical facilities, headquarters and dumps had to be established, lines of communications had to be repaired or laid. It was no easy task to mend the roads with heavy traffic going in both directions. In

effect, the siege had moved and the siege train had to catch up. Everything had to move before the attack could recommence.

Although great gains were made, the gains of the first two days were not repeated and despite the efforts of the troops the battle stagnated into attrition trench warfare. The battle was officially 'closed down' on 27 May 1917 but fighting still continued in the Arras Sector. The Battle of Arras, the biggest British offensive to date simply petered out.

### **7.11. Conclusion**

Arras had been very well planned and in the opening stages very well executed. Three things had come together to make this battle happen. Firstly, and in the eyes of the military, most importantly, the British army was, after the harsh lessons of the Somme Campaign, a well-trained and professional fighting force. Secondly new weapons and new ways of using weapons had been learned and that data had been fed back to manufacturers back in Britain. Thirdly, and most importantly, the army had the munitions and equipment to do the job. Perhaps, as has been noted, too much! Having such an "embarrassment of riches" allowed the planners to be detailed in their plans and lavish in their use of materials. The October 1916 Shell Manufacturing Programme had ensured that by January 1917 two million shells, both shrapnel and high explosive and of all standard calibres were being produced by British factories weekly. And full manufacturing capacity had not been reached. By March 1917, a month before the Arras battle began, the Ministry realised that there were not enough guns to fire all of the shells being produced. Therefore, such was the spare capacity built into the manufacturing system factories were taken of shell production and converted to the manufacture and repair of artillery pieces.

The conclusion is that the Battle of Arras was made possible by the manufacturing effort that had been put in motion in 1915. It was fought with resources that Sir John French and his staff at Loos could have barely dreamed of. No amount of combat training on the Somme could make up for the fact that there was more than enough of all types of war material to prosecute the war in 1917. It could be argued that the battle became bogged down because of the amount of ammunition and equipment available but that argument is rendered impotent by the experience of earlier battles such as Loos which was lost partially through a lack of munitions and equipment. Arras proved that the British effort to mobilise manufacturing and the great potential in the workforce was going to pay dividends as the war progressed. It did not mean that victory was assured in 1917 but the tools for victory were being made available in increasingly large numbers. Despite the fact that Arras was not a glittering victory and was a battle that bogged down into the usual trench warfare it was a signpost to the future. The protagonist who held out the longest, wore down the opposition, sustained the greatest manufacturing effort, husbanded raw materials well or sought new, viable materials and bought those products of the manufacturing effort to bear on the enemy would win. Starkly, it was a manufacturing valediction of Sir Douglas Haig's doctrine of the war. 01/ The manoeuvre for position. 02/ The first clash of battle. 03/ The wearing-out fight of varying duration. 04/ The eventual decisive blow.

For the great output to be sustained the workers needed to be well treated. If fatigue, injury and disgruntled strike action all of which could damage manufacturing output as surely as a shell hitting a munitions factory were to be avoided. Of course there were injuries and of course there were strikes and working long shifts did fatigue the workforce. Their welfare needed looking after. The unions were concerned that welfare was just another method of increasing production, which it was really but the

excuse that the Ministry and the government used was women. There were thousands of them in the factories and they needed to be looked after. Since 1916 a new industrial role had come into existence. Worker welfare, the need for and the work of the Welfare Supervisors is illustrated in the following chapter.

## **Chapter 8.**

### **Worker Welfare**

#### **8.1. Introduction**

Quite simply wartime munitions production set the clock back as far as hours of work, regulation of wages and the liberty of the workforce was concerned. In 1915 comparisons were drawn between the Munitions of War Act of 1915 and the Statute of Artificers of 1563. Yet Mr Lloyd George, in 1916, prophesied “that the making of weapons of destruction should afford the occasion to humanise industry.”[47] He went on to say “effort now being made to soften asperities, to secure the welfare of the workers, and to build a bridge of sympathy and understanding between employer and employed, will have left behind results of permanent and enduring value to the workers, the nation, and to mankind.”[47] How much Welfare work was a reflex action to the war or industrial unrest or both is a good question. The Department of Welfare’s work in the factories was outstanding and the contribution made to the standardisation of principles and practice across the manufacturing industry was enormous [47].

The workforce were and are a company’s first and best resource. Without them, nothing will be manufactured. Improvement in working practice and the working environment increases productivity through a happy, healthy and well looked after workforce. Output was increased by the innovations brought in for female workers because these innovations were rolled out to the whole workforce, men and children. Increased munitions production that was required after the shell scandal of 1915 could not have been achieved without the co-operation of the workforce. It is worth,

therefore, examining the innovations brought in for women and the role of the Welfare Supervisor within the factories.

The arrival of a female workforce (women and girls) had the effect of altering work conditions for the whole workforce. Not that the presence of women in the workforce was a novelty, working class women had been in the factories since the early days of the industrial revolution. The only people who seemed surprised that women were in the workforce were the press. The differences were their increasing numbers and the type of women coming into the factories; better educated, middle class women were finding their way onto the factory floor. They expected more, were articulate, were aware of their abilities, understood their importance to the war effort and they could be as militant as the men.<sup>59</sup> For some women it was the liberation and independence that they had desired for so long.

## **8.2. Ministry of Munitions action on Welfare**

In January, 1916, with the rise of female labour, the Home Office looked into the welfare conditions of the munitions factories on behalf of the Ministry of Munitions. This work was invaluable and supplied a cross section of information during what was a year of changes. Some 1,396 factories employing 200,000 women and girls between them were divided by the Home Office inspectors into three classes. Class 'A', 31% of the factories nationwide, Class 'B', 49% of the factories and Class 'C', 20% of the factories [47]. Class 'A' was deemed to be satisfactory as far as welfare provision was concerned. 'B' and 'C', either partially or completely, lacked mess rooms, areas for cooking food, cloakrooms, washing facilities, seats and women and girls were supervised by men. Some of the factories in the 'B' and 'C' Categories, like all factories

---

<sup>59</sup> Before the war Emily Pankhurst and the Suffragettes had taught the establishment not to ignore women. Indeed, Emily Pankhurst was at this point actively involved in the war effort.

operating twelve hour shifts, were an extremely long distance away from some of the workers homes meaning that the workers had a long journey to work before they started work and an equally long journey home before they could rest. After this initial round of inspections follow up visits were subsequently arranged to make improvements in these factories by Welfare Officers employed directly by the Welfare Section of the Ministry of Munitions. By 1917 and 1918 the Welfare Officers were stationed in eight areas of the country each with between 400 and 500 factories in their care and supervision [47].

During the course of the war improvements were made for the female work force. However, the innovations of canteens, first aid, ambulance rooms, factory nurses, rest rooms, wash rooms, changing rooms, soap, running hot water, drinking water, warm food, decent breaks, protective clothing, transport to and from work and crèches all had to be co-ordinated and supervised.

The creation of the factory Welfare Supervisor was probably the most important innovation of all. Without her in the workplace none of the list of work place improvements could have succeeded. The role was the classic Ministry of Munitions remedy that seems to crop up again and again. Things worked better if there was someone present to oversee the situation and make those ‘things’ happen. The care of the human material of the factories had to be placed on an administrative level [47].

### **8.3. Innovations for the Female Workforce**

Despite the effectiveness of the post the appointment of the Welfare Supervisor was not universally taken up. Initially, unlike so many other initiatives in war-material production, her role was recommended but was not law (the Department, the Welfare Section, *did* press hard to get firms to make an appointment) and many factories made

excuses for not taking on a Welfare Supervisor [47]. In T.N.T factories it was compulsory to employ a Welfare Supervisor and it soon became practically compulsory in National Factories. Data gleaned from the end of the war and into 1919 shows that this was a false economy and short sighted, men soon benefitted from the improvements made for their female colleagues.<sup>60</sup> Where Welfare Supervisors were set on productivity increased and the workforce in general, both men and women, were happier, healthier and less militant. In most cases, where a Welfare Supervisor was set on, the Department received calls from Firms saying how the tone in the factory had changed and describing the advantages of the Supervisor [47].

The Welfare Supervisors soon became part of the 'setting on' system, working with the manager and surgeon in the selection process of new employees. Their role extended to vetting worker's lodgings, dealing with worker's transport issues, handling and getting sick pay, helping sick workers and to monitoring attendance by having access to time keeping records and wages books. Often they also acted as the un-official 'morale' officer and arranged dances and concerts at lunch time. The survival of the role and system after the war best demonstrated the effectiveness of the Welfare Supervisor. Information from 1919 shows that of 733 controlled factories (out of a national total of 5,603) which sent in returns to the Ministry of Munitions, 249 were permanently retaining their Welfare Supervisors and 42 were keeping theirs until the women were discharged (or sacked). The finest post war example of the success of the Welfare Supervisor role was seen in factories in London where the possibility of promoting these women to become factory managers was discussed.<sup>61</sup>

---

<sup>60</sup> The male workforce had large numbers of boys, old men and wounded soldiers in its ranks who would benefit from the innovations introduced for initially for the women.

<sup>61</sup> Unfortunately, if they were set on as factory managers it was not recorded.

#### **8.4. Welfare Supervisors**

When in early 1916, the Department, or Welfare Section, began to press firms to take on Welfare Supervisors it was not at all easy to find suitable candidates for this role and, not surprisingly, at first appointments were made of ‘unqualified’ candidates. Often qualifications in teaching, social and administration work were enough to secure the post for the first wave of Welfare Supervisors and these qualifications remained desirable for access for the academic and practical course that the Department set up. In March 1916, the Department distributed, received and processed applications for the post centrally. This was to take the burden away from the employers and to set a centralised standard qualification for the post. Courses were set up and the length of the course varied from three to twelve months depending upon the needs and qualifications of the student. The courses, run at most of the national universities, were based around a curriculum that contained industrial law and history, economic theory, and industrial hygiene. Students were also given the opportunity to experience the practical side of the problems of working class life and factories conditions. In 1918 it was demanded that the training should also include knowledge of trades union aims and methods. As time went on the role of Welfare Supervisor, with its different grades and own hierarchy, supported by university study and accreditation, practically became a brand new profession for women [47].

