

***NECIES\* Proceedings, vol. XXXV, 1918–1919***  
**Women's Work in Engineering and Shipbuilding during the War**  
by the Honorable Lady Parsons, Honorary Fellow,  
read at the Victory Meeting in Newcastle upon Tyne, 9 July 1919

The introduction of women into the engineering trades is not a fact dating only from the war, as is often supposed, although the immense influx of women took place in 1915. Already in 1840 cheap female labour in the metal trades was becoming a serious complication, and the numbers of women were increasing steadily. About the year 1870, the brass workers, the nut and bolt makers, the chain and nailmakers, and the makers of all sorts of small metal goods, protested loudly against