#### **8.5. Development of Welfare Supervisors**

Welfare Supervisors varied as widely as the interpretation of the term ‘welfare’. In the first year of the Welfare Section the Welfare supervisors met with a good deal of misunderstanding. Initially their work was ill-defined and appointments were often made under departmental pressure. Existing managers, foremen and forewomen mistrusted another and new supervisory role that might impinge upon their authority.

In some cases men were not happy to defer to a woman and a woman unused to factory life. Workers themselves were suspicious at first, seeing the Welfare Supervisor as another 'gaffer'. In most cases difficulties and opposition vanished in practice and time. A Welfare Supervisor depended upon her own ability and in the position assigned to her by the factory management to succeed or fail. Where her role was ill-defined there were problems; where it was well understood and supported it worked. Fortunately in most munitions factories, especially the national ones, her role was very well defined and supported [47].

In some instances, in the early days, a nurse or two would be set on and that was deemed enough. In small concerns Welfare Supervisors were often promoted charge hands who added to their technical and production tasks the jobs of looking after the first aid kit and keeping an eye on the messroom. At the other end of the scale, in major factories they were the "Lady Superintendent". She was very much part of the hierarchy and embedded in the factory set up. Reporting to the directors and the general manager she was recognised as the authority on all welfare matters, she also had staff that reported directly to her [47]. The most famous of these Superintendents was Lilian Barker, known as "Lady Barker" or "Good old Lil" but who had to endure a good deal of opposition from the men and women when she first started at Woolwich Arsenal. In some cases the Welfare Supervisors were initially considered to be management spies and protagonists of class warfare. It was true that in most cases the Welfare Supervisor was an upper or middle class 'lady' but only because educated women were needed for the role. Upper and middle class ladies tended to be educated [48].

## 8.6. Good old Lil'

Ironically, Lilian Barker was neither of these. Her father had been a butler to the Bishop of Salisbury but by the time Lilian was born the family lived in poverty in Kentish Town. She apprenticed as a florist and then became a teacher. She gained a reputation for successfully working with slum children abandoned by the school system. By 1914 she had a reputation for being a miracle worker who, through her powerful personality and dislike of convention sought to expand the knowledge and experiences of her slum girls. She was not a suffragette, she was not a socialist, she loathed injustice and sought to transform the lot of the human casualties of British industrial power. Lilian Barker, like many of her colleagues, endured graffiti chalked on walls, mistrust and insolence from her girls on the shop floor. There was only one way for the likes of Lilian and that was forward. Taking unpopularity as their lot the Welfare Supervisors persevered in much the same way that officers were expected to do at the front. They pushed themselves hard and worked longer hours than their charges. They also looked after their charges, in Lilian's case 'like a benevolent hawk' [48]. They took their charge's side and fought their corner. They organised clubs, concerts, saw to it that the girls could bring their boyfriends to the 'dos', organised effective childcare, raised money for trips to the seaside for the workforce and to open convalescent homes for injured and broken workers. Lilian defended the rights of pregnant Arsenal girls. If they were to be sacked for being pregnant she said, then so too should the father; if he was also an Arsenal employee. This was leading the workforce by example and it worked.

## **8.7. Welfare Duties**

Initial Welfare Supervision was first described by the Health of Munition Workers' Committee in December 1915. It was further embellished in 1916. The Supervisor's general duties are laid out in Volume V of the History of the Ministry of Munitions:

1. The selection and rejection of candidates for employment, or the preliminary sifting of such applicants before passing them on to the foreman or forewoman for engagement on technical grounds.
2. The supervision of the women's accommodation, including canteens, messrooms, cloakrooms, etc., and the engagement of their staffs.
3. The general supervision of the discipline of the women, either personally or through forewomen or cloakroom matrons, on day shift or night shift.
4. The supply and upkeep of protective clothing.
5. The investigation of workers' complaints.
6. Inquiry into absenteeism and bad time-keeping.
7. Inquiry before dismissal of a worker.
8. Care for the workers' health, especially in regard to ventilation, lighting, heating and cleanliness of the shops, the lifting of heavy weights, and the effects of long hours of work.
9. The supervision of first aid treatment by the factory nurses, if there was no factory doctor, and the administration of first aid treatment if there was no nurse [47].

While all of the above were aimed at women and girls all of these duties, with perhaps the exclusion of point 3, would benefit the men and boys. The men were often older and therefore past their prime or wounded soldiers no longer fit for the front line and the boys many of whom would not be fully developed so points 8 and 9 would also be very pertinent to them.

In 1916 the Ministry of Munitions attempted to change the Welfare Supervisor's job title to "Employment Superintendent" or "Establishment Officer". This because the word "welfare" carried with it connotations that were not always palatable to the workforce, to some, it was tainted with 'Philanthropy' and 'Patronage'. The title, however, remained the same.

In 1917 with a year's worth of experience and data the role of the Welfare Supervisor was even further defined in this Ministry of Munitions circular.

*The duty of a welfare supervisor is to obtain and maintain a healthy staff of workers, and to help in maintaining satisfactory conditions of work. She should, it stated, on these grounds undertake the selection of the staff (with reference, if possible, to the certifying surgeon or panel doctor), the supervision of working conditions, of the canteen (probably in consultation with the trained manager in charge), of the ambulance, rest room and first aid apparatus, of cloakrooms and the supply of overalls. She should, finally, be in touch with "the relation of health to efficiency" by access to the wages books and the time office, and by keeping records of ambulance cases and accidents [47].*

Even so in many factories and facilities the role of the Welfare Supervisor had an element of the un-defined. She could spend a great deal of her working time dealing with complaints and working with the trade union secretary endeavouring to remove friction from the workplace. By involving herself in workers' illnesses she entered the

nebulous realm of 'human relationships' that the university course could not equip her for. After the Welfare Supervisor had addressed the "obvious and immediate needs" of the workforce some firms picked out specific welfare areas that they wished to be attended to.[47] This was logical. In some factories where dangerous work was undertaken worker's health would be highlighted, in others the social aspect of working and leisure life could be at the fore, in others it was the emphasis could be placed upon the taking on of the right staff. In the latter she was expected to be business like in her dealings with the women in her care and to try to reduce changes in personnel. Reasons for absenteeism and poor time keeping were investigated and addressed by her.[47] The range of the Welfare Supervisor's duties was elastic.

### **8.8. Welfare Innovations for the entire Workforce**

Whereas the welfare of women, girls and boys covers pages of text the issue of male welfare is dealt with in two paragraphs. Incredibly, there was no effort to cater for the welfare of men in the workforce. Any complaints about accommodation made by men were addressed to and by the Welfare Section. Almost unbelievably the author of Part III, Volume V states that "formal complaints were, however, seldom made, either by individuals or by labour organisations.[47]. Any that were made referred to "details" about canteen management or heating. The latter caused a series of small strikes during the fuel shortage of 1917-18. These issues were dealt with by the Committee for Production and other 'courts' but by and large the issues of difficult and unhealthy conditions were dealt with by offering the men higher wages rather than improving things physically or practically [47].

"No definite demand appeared to exist among workmen during the war for a general improvement of working conditions."[47]. No, because they had no need to ask.

Working conditions were being improved for them by default. The work being carried out by the female Welfare Supervisors for the female workforce was improving the lot of the men. Could it be that the male workforce, management and the author of Part III, Volume V, could not admit that the feminine improvements were helping the men? Or was it just that men were expected to be stoical? In a hangover of Victorian and Edwardian (which they were) values and notions? Almost airily the author of Part III, Volume V, says that it was *probably* expected that welfare for boys would have an effect on welfare for men [47]. In truth, it seems that he did not know.

### **8.9. Male Welfare**

There were male Welfare Supervisors but according to Part III they were not in the same league as their female counterparts. While the female Supervisors were expected to be business like with their women the male Supervisors were expected to be chummy with the men. If a recreation club was set up he was expected to run it. He was expected to be the secretary of the Men's Committee or Works Council [47]. He was meant to be in there, working and socialising with the lads. He does not seem to have had the many and elastic duties of the female Welfare Supervisor. Could it be that men were not deemed to have the need for "human relationships" that were experienced by the women? Grudgingly, the author of Part III does admit that the male workforce in munitions factories enjoyed the advantages of messrooms and first aid originally introduced for the women. Is that all? Innovations such as the messrooms and first aid had to be shared and so too did others. It would be impossible to have entirely women only benefits. The men, militant as they were, would have staged industrial action if they thought that women were getting a fairer deal than them surely?

## 8.10. Trades Unions

One area that benefited the whole workforce was the inevitable involvement of the unions. Unions initially feared the welfare reforms, considering them a form of separatism that emphasised the firm's relationship with single workers rather than a collective whole. It weakened the work that trades union officials were doing with the women said the unions. Nevertheless Welfare Supervisors had to help and train a shifting population of young and often irresponsible workers who had no notion of collective factory work. The Welfare Supervisors often managed to inculcate their young charges with the kind of collective esprit de corps which in turn created a sound platform for strong trade unionism [47]. In truth there was little friction between the Welfare Supervisors and the Unions because their tasks were at once related and distinct. The care and wellbeing of the workforce was at the core of both remits. Therefore, the unions were strengthened and the entire workforce benefited.

The quasi-official Welfare Supervisor concerned the unions; the post was another layer of management control. In April 1918 a memorandum about "Welfare Supervision" for all sections of the workforce by the Woolwich Trades and Labour Council. Any system of Welfare Supervision must, it concluded, gain the support of the workers and must not interfere with the functions of the trades unions. Crucially the memorandum also said; "Welfare supervision must aim primarily at promoting the welfare of workers and not increasing the workers' output." [47]. It was just what Welfare Supervision *was* doing. The demand was made that Welfare Supervisor training should also include a working knowledge of trades union aims and methods and if welfare was to continue for all after the war then control of the work should move to the Ministry of Labour. As a permanent part of the industrial system industrial centres should hold conferences overseen by the unions or the Labour Party to consider welfare provision, aims, scope

and methods within that area. Welfare, originally introduced by the government and mainly for women was now firmly a permanent part of industrial life and in the hands of the workforce.

### **8.11. Medical, Housing, Canteens and Messrooms**

Medical improvements benefited the whole workforce. The duties of the works doctors changed through Welfare innovations. Working under specialists at a headquarters they greatly reduced the dangers of working with dangerous substances and in dangerous environments. Their workplace based research led to studies in the physiological effects of fatigue, the effects of good and poor ventilation and many other conditions experienced in the work place. This research and the results and recommendations of which benefited the whole workforce demonstrated how much more work there was to be done in the sphere of industrial health and hygiene. A link was made between good and bad timekeeping and good and bad health and hygiene [47]. The Welfare policy promoting health and comfort in the workplace entered the realm of the psychological. Discipline on the factory floor was vital to the national crisis. It was recognised that Labour management on one side and personal discipline on the other was, during the war, a matter of national and not local importance [47]. Not that strikes and industrial unrest were completely avoided, they were not but perhaps there were fewer strikes and there was less unrest than might have been without the Welfare reforms.

Many firms learned that the labour force actually needed handling with a certain amount of care. Even though, in certain circumstances, the role of the Welfare Supervisor was perhaps indeterminate and even by the armistice there was a tendency to try and separate the managerial from the social, its significance could not be

diminished. It was recognition that labour had human needs [47]. Welfare work demonstrated that the application of scientific methods of labour management were viable [47].

A comprehensive housing policy saw the building of 11,738 houses and flats for workers along with the provision of hostel places for 23,500 workers. Canteens and messrooms were supplied by the Department and their running costs of £2,000,000 were written off. The workers could get decent food when at work [47].

### **8.12. Towards the end of the War and after**

By 1919 the Ministry of Labour suggested these subjects for consideration by Works Committees in conjunction with the Joint Industrial Councils. “The distribution of working hours; breaks in spells of work, and systems of time-recording; the provision of meals, drinking water, safety appliances, heating and sanitation; discipline and conduct in the works, the engagement of labour, the training of young workers; entertainment and sports, etc.”[47]. They show that workers conditions had attained a much higher standard than had ever been achieved before the war began. These are the sum of the work of the Ministry of Munitions’ Welfare Supervisor of the Great War.

The elimination of local pay differences and standardisation of wages provision for women was of profound benefit to the national workforce [47]. Standardisation of working practice had also taken effect and if it seemed transitory for the war period this was not the case. When the women and girls were sacked as men returned to re-take their jobs or when the munitions factories closed down, the women and girls, if they could, returned to smaller companies or service they took with them the notions and principles of welfare at work. They and their new workplaces benefited from their

considerable experience and expertise. It was the same for men, no longer required in the munitions factories. They too took the notions and principles with them into other workplaces ensuring a certain civilisation of industry as a whole. Both men and women took with them into new workplaces notions and experience of esprit de corps and common action for common good which had indirect social benefits for society as a whole [47].

Focusing on the duty of the Welfare Supervisor to push forward the reforms and innovations was an innovation in itself. It stimulated the creation of special, professional training for a new branch of factory management. This was so successful it continued after the war had ended and the special requirements of the Munitions Factories had ceased to be important and the curriculum remained in place and continued to be taught in the places of learning where the courses had been offered [47].

The Munitions Welfare Movement was significant. Welfare work provided a level of comfort in National Factories and government establishments far above that laid down by the Factory and Workshops Act. Allotments, canteens, rest rooms, ambulance rooms, sports days and sundry comforts provided by Welfare work and overseen by Welfare Supervisors benefited women, girls, men and boys by the end of hostilities [47].

### **8.13. Conclusions**

The question is, if women in the workforce were not a novelty, then why did the reforms/innovations come about? And what were they for? Was there a notion that Victorian/Edwardian values should be upheld and ladies be treated with honour and chivalry? Or was it because the establishment knew that productivity needed to be maintained at a high rate and the good will and service of the women was desperately

needed for this? If they did not treat them well then productivity would suffer, there would be strikes and Britain could lose the war.

It was believed by the establishment that while fundamental differences between the workforce and management could not be addressed (in this early part of the twentieth century), strikes and disputes could be prevented and defused by discipline on the shop floor and tactful management. It was known that tact was the first requisite of welfare management, it could be said that it was, and is, a primary form of management [47].

Of course welfare at work, overseen by the Welfare Supervisor was, along with philanthropic aims, there to improve productivity of the workforce. An unhealthy, unhappy, over tired and over worked labour force was not a productive one. Shell production continued to improve and increase after the scandal of 1915 and the setting up of the Ministry of Munitions. Standardised shells were manufactured and sent along the supply chain from factory to the front line in increasing numbers. The guns on the Western Front<sup>62</sup> were fed for the Somme, Arras, Cambria, Passchendaele, to defend during the German 1918 Spring Offensive and The 100 Days as well as the usual, daily, barrages and bombardments that trench warfare demanded. There were no more shortages and by March – April 1917 the gunners in the Arras sector were begging the ordnance troops to send no more shells to the dumps and gun line; they had nowhere to store them. Manufacturing and supply were both working very well indeed and that could not be achieved without the co-operation of the workers.

Once the crisis of 1915/16 was over the pressure was somewhat removed and the lid was lifted on factory life and the lines of work and social laws were blurred. Requirements for a connection between social and work life were recognised and acted upon. It was a demonstration of state socialism where cocoa and milk drinks and the

---

<sup>62</sup> Not to mention operations in other theatres of war throughout the world.

value of suet pudding, the price of boxing gloves and hockey sticks, children's swings, the right type of cap and overalls, the right soap, enough space to wash in at the sink, the advantage of a crèche, the tackling of overcrowded trains, trams, buses and ferries and decent accommodation all had their place in the improvement and humanisation of the workplace and workforce [47]. The job was to fulfil the Ministry of Munitions remit. "To organise the skilled labour of the country for the production of the munitions of war." [11]. To make sure that the production of shells was effective, optimised and achieving monthly government targets to provide the required munitions to kill as many enemy combatants as possible. In the last year of the war they had just about achieved that aim, the British and their allies were going to face the storm of German offensives and they were going to lose a great deal of men, equipment and munitions. Yet in a short space of time, the British and the Allies were going to go on the offensive themselves and they had enough war material and munitions to do it. The next chapter examines and charts the situation in 1918 up to the Armistice in November of that year.

## **Chapter 9.**

### **The Situation in 1918. To the Armistice**

#### **9.1. Introduction**

The year 1918 has been called the “Year of Victory” and what a remarkable victory it was. It had come about despite a series of enemy offensives in Europe that inflicted thousands of casualties, consumed a large amount of stores and supplies and took allied positions. Victory came against a backdrop of rising casualty lists and it came about despite industrial unrest at home. The workforce, after the huge efforts of 1916 and 1917 were exhausted, suffering food and fuel shortages, high prices and the loss of loved ones in the fighting. They would strike over anything now. It was perhaps fortunate for the army in France and Flanders that their efforts had manufactured so much in the previous two years.

#### **9.2. The Workforce and Unrest**

In early 1917 the workforce was showing signs of overstrain and that continued into 1918 [30]. In 1916 holidays had been curtailed to ensure maximum output and the Ministry realised that proper summer holidays had to be re-instated in 1917 and 1918. Travel restrictions, concerning civilian travel, imposed upon the railway companies would have to be lifted. In early 1917 ticket prices were raised for the first time during the war but that had little effect because civilian take home pay was standing at 106% higher than in 1914 [49]. Passenger services were cut back even more and speed limits were introduced for these services. No specials were put on for Easter, Whitsun or August Bank in 1917 but the crowds had turned up at the stations to catch trains anyway. The public did not take the restrictions lying down, they complained and they

carried on travelling. Demand remained high and the companies simply added more coaches to the slower, restricted services. But were the railways really trying to get rid of their customers? After all large sections of the civilian population had more money to spend than they had ever had. In an attempt to cope with passenger demand some tickets were interchangeable allowing the public to use alternative routes. Not all dining facilities were withdrawn, the Midland, the South Western and the Pullman Company continued with some of these services [50]. Trying to stop railways carrying fare-paying passengers was impossible, it is what they did for a living. Restricted and poor railway services added to the anger and frustration already felt about high food and fuel prices.

In the summer and autumn months of 1917 it was also beginning to dawn upon the Ministry that they would have to impose a limitation on work hours if exhaustion in the workforce and unrest was to be avoided. However, no experiments in reduced hours were undertaken until November 1918, by when it was an academic exercise. Overcrowded workforce housing had become an issue and the government wanted “energetic” action on this issue. A major factor that caused unrest in the workforce was the food shortage. The Government had attempted to divert trouble caused by a lack of food by fixing prices and trying to make sure that principle food stuffs were distributed fairly. It did not work and in November there was a strike in Coventry, only over a weekend, about unequal food distribution and sky high food prices. Such strikes were threatened on a two weekly basis until the grievances were addressed. Further strikes were threatened and occurred over pay bonuses to skilled workers. Semi-skilled and un-skilled workers wanted bonuses as well. Rising wages for the semi and unskilled caused unrest among some of the skilled workers. Quite remarkably, despite the unrest and exhaustion manufacturing continued to turn out the shells and other war materials. When disaster loomed in France as the Germans launched the Spring Offensive, some

workers who had been on the verge of striking called off their industrial action and worked to replace the ammunition being lost.

### **9.3. The Embargo Strike of 1918 potential catalyst or damp squib?**

In 1918 there were localised strikes and numerous disputes all over the country. The worst of which and the one that worried the government the most was the Embargo Strike.

By 1917, the Ministry had been aware that for some time certain companies had been attracting and employing a disproportionate number of skilled workers, this in turn had been hampering the manufacture of munitions in other parts of the country. The embargo scheme was drawn up in an attempt to ration and control skilled workers and rather than be rolled out for all factories it would be used for specific companies. Firms were told that skilled men should not be taken on to replace semi or unskilled men or women. The firms were then warned that if they did so then all recruitment by those firms would be taken over by the Ministry.

A strike in January 1918 by skilled workers at a London aircraft factory led the government to enforce the embargo on that company when it was discovered that they had a high number of skilled men. The embargo was then placed upon Daimler at Coventry and North British Locomotive Company at Glasgow in April 1918. A dozen more embargos were placed between May and June and then between 25 June and 10 July 70 more embargos were in place. This was a dramatic leap in numbers over a short 16 day period.

In June 1918, when it was clear that the situation at the front was no longer critical, made a public announcement about an embargo that would be placed on the

recruitment and movement of skilled workers. It was an ill-advised move. The Trades Union Advisory Committee had warned the Winston Churchill and his Ministry that the workforce would be prepared to put up with “drastic measures during a crisis” such as the German Spring Offensive, but they would not be well disposed to those measures during a time of allied success [30]. The Ministry did not listen, it said that the restriction was placed upon employers, not employees but the workforce thought that it amounted to the same.

On 1 July 1918, the day that Chilwell Shell Filling Factory blew up, embargo letters were sent to three more Coventry firms. Hotchkiss, Siddeley Deasy Motor Company and Triumph Cycle Company. Hotchkiss accordingly issued instructions about recruiting new workers to their foremen that because of its wording was apparently misunderstood.<sup>1</sup> News that recruitment preference would be given to semi and unskilled workers and the only skilled men that Hotchkiss could employ were discharged servicemen went ‘viral’ across Coventry. Skilled men in Coventry were already disgruntled about the fact that some dilutees were earning at a similar money to them. At the same time the news was spread at Hotchkiss, at Siddeley Deasy a number of recently engaged, skilled men had arrived for work but because of the embargo it was uncertain if they could be given work. There was a long delay of many hours before it was confirmed that they could work. This ill-treatment of skilled men simply added fuel to the fire of discontent.

On Friday 12 July the local engineering unions met and were addressed by a man from the Ministry hastily despatched to try to avert trouble. He signally failed in his task and the union officials were unimpressed. At the end of the meeting they passed a

---

<sup>1</sup> The instructions did not mention that skilled workers could be recruited if a special licence was sought from the Ministry.

resolution. If the embargo was not removed by the Ministry by noon on Monday 15 July, all skilled men would give a week's notice to quit.

The Ministry refused to withdraw the embargo so the skilled workers of Coventry handed in their notice on 16 July. Negotiations with the Ministry followed. The Ministry line was explained and the delegates were told that their members were lucky to be working at home instead of being in the trenches [30]. By now there were 100 Ministry embargos in place across the country. Dissatisfied with the Ministry's attempts to broker a deal 10,000 men went on strike in Coventry on 23 July. The very next day 12,000 men in Birmingham joined them. There was unrest in Manchester and strike action was threatened in London, Sheffield, Lincoln, Plymouth, Southampton, Leeds and Barrow. In Leicester, men did go out on strike but went back to work after a few hours. The strikers repeated their demand that the embargo be removed but at this point the Prime Minister, Mr Lloyd George stepped in to assist the beleaguered Churchill. There was concern in the government that in some cases the strikers were ignoring union officials and shop stewards. Bluntly, Lloyd George told the strikers that if they did not go back to work they would be conscripted into the army [30]. The strikers voted to stay out but the unions over-ruled them and ordered that they should return to work. On 29 July they did so but in certain areas resentment was strong and skilled men refused to instruct or set up machines for newly appointed semi and unskilled workers.

The strike had shaken the government and had threatened to spread throughout the land but by July 1918 there were 4,964,000 people [30] engaged in government war work out of a working population of 13,015,000 [30]. Plenty of them were semi-skilled and unskilled workers but many were newly trained skilled workers some of whom were women. They were not the skilled workers steeped in tradition of the past but the

new products of the training courses brought about by the war. In the end the question is did it matter that 22,000 went on strike when there were 4,942,000 still on direct war work? Probably not, and despite threats of strike action in other industrial areas they simply remained just that, threats. The dilutees had certainly watered down certain elements of working life. Lloyd George was possibly safe to threaten the skilled men with conscription because despite the shortage of skilled workers industry just might have been able to do without them. Perhaps the strikers knew it. Production continued.

#### **9.4. Shell Manufacture, Conventional and Chemical, 1917-1918**

Variation in demand for shell in 1917 and 1918 caused constant trouble for the manufacturers in the last two years of the war as did a shortage of materials, particularly steel, brass and copper. Gun ammunition production in 1917 managed to exceed that of 1916 and in this year more shells were fired than in the previous campaigns of the war. January, February and March 1917 saw an increase in the manufacture of High Explosive munitions as opposed to Shrapnel rounds. By March 1917 shell production had outstripped the manufacture of artillery pieces and the heavy shell programme had to be reduced and some of the munitions factories turned over to gun repair or the production of 18-pounder and 4.5-inch shell. Eighteen-pounder and 4.5-inch production continued as normal so as to feed the army's expensive barrage system. What happened next was a steel shortage because of the demand for new guns. There was not enough steel available to supply all of the projectile factories and in 1917 some, national and private, had to convert to work such as aircraft manufacture, gun production or other war work [14]. On 24 May 1917 a new programme was ordered for 1918 and then revised in July 1917.

When the Passchendaele battle was at its height the supply of High Explosives became a vital matter. The factories were put back onto maximum manufacturing output. In October 1917 demand for High Explosive rose again as more trench mortar bombs (to be fired by the increasing number of Trench Mortar units), hand grenades (the most popular infantry weapon), and aerial bombs, (to be dropped from the increasing number of aircraft) were demanded along with the usual orders for artillery rounds. At Passchendaele 3,200,000 shells a week were fired. This remained the high water mark until October 1918, during the 100 Days Campaign, when 3,500,000 shells were fired on the Western Front in one week [20]. December 1917 was said to be the high water mark for British home shell production of all types during the Great War. By the end of 1917 weekly home production of shells of all types stood at 1,500,000.

The amount of heavy shell fired increased as the war went on.<sup>2</sup> These were measured not in rounds but in weight. During the Somme Campaign, the weekly average was 25,394 tons fired. In 1917 the average weekly weight fired into the German lines was 43,300 tons. The open warfare of the 100 Days saw the opening big bombardment for an attack cease as a tactic but this did not have the effect of reducing consumption of ammunition. The heavy guns retained their allotment of shells and they continued to operate. There was a reduction in heavy howitzer shells and a rise in demand for smoke and chemical shells. Counter-battery became the British artillery's main job of work at this time. In September 1918, the peak of 86,000 tons of heavy shells fired was reached and from here it diminished. Only because the planners assumed that the war was going to run into 1919/20 and that there would be a return to trench warfare. Therefore, stocks had to be husbanded because resources back in Britain were

---

<sup>2</sup> All the while there was the deadly competition with the German artillery for range. Meaning that guns had to be constantly modified and adapted and patterns of shell had to change.

dwindling. It had been anticipated that the heavy guns could have an allotment of 57,000 tons a week for 1919 but this was revised down to 50,000 tons [20].

One remarkable fact about shell manufacturing in 1918, apart from how it continued despite industrial unrest, was spare manufacturing capacity of High Explosive Shells. Because the war was expected to go on for at least another two years these factories specialising in the production of High Explosive were converted and turned over to the manufacture of poison gas. The war was over by the time that these factories had begun bulk production. Had the war gone into 1919/20 as predicted, because of the spare capacity in the manufacturing system and the ability to convert to a different type of production, the British would have been capable of producing large amounts of poison gas [14]. Until 1918 chemical shells were not manufactured for the 18-Pounder, 6-inch gun, 8-inch gun or 9.2-inch howitzer. From 1916 on they were produced for the 4.7-inch gun, the 4.5-inch howitzer, the 60-pounder and from 1917 for the 6-inch howitzer. In February 1918 chemical shell production in Britain stood at 29,000 per week and that rose to 57,000 per week by September 1918. By the end of the year 4,724,500 chemical shells of all calibres had been produced [14]. In May 1918 another revised programme for conventional shells was begun and another started on 23 September, it was the final shell manufacturing program of the war [14].

From the beginning of the war to the end of 1918, 258,442,000 shells of all types had been produced for the British Army. Of which 63.1 % or 163,076,902 shells had been manufactured in Britain alone [14]. Production aims for 1919 was the introduction of a new 18-pounder field gun, a significant increase in the stock of chemical shells, the manufacture of more aircraft, more tanks and more railway material of all types [20].

## 9.5. German Spring Offensive 1918

The BEF had all that it could want in terms of arms, supplies and ammunition in early 1918 but it did not have the personnel it required. British strength on the Western Front had decreased by 25% since the closing of the Battle of Passchendaele in late 1917 [51]. In 1916, the Somme had seen 415,000 casualties. Some 250,000 British and Commonwealth troops had become casualties at Passchendaele and these were losses on top of the 139,867 casualties at Arras and 70,264 casualties at Cambrai [52]. It must also be remembered that losses were occurring all of the time, between the campaigns and battles. German strength had increased by 30% in the period November 1917 to March 1918 because troops were arriving from the Eastern Front and from Italy [51]. Reduced in numbers by these losses the BEF was stretched further by the loss of five divisions, which were sent to Italy in 1917. It was stretched again in January 1918 when the British had to take over twenty-five more miles of the front line. Lloyd George<sup>3</sup> made certain that in January 1918 38,225 officers and 607,403 fighting men were stationed in Britain and not sent to France [52]. In 1917, the Americans had come into the war but they were slow arriving on the Western Front. The shipping crisis affected this, as did training on and the supply of Allied weapons and equipment. Determined to use artillery of their own manufacture a decision was taken to arm the American field artillery with French 75mm guns, while they waited for their own to arrive.<sup>4</sup> In the meantime, the line had to be held by war weary Belgian, French and British divisions supported by a small number of American units in training and a few Portuguese divisions. The Americans would place further burdens on the British and French supply chain in France until their own system was up and running properly. Even by

---

<sup>3</sup> Even as the Prime Minister Lloyd George was seeking to take more men from munitions manufacturing for the army, horrified by the losses on the Western Front, he was determined to thwart Haig's offensive operations by not giving him the re-enforcements that he asked for.

<sup>4</sup> This was instead of issuing them with British 18-pounders of which there was a ready supply with a plentiful amount of ammunition. Their armament industry also had experience of making 18-Pounder ammunition. Their own artillery arrived in time to fire a victory salute on 11 November 1918.

the end of the war, Major-General Forbes said that the American system was inefficient.

The Germans were aware of the Allied situation. They knew that the Americans were coming but that they were delayed. Having numerical superiority in the early months of 1918, they decided to strike hard against the British and French and knock them out of the war before the Americans arrived in force. The Allies expected an attack by the Germans in 1918, they just did not know where [17]. German Storm Troopers and machine gunners, under cover of thick mist, followed a heavy bombardment and deeply penetrated Fifth Army defences. Gough's Fifth Army disintegrated and ceased to be a cohesive command. On the left Byng's Third Army fought doggedly on and held but by the end of the day it became obvious that it was in a salient. Third Army had to comply with Fifth Army's retreat and retire in an attempt to straighten the line [17].

The German Offensive slowed. Another, smaller, German Offensive named Georgette<sup>5</sup> began on 28 March near Arras but it was repulsed. In early April the German Michael Offensive came to a halt short of the important strategic rail centre at Amiens [17]. Famously, it was recorded that the German troops had been halted by the vast array of British supplies. A German staff officer, Rudolf Binding, attempting to ascertain why the troops had halted in the Albert area when there was no serious enemy activity, discovered the immediate reason. Binding said that he found men in Albert, drinking wine, looting and writing home on good paper; in fact doing nothing martial at all. Such luxuries, good alcohol, polish and decent writing paper had been missing from their lives for so long that, hungry, tired and thirsty, they simply stopped [53]. Ernst Junger [54] and Paul Hub [55] both recalled the same. As they advanced the

---

<sup>5</sup> Originally, it had been named St. George but a shortage of troops apparently forced the renaming.

sight of so many stores and supplies of different kinds that included luxuries must have had a morale sapping effect of the weary German soldiers.

With German forces halted near Amiens and near Arras, they launched another big attack on the British line along a sixty-mile front from the north of Arras up towards the coast. After a few days fighting the line bent but did not break but this situation was very worrying to the Allies. The coastal ports, so long defended by the Ypres Salient, were threatened. If German forces successfully captured them, it would be a severe blow to Allies. Now, the British had their backs to the coast and there could not be any further retirement. Attack after attack went in against this bent line as the German forces tried to push through to the coast. British units were swapped around and moved from place to place, French reinforcements were sent into the line and Hazebrouck, another strategic town was threatened but the line held [17].

Some 4,000 machine guns were lost during the German Spring Offensive. From 20 March to 30 April 1918 some 1,621 British artillery pieces had been lost [17]. Artillery ammunition that could not be issued or saved was, in the main, rendered unusable or fell into German hands. Some 100,000 tons of war materiel was lost, amounting to a value of £2,000,000 [17]. The loss of war materiel during the Spring Offensive “though immense, was quickly made good.”[17]. There were gun repair factories at Criel and Fressenville, there were huge stacks of ammunition at Saigenville, Rouxmesnil and Blargies. During the Spring Offensive the Germans came within twenty-eight miles of the latter and British batteries were able to draw ammunition from that dump directly.

Divisions that were withdrawn from the fighting during April were sent to Abbeville where they could be refitted with everything that they required. From uniforms to guns and ammunition. The materiel losses were made good by the efforts of factory workers in Britain. Some munition workers had been on the verge of strike action before it was

obvious that their services were required. They gave up their Easter break in order to work to manufacture the required replacement equipment and ammunition [17]. At this time “The only limit to the rate at which materiel was sent to France was the rate at which it could be absorbed.” By mid-April the losses were on the way to being made good. Large stocks of stores, supplies and weapons were available to the British at Calais, Harve and Paris. While lines of communication were threatened and strained during the Spring Offensive, they were never broken and the flow of supplies could continue to beleaguered units.

German supply lines had reached limit and now stretched out across devastated battle zones and the roads were clogged with units coming up, units going back, artillery and ambulances, supply wagons and the rest. There had to be a pause while the German Army sorted out their lines of communication and brought up the big guns. Once they had done this, they could renew the assault but this time without the element of surprise. Further German attacks went in near Rheims and Compiègne to threaten Paris. The attack carried on against the line defending the channel ports. Paris was indeed threatened and British divisions were loaned to the French from the weakened British part of the front line. In July a brilliant French counter-attack pushed the German forces back from the Marne and the end had come to the German offensives. They had run out of time and more importantly, they had run dangerously low on resources and supplies. In contrast, the British were by now well supplied and amply replenished with weapons and ammunition. It was now the turn of the Allies to go onto the offensive.

## **9.6. The 100 Days to the End**

French forces had been successfully attacking since 18 July and on 8 August, the Battle of Amiens began. The British Fourth Army went on the offensive on the edge of the old Somme battlefield in what was a surprise attack that caught the German Army unawares. General Rawlinson, who had commanded the Fourth Army on the Somme in 1916, now had 2,000 guns, 800 aircraft, 500 tanks and three Corps of infantry and cavalry with which to attack the enemy. The Fourth Army attacked at 4.20 am and the French First Army attacked 45 minutes later into the thick mist that gave the attackers good cover. The German defenders were caught completely by surprise and off guard. By the end of the day, in this sector, the Germans had lost 27,000 men, killed, wounded or captured and had been pushed back up to eight miles from their front line positions gained by the Spring Offensive. It was as Ludendorff famously said “the black day of the German Army in the history of the war.”[53]. It was, as he and the German High Command knew the beginning of the end.

There now began a series of attacks that pulsed along the line of the Western Front as American, Belgian and French troops joined in the assault. Each of these attacked and stopped, held up by German resistance, then attacked again with renewed vigour. The British and Commonwealth troops kept moving forward, only checked for short spaces of time, before moving again. This series of assaults had the effect of keeping the German forces off balance, never knowing where they would be attacked next. Their morale, already lowered, fell even further and they gave ground.

In September, the British Heavy Artillery proved to be very effective, practically annihilating the targets that it was called upon to engage by the sheer weight of plentiful shells. Obstacles, barbed wire and enemy batteries were obliterated [56]. As time went on big bombardments became rarer so the guns did not need massive stores of shells.

Heavy guns were often left well behind because they could not keep up with the general advance and therefore did not need to be supplied in a hurry. Field guns became the mainstay of the artillery battle. Said Major Burne of the 32 Division Artillery, “We just push along till we get stuck, bring up ammunition, put down a barrage next morning, get on to the next line, whether a 1,000 yards or 2 or 3 miles, come up against more opposition, and repeat the operation.”[56] The British guns had good stocks of mustard gas shells by now and they were being used against individual targets and enemy gun batteries by 26 September [56]. It was warfare more akin to Europe in 1944 than the Great War of common perception.

The pace of the advance slowed down but despite dogged defence by some units the allies continued pushing the Germans back. They turned and fought and tried to dig in but after a while they were dislodged and forced to retreat once more. A series of battles were fought in these last days that have names but they do not have the place in British memory that Loos, the Somme, Arras, Cambrai, Ypres and Passchendaele hold. These battles of the last days happened so quickly that they seem to have faded from history, hence the name “The 100 Days”. Peace overtures were well under way by September and Germany’s allies crumbled one by one but there was still plenty of fighting to come in October and into early November before the armistice was signed.

The infantryman of the 100 Days carried less than he did previously. Fred Hodges<sup>6</sup> said that they had been stripped down to the bare minimum. “Haversack on the back... rolled groundsheet, entrenching tool, water-bottle, gas mask on the chest in the alert position; steel helmet, rifle and bayonet; 120 rounds of SA ammunition; Mills bomb in each breast pocket...” Other bombs and rations, tools and flares were

---

<sup>6</sup> Of the 10<sup>th</sup> Lancashire Fusiliers, 17<sup>th</sup> (Northern) Division. Fred was 18 at the time.

distributed between the platoon. They had to be ready to move at any time and Hodges said that they remained like this until the end [57].

Railways both narrow gauge and standard still brought the supplies forward but as the advance continued they were left behind in the wake. Railway troops worked tirelessly to lay the tracks and bring into use captured or in most cases, re-captured metals. Trains on the narrow gauge lines, or tramways could, if maintained properly carry 30 tons of stores each, but to sustain this on a regular basis the metals would have to be laid and maintained to standard gauge 'express line standard' and that was not possible to do. On the standard gauge lines, the trains could carry 300 tons of stores each but laying and maintaining these lines was costly and time consuming. However, despite dwindling railway materials this was where the effort was maintained. In the end supply was maintained by convoys of lorries and then mules and finally, as usual, by men to the men in the line. Any number and type of good were delivered to the fighting troops. At 3.20 am on 18 September 1918, the commander of the 6<sup>th</sup> Dorsets, a battalion in the 17<sup>th</sup> Division, was seen reading a new copy of *The Times*. The unit was about to go into action at 4.30 am [58]. This act of seemingly unconcerned calmness would have had a good effect on his men but the real fillip was in the fact that it had been printed and delivered to the front line just a few hours before. Yet it was supply that slowed the advance down and eventually brought it to a halt. Railway lines that had to be re-opened were booby-trapped and damaged by shellfire, German aircraft mounted raids on junctions, sidings and railheads. All of this held up forward construction of the railway lines and delaying trains. The roads too, as well as being poor, deteriorating quickly and almost impossible to maintain, were also sabotaged and shell damaged. All of this had the effect of slowing down supply of the advancing divisions.

By November, the infantry advance had progressed so quickly that road maintenance could not keep up, lorries and wagons could no longer get forward. As the divisions approached the Belgian frontier the lines of supply began to stretch, just as the troops began to tire. Worsening weather made roads and tracks worse, if not impassable. As divisions converged on single objectives, roads became congested and grid-locked as various columns and transports tried to get forward and back. Bridges became bottle necks as large formations all tried to use the same crossings. On 9 November 1918, it was not enemy action that halted the 17<sup>th</sup> (Northern) Division, nor was it the impending end of the war, it was congestion on the lines of supply and the lack of ability to supply the division for further operations. An officer at 17<sup>th</sup> Division H.Q. wrote about road traffic on 8 November, “all movements being restricted to bad, narrow and broken roads, congested with traffic of four different divisions...”[59]. The advancing fighting battalions now had to go without rations for days at a time. The BEF was grinding to a halt. Captain O’Hanlon of the 6<sup>th</sup> Dorsets wrote, “There was little else to do: congestion at the only bridge over the Sambre made a further advance impossible. Three divisions were trying to cross it simultaneously. Supplies could not have been got forward.”[58].

At the end, just before the Armistice, only a small, lightly armed force kept in touch with the German forces because wholesale, major re-supply of the divisions could not take place fast enough to allow those formations to be properly operational. The advance had finally outstripped the supply chain and by 11 November railheads were between 30 and 50 miles behind the front line, the armies had gone as far as they could go without new supply infrastructure in place [29]. At this point, had the German will to go on fighting been stronger, it is more than likely that trench lines would have been dug once again, the railways would have crept closer, the big guns would have been

dragged up and static warfare would have resumed. And that was it; the phenomenal flow of munitions from the factories to the front had been stemmed. Not really by force of arms but simply because the supply chain had broken.

## **9.7. Conclusions**

By mid-1917, the supply of T.N.T for High Explosive shells had exceeded the output of that type of shell so a reduction in manufacture had been ordered. The events of late 1917, Passchendaele, changed that and High Explosive was in demand again. Such was the flexibility of the factories now that the return to ramped up production of high explosive was no problem. High capacity production continued until April of 1918 when stocks of chemicals for explosives began to dwindle, but by this time it did not matter. There were enough shells available for 1918. The statistics of shell production speak for themselves, and the fact that chemical shells were on the increase displays a signal intent to shift from the mainly conventional to chemical warfare. At Loughborough Instructional Factory they were training to manufacture gas shells for 18-pounder field guns.

The German Spring Offensive proved that British manufacturing had been and was operating well and was capable of producing what was needed at speed. Large amounts of stores had been lost but, crucially, even more had been saved. Manufacturing efforts back in Britain made sure that the losses were made good and that there were ample supplies with which to go on the offensive in August. The effect of the weight and scale of British supplies must have had a positive effect upon the British as it had a negative effect upon the German troops.

Even after the losses incurred during the Spring Offensive, The 100 Days was fought with enough shells and weapons to handsomely do the job. It could not have been

fought at all if there had not been the manufacturing and training initiatives of 1915 and the ramp up and gun programmes of the following years. The mobilisation of the nation's workforce had been an important part of the ultimate victory. The 100 Days campaign could not have been fought and victory not achieved without the incredible manufacturing output of the British nation. The last chapter deals with the conclusions of the thesis.

## **Chapter 10.**

### **Conclusions and Further Research**

#### **10.1. Conclusions**

The conclusion has to be that British Manufacturing helped in a huge way to win the Great War. Without the efforts of the civilian workforce who volunteered in their thousands to work in the war materials industry there can have been no victory. The British successfully mobilised their potential workforce and created a manufacturing base that was the most efficient among all protagonists of the war.

Such were the stockpiles of munitions and other war material the British Army was re-supplied after so much as lost during the German Spring Offensive. Material losses that earlier in the war that would have been crippling to the war effort were made good so rapidly that the British were able to join their allies in a major offensive only five months later. Despite industrial unrest and strikes, the material losses were replaced. This and the victory of the 100 Days bear testament to the ability of British Manufacturing to literally deliver the goods. The industrial recruitment, the training, the schemes and the welfare work in factories had all combined to ensure that Britain could manufacture itself out of a crisis. Most thought that the war would go on into the twenties but it did not. By providing Haig's BEF with the equipment and ammunition that it required for the 100 Days manufacturing had shortened the war considerably. At the end of the war Britain stood at the pinnacle of her power but that moment was short lived.

It of course came at a terrible price; those materials made by the workforce took countless lives in a mechanised war that changed the world forever. With the armistice,

war workers were put out of work almost literally overnight. A world at peace did not need vast factories pouring out weapons and tools of destruction. Returning soldiers wanted their old jobs back. In some cases, they were given them back but in others, they were not. They had either been replaced by better workers, were not needed any more or they had not been forgiven, as in the case of many railwaymen who joined up, for going in the first place. What of those trained to make ammunition and weapons? Well, to use a cliché, “the genie was out of the bottle” and it would not go back again. The notion of training and learning to do other jobs was now a potent idea among people who before the war would not have contemplated such things. Un-skilled and semi-skilled workers had proved that they could become skilled workers and did not have to undertake long and almost arcane apprenticeships to do so. There was still a long way for them to go but women had come out from the shadows and proved the male dominated nation that they could do anything that men could. Be that working in a factory, working in a drawing office, being a scientist and being part of research and development of aircraft and weapons of war. They took with them notions of collective working and union ideals and solidarity to their former workplaces. They took with them the principles of Welfare in the workforce to their old jobs and into the home. While this is not a reason to support mechanised killing on an industrial scale, the Great War, while killing so many, had empowered even more.

## **10.2. Further Conclusions**

Both industry and the military were ready to deal with a small crisis but not the one that ensued. Manufacturing was one of the keys to dealing with the crisis. Systems were in place but were swamped by the size of the crisis and the speed at which it grew. Rapid expansion of the army and of manufacturing facilities and the workforce was necessary to cope with the crisis. Old, political methods and old manufacturing methods had to

be rejected or modified to achieve the victory. Therefore, a new, hard, professional way of fighting the war and co-ordinating the manufacturing effort had to be employed.

In 1915 British operations, attempts to deal with the crisis of the war were hampered by the lack of the right tools for the job. One of the reasons that the Battle of Loos was lost was because of a lack of the right equipment and munitions to do the job. Where artillery had done its job the British troops enjoyed success, where it had not they did not. Enemy forces, caught off guard and subjected to heavy bombardment had shown themselves to be vulnerable and shown the British that they could win. It taught the Germans the same lessons of course and it did make the French take notice of the potential in the British Army. Unfortunately, Loos set a pattern for most of the rest of the war. Entrenchment, and the battle phase of bombardment and assault and entrenchment.

Skilled workers were in a small pool. Initial attempts to move them around failed because of a lack of preparation. This scheme continued and over time reaped rewards but only from greater data collection which led to better deployment of industrial workers.

Training on a mass scale for different elements of the populous was needed and Educational establishments led the way. Educationalists with Ministry of Munitions personnel devised syllabi that fulfilled the need. Despite some resistance by the 'trade' and private and unions this went forward & produced good semi-skilled workers from a hitherto un-tapped part of the populous to provide good workers, These courses went on to produce skilled workers. Women, research, development and science.

An exhausted workforce is a bad one, care of their needs was vital. To avoid strike action and unrest. Welfare looked after the needs of women and naturally had an

impact upon male work of all skill levels. Work practices and welfare changed after the war in all sectors where the former munitions workers went after 'demob'.

The Battle of Arras was well planned because it was well supplied. This allowed the generals to plan with confidence knowing that all they needed was available. The opening days of the battle were a great success for the British. If there was a criticism of the stores, it was that there was too much!

Victory was won against a backdrop of the industrial unrest at home and mounting losses and German victory of early 1918 in Europe. The fact that losses were made good of spring was because of the industrial machine in the UK. Supplies had been made and laid in by the massive manufacturing efforts of 1916 and 1917. The same is true for the victory of the 100 days. The stores were there and the capacity to produce was there as well. Even if some raw materials were showing signs of running out. Finally, two things won the war for the British. The raising of the Kitchener armies and the industrial volunteers that released and harnessed the nation's manufacturing potential.

### **10.3. Lessons Learned**

- Powerful legislation is required. D.O.R.A or the Defence of the Realm Act was a remarkable piece of legislation that had numerous sections and amendments. It literally allowed the Ministry of Munitions and the rest of the Government to do what they wanted. It caused great unease in Parliament as it certainly infringed personal liberty. Military or Government requisitioning of land under D.O.R.A worried many MPs who were landowners [25]. This was one piece of legislation among many.

- State Control of industry and materials. Industry and therefore manufacturing had to be centrally controlled if the central goal of victory was to be achieved. Even so central control posed many problems. All industry had to be centrally regulated; even those not engaged in major war work. These companies still had to be able to turn their hand to some kind of minor war work if and when required [60].
- Politicians must listen to the ‘experts’ and act upon their advice. Kitchener in his role as a politician did not heed the advice of French or Haig in the lead up to Loos. They told him it would fail for want of trained troops and shells and they were proved correct [26].
- Do not enter into a program/operation until ready. The British Army was not ready to fight the biggest battle it had ever faced in September 1915 [26].
- Mobilisation of the work force. The civilian population and importantly the skilled workers had to be placed where they were needed. Lloyd George believed that the war would only be won if the nation submitted to the sacrifice of personal liberty. The state had to control labour [25].
- Support of the population for projects is vital. Hearts and minds. Do not treat the population as idiots. To achieve the previous point this was vital. The notion of wholesale industrial compulsion advocated by Lloyd George was an anathema to the British then and it would be today. Therefore, Government ambition and plans had to be modified to take this national attitude into account. Concessions had to be made to the workforce, pay and conditions being central to this [25].

- Welfare of the workforce and population to maintain support. The provision of canteens in factories went a good way towards improving the welfare of the workforce. The canteens ensured that the workers on all shifts ate well. Some canteens also provide gyms, baths, and classrooms as well as food. Legislation, the Munitions of War Act 1916 and Miscellaneous Provisions Act 1916, was used to force the employers to provide decent canteen facilities for the health and well-being of their workforces [47].
- Be ready to try something new and be open to ideas. A distinctive feature of the organisation was the employment of businessmen in key chief executive positions. What became known as the “Business man system” Previously the Government had only employed these men as advisors, the Ministry of Munitions utilised their talents as well as seeking the experience of engineers, scientists and railwaymen among others [25].
- In a commercial setting the desire for profit (by companies and shareholders) has to be subsumed by the greater need. The greater good of the aim, in the case of the Great War, victory, had to be put first. Moneymaking had to be seen as a secondary goal and companies had to get used to accepting a fixed price for a product [11].

## **10.4. Further Research**

### **10.4.1. Future work**

This thesis is merely a beginning of a process. There are so many themes within the study of the industrial ramp up of the Great War that the surface has been barely

scratched. There exist a number of lines of research for both engineering and history that will yield useful and illuminating data because within in each theme there are lessons and warnings for industry in the modern world.

#### **10.4.2. Standardisation**

Before the war began and before the Ministry of Munitions the standard weapons of the war had been developed and adopted. The Short Magazine Lee Enfield Rifle, the 18-pounder field gun and the 4.5-inch howitzer to name but three. Mention could also be given to the 9.2-inch howitzer, so new that it was undergoing tests when war broke out but which became a standard weapon. There was standardisation of a huge number of military items which aided manufacturing and the army. Standard fuse caps were a great innovation. An enormous amount of research could be done in this field about the benefits of standardisation.

#### **10.4.3. Materials and resources**

The constant battle to keep up with the demand for raw materials and resources could be examined. Mining for the coal to keep the machinery turning, the locomotives hauling and the ships carrying and excavating the ore and minerals needed for the weapons and explosives would be a worthwhile research topic.

#### **10.4.4. Transport and Supply**

Supply from the mines through the whole manufacturing process and to the front line is a very important line of research. The chapter that dealt with blockages in the supply chain had to be deleted from the thesis. It was an important part of the ramp up however. The different methods used by the railway companies and the Ministry of Munitions to ensure the flow of materials and finished goods contain very useful

lessons for the modern day. The convoy system put in place to protect ships from U-Boats is another useful line of research. As is the motive power used to haul and carry the manufactured goods.

#### **10.4.5. The workforce**

While worker welfare in the factories through the Welfare Supervisors has been introduced, extra mural or welfare outside of the factories has barely been touched. Research into how much sports clubs, day trips and dances affected the morale of the workforce and improved productivity could yield interesting results.

So too could research into how much welfare reduced the effects of militancy in the work place and how far it went to influence the number and length of strikes. Particularly in the 1917/18 period when worker unrest was high. Comparisons could be made between the factories that did have Welfare Supervisors and those that did not. Questions could be asked about the productivity of each and the number of strikes and disputes that took place in each during 1917/18.

The effects of welfare and indeed new working practices in industry on the peacetime workplace could be examined. Any 'in extremis' ramp up provides innovations and discoveries for future times. War is an example of this as is the remarkably swift ramp up for the space race in the 1960s and 1970s.

What effects on the workplace did the new workforce have after the war ended? So many had been trained and educated in various different skills and had learned so much from their wartime workplaces, surely there must have been an impact?

#### **10.4.6. Unions**

The work of the unions during the war and the industrial unrest that ensued could be examined. What effects did the war and the new workforce have upon the unions post war?

#### **10.4.7. Education**

More could be done to research the kind of training courses put in place and implemented during the Great War. How far was the skill pool increased by education and what was its impact on manufacturing during and after the war?

#### **10.4.8. Inspection Process**

The initial lack of inspectors and the impact that had on production and the quality of munitions could be examined. For instance, in 1914 there was only one British inspector covering North America and Canada. The quality of foreign shells was at first poor and according to the army the quality of homemade munitions was poor in 1916. Why? That improved with time, how? More inspectors were trained and inspection regimes changed. What impact did that have?

#### **10.4.9. Research and Development**

How far was research and development of new military munitions influenced by the need to preserve materials or speed up manufacture? A comparison could be drawn with the German experience of World War Two. How was research and development influenced by the experience at the front? Did the requirements of the soldiers feed back to the research and design departments and then on to the factories?

#### **10.4.10. The Military**

The research, development and deployment of the weapons of the Great War could be examined. How the military during the Great War developed the use of their standard weapons and munitions could bear scrutiny. How were they used in tactical developments on the battlefield? How far did the available weapons and munitions influence operations and tactical thinking throughout the war?

#### **10.5. Concluding remarks.**

Huge amounts of money and raw materials and a large amount of time had gone into research and development for the Royal Navy. Its presence on the world stage was intended to avert the crisis of war and if it failed in that goal, to win a war. It certainly failed at the first and could only contribute to the second. The tool that was deployed to deal with the crisis was the army and that, as we have seen, had not enjoyed the investment that the navy had seen. It had been ready to re-fight the Boer War. The threat of war was acknowledged in pre-Great War Britain but when it broke out the scale of the world crisis was only dimly perceived by all but a few. The key to beginning to handle the crisis was to recognise and acknowledge just how big the crisis was and that only came about in May 1915, some nine months after the start of the war. That realisation only came about because the government department tasked with dealing with the crisis was mis-handling it and was defied by the military, an act which galvanised and mobilised public opinion. The upsurge in industrial volunteers to make shells was second only in importance to the raising of the Kitchener's Armies in the volunteer effort of the early part of the war. The plans for munition production and procurement of the tools to deal with the crisis had been found wanting. Craftsman like production of manufactured goods of superb quality was far too slow to serve the

guns of war. The faith placed in foreign manufacturing of munitions initially proved false. Contracts had been placed at home and abroad but by May 1915 those contracts had hardly been fulfilled. No longer could the peacetime method of accepting small and slow production runs at a high financial price be tolerated. Centralised control was vital if the crisis was to be dealt with and the war won. It had to be a civilian government organisation working with the 'Trade' and the military and it had to wield immense power to achieve its aims.

Expansion was required of manufacturing industry both in terms of factories, facilities and the work force. While the fledgling Ministry cast around for skilled men, thousands of volunteers from all walks of life, old and young, men and women, came forward to offer their services. They demanded training and the educational establishments set up courses in shell turning and engineering. All of this was done in spite of the Ministry not because of it. To begin with the Ministry had to run to catch the public up. What the Ministry had to do was take control of the situation and co-ordinate the training effort in the same manner that it was taking control of manufacturing in the nation as a whole. The workforce, once trained and employed were worked very hard and their welfare had to be looked after. Long hours and draconian but necessary rules banning holidays and time off led to exhaustion and industrial unrest. Strikes and disputes were common but they did not, in the main, derail wartime production. The population as a whole, in khaki and in overalls could not be expected to keep on sacrificing for no obvious reward. By 1917 and 1918 the Ministry had realised that simply paying high wages could not offset the sacrifices that the workers had to make. Besides, spiralling food prices made the high wages almost pointless. Plans were afoot to re-instate holidays and to limit working hours when the

war ended. It is mere speculation but what would industrial relations looked like had the war gone into 1919/20 as planned? How in addition, would the army have coped?

The lessons of the Great War can be applied to many situations. Not in the least of how to try and avoid such a crisis occurring again. The expansion of manufacturing in the UK to deal with the crisis of the Great War has resonance today. Should another crisis occur then manufacturing will have its part to play to help to solve that crisis. For instance the lessons of the Great War ramp up could be applied to the issue of UK power generation. Current power supply is failing, importing power such as gas is costly and an uncertain venture, a tap that could be switched off. When the lights go out and the freezers and computers stop working and people begin to go hungry there could well be more than a little trouble in the land. Social unrest would be a crisis that could engulf us all. We cannot rely upon wind turbines, 'fracking', wave energy and solar energy to give us all of the power we need; the nation needs power stations. A programme to create the new power stations would have to be initiated. Fifteen years to build one power station is thirteen years too long. Construction of the power stations and the manufacture of the machines and tools that they need would have to be speeded up. The workforce in both manufacturing and construction would have to be expanded.

Attitudes will have to change just as they had to in the Great War. If any in 1914 thought that amateurism defeated Napoleon in 1815, they would have been wrong; hard, professionalism did that. The problem for 1914/15 was that that lesson had been forgotten and had to be re-learned. In 1915, the old British method of muddling through *bad* to give way to hard, professionalism. So too, the (understandable) loathing of war had to give way to an acceptance of it as a reality before the sacrifices had to be made to win it. In the modern day there is a fear and loathing of nuclear power and

that attitude has to change if cheap, affordable energy is to be generated. The planet's resources are dwindling, emissions are rising, energy is needed. Nuclear energy is the only way forward for the foreseeable future. The ramp up of the Great War, the changes that manufacturing went through to provide the tools of victory contain huge lessons for modern times and the future. Perhaps out of the wreckage of a victory in the past we can glean some lessons for the now? Modern British manufacturing is nowhere near its pre-Great war levels and seems to have been in a decline but the national character is the same; the engineers, the scientists, the academics, the educationalists and the women and men of 'push and go' are still here. Should the need arise to manufacture the country out of a crisis it could be done again if the lessons of history are learned and not forgotten.

## References and Select Bibliography

1. W. Osborne. *An Average Division? An analysis of factors affecting the performance of the 17<sup>th</sup> (Northern) Division in the Somme Campaign, at Arras and in the 100 Days.* Unpublished M.A. Thesis, University of Birmingham, 2008.
2. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions.* Volumes I to XII (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
3. J.E. Edmonds (ed), *The Official History of the War, Military Operations, 1914-1918* (in 19 separate volumes) (First published, HMSO, 1920-1947, Re-printed by the Imperial War Museum and The Battery Press, 1990s)
4. N. Friedman, *Sea power as Strategy: Navies and National Interests,* (Naval Institute Press, 2001)
5. R. Woodman, *The History of the Ship,* (First published, Conway Maritime Press, 1997. Re-printed, Conway Maritime Press, 2002)
6. Lord Hankey, *The Supreme Command 1914 – 1918,* (George Allen & Unwin, London, 1961),
7. Richard Burdon Haldane, *An Autobiography,* (Hodder & Stoughton Ltd, July 1931)
8. P. Simkins, *Kitchener's Army, The Raising Of The New Armies 1914 – 16,* (First published, Manchester University Press, 1988. Reprinted, Pen & Sword Military, 2007),
9. R. D. Thomas & B. Patterson, *Dreadnoughts in Camera, 1905 – 1920,* (Sutton Publishing Ltd, 1998),
10. F. T. Jane, *All the World's Fighting Ships 1903,* (Sampson Low, 1903)
11. D. K. Brown, *The Grand Fleet, Warship design and Development 1906 – 1922,* (Chatham Publishing, 1999)

12. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions*. Volume I, *Industrial Mobilisation 1914 – 15*. (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
13. K. Case & W. Osborne, (eds), *A Great War Sharpshooter, The Great War Diary of Colonel Weston Jarvis*. Vol I, *Norfolk, Egypt and Gallipoli, 1914 – 1916*, (Salient Books, 2012)
14. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions*. Volume X, *The Supply of Munitions*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
15. Prime Minister Asquith in *Great Britain and the European Crisis. Correspondence, and Statements in Parliament, together with an Introductory Narrative of Events*, (HMSO, Hazell, Watson & Viney Ltd, 1914)
16. J. Walter, *Allied Small Arms of World War One*, (The Crowood Press, Ltd, 2000),
17. Forbes, *A History of the Army Ordnance Services*, (HMSO, 1929. Re-printed by Naval & Military Press, 2010)
18. D. Clark & B. Delf, *British Artillery 1914 – 19, Heavy Artillery*, (Osprey Publishing Ltd, 2005)
19. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions*. Volume VIII, *Control of Industrial Capacity and Equipment*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
20. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions*. Volume IX, *Review of Munitions Supply*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
21. C. Court Repington, *The First World War 1914 – 1918*, (Constable and Company Ltd, 1920)

22. Lloyd George, *War Memoirs of David Lloyd George* (First published Odhams 1934, re-printed by Odhams, 1938),
23. J. E. Edmonds, *Official History of the Great War, Military Operations France and Belgium, 1915* Vol I, (Macmillan & Co, Ltd, 1927)
24. R. Holmes, *The Little Field Marshal. A Life of Sir John French*, (First published Jonathon Cope, 1981, re-printed by Weidenfeld & Nicholson, 2004)
25. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions. Volume II/1, General Organisation for Munitions Supply*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
26. J. E. Edmonds, (ed), *Official History of the War, Military Operations France and Belgium, 1915, Vol II*, (HMSO, 1928. Re-printed, the Naval & Military Press and the Imperial War Museum, 2009)
27. C. Barnett, *The Great War*, (First broadcast, BBC, 1964. First published, Park Lane Press, 1979. Re-printed, 2003)
28. G. Sheffield & J. M. Bourne, *Douglas Haig, War Diaries And Letters 1914 – 1918*, (BCA, 2005),
29. A. M. Henniker, *Transportation On The Western Front*, (HMSO, 1937, re-printed, Imperial War Museum and Naval & Military Press, 2009)
30. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions. Volume VI, Manpower and Dilution*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
31. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions. Volume IV, The Supply and Control of Labour 1915 – 16*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)

32. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions*, Vol III, *Finance and Contracts*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
33. F. E. Foden, *Herbert Schofield and Loughborough College, The Vocational Aspect of Education*, (First published, Routledge, 1963. Digital version, 2007)
34. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions*. Volume II/2, *General Organisation for Munitions Supply*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
35. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions*. Volume XII, *The Supply of Munitions*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
36. Loughborough University Archive, *Minutes of the Loughborough Technical Institute*, 1915
37. A. J. Heraty, *A Duration Man, A Staffordshire Soldier in the Great War*, (Churnet Valley Books, 1999)
38. Keith Grieves, *The Politics of Manpower, 1914 – 18*, (Manchester university press, 1988)
39. L. M. Cantor & G. F. Matthews, *Loughborough from College to University, A History of Higher Education at Loughborough, 1909 – 1966*, (Loughborough University of Technology, 1977)
40. Ian Hay (Major-General John Hay Beith), *The First Hundred Thousand, K 1*, (William Blackwood & Sons, 1915)
41. H. Schofield & J. F. Driver, *Shell-Turning for Munition Workers*, (First published, Lackie & Son Ltd, 1916. Re-printed, The Royal Armouries and The Naval & Military Press, 2008)
42. C. Rotherly, *Doctor Schofield*, (Privately published, 1960),

43. Edmonds & C. Falls, (eds), *Official History of the Great War, Military Operations, France and Belgium, 1917*, Vol I, (HMSO, 1940. Re-printed The Imperial War Museum and The Battery Press, 1992)
44. TNA: PRO. WO 95/1984. 17<sup>th</sup> (Northern) Division H.Q. War Diary, April 1917
45. TNA: PRO. WO 95/1986. 17<sup>th</sup> (Northern) Division Adjutant & QMG, April 1917
46. TNA: PRO. WO 95/2008. War Diary, 10<sup>th</sup> Notts & Derbys, April 1917
47. Ministry of Munitions, Munitions Council: Historical Records Branch, *The Official History of the Ministry of Munitions*. Volume V, *Wages and Welfare*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)
48. D. Mitchell, *Women on the Warpath, The Story of the Women of the First World War*, (First published in Britain, Jonathan Cape, 1966)
49. Vaughan, Adrian, *Railwaymen, Politics and Money The Great Age of Railways in Britain*, (London, John Murray, 1997)
50. Hamilton Ellis, Cuthbert, *British Railway History 1877 – 1947*, (London, George Allen and Unwin Ltd, 1959. Second impression, 1960)
51. A. Banks, *Military Atlas Of The First World War*, (First published, Heinemann, 1975. Re-printed, 1998)
52. M. Middlebrook, *The Kaiser's Battle*, (First published, Allen Lane, 1978. Re-printed, Penguin Classic, 2000)
53. J. Terraine *The First World War 1914 – 18*, (Macmillan & Hutchinson & Co, 1965)
54. E. Junger, *Storm of Steel*, (First published 1920, re-printed by Penguin Books, 2004)
55. S. Palmer & S. Wallis (Eds) *A War in Words*, (Simon & Schuster, 2003. Re-printed by Pocket Books, 2004)
56. T. Travers, *How The War Was Won*, (First published, Routledge, 1992. Re-printed, Pen & Sword, 2005)

57. Frederick Hodges, *Men of 18 in 1918*, (Privately published by Frederick James Hodges, 1988)
58. G. O'Hanlon, *A Plain History Of The Sixth (Service) Battalion The Dorsetshire Regiment 1914 – 1919* in *History Of The Dorsetshire Regiment 1914 – 1919* (Originally published by Henry Ling Ltd and Simpkin Marshall Ltd, 1932. Re-printed by the Naval & Military Press)
59. TNA: PRO. WO 95/1985. War Diary, 17<sup>th</sup> Division, Narrative of Operations, November 1918
60. Ministry of Munitions, Munitions Council: Historical Records Branch, *Official History of the Ministry of Munitions*, Volume VII, *The Control of Materials*, (First published, HMSO, 1915 - 1922. Re-printed by the Imperial War Museum and Naval & Military Press, 2008)

### **Select Bibliography.**

- R.J.Q., Adams, *Arms and the Wizard*, Lloyd George and the Ministry of Munitions 1915 – 1916, (Texas A & M University Press, 1978)
- J. M. Bourne, *Britain and the Great War 1914 – 1918*, (Edward Arnold, 1989, reprinted 1991)
- V. Carolan, *WW1 At Sea*, (Pocket Essentials, 2007)
- J. E. Edmonds, (ed), *Official History of the War, Military Operations France and Belgium, 1918, Vol IV*, (HMSO, 1947. Re-printed, the Imperial War Museum and the Battery Press, 1993)
- J. E. Edmonds, (ed), *Official History of the War, Military Operations France and Belgium, 1918, Vol V*, (HMSO, 1947. Re-printed, the Imperial War Museum and the Battery Press, 1993)
- J. Gooch, *The Plans of War, The General Staff and British Military Strategy c.1900 – 1916*, (Routledge & Kegan Paul, 1974)
- K. Grieves, *The Politics of Manpower, 1914 – 18*, (Manchester University Press, 1988)

- M. Hankey, *Government Control in Wartime* (Cambridge University Press, 1945)
- R. J. S. Hoffman, *Great Britain and the German Trade Rivalry 1875 – 1914*, (Russell & Russell inc, 1964)
- E. A. Pratt, *British Railways And The Great War, Volumes I & II*, (Selwyn and Blount, Ltd, 1921)
- David Stevenson, *Armaments and the Coming of War*, (Oxford, University Press, 1996, reprinted 2002)
- Clive Trebilcock, *The Vickers Brothers Armaments and Enterprise 1854 – 1914*, (Europa Publications Ltd, 1977)
- S.R. Williamson, Jr, *The Politics of Grand Strategy*, (Harvard University Press, 1974)
- E. L., Woodward, *Great Britain and the German Navy*, (First published by Oxford University Press, 1934. Reprinted by Frank Cass and Co. Ltd, 1964)
- P. Hore, *Battleships of World War I*, (First published by Anness Publishing Ltd, 2006. Reprinted, 2008)
- R. Holmes, *The First World War in Photographs*, (Sevenoaks, 2001)
- D. Williams, *The Birmingham Gun Trade*, (First published by The History Press, 2004. Re-printed, 2010)
- A.H. Atteridge, *A History of the 17<sup>th</sup> (Northern) Division*, (Robert Maclehose & Co Ltd, 1929. Re-printed by Naval & Military Press, 2004)
- G. Griffith, *Women's Factory Work*, (Sutton Publishing, 1991)
- H.C. Casserley & C. C. Dorman, *Railway History in Pictures, The Midlands*, (David & Charles, 1969)
- A.J.P. Taylor & S.L. Mayer (eds), *History of World War One*, (First published by BBC Publishing Ltd, 1968/69. Re-printed, Octopus Books, 1974)
- W. Osborne, *A History of the 10<sup>th</sup> Battalion, The Notts & Derbys, Vol I*, (First published by Salient Books, 2009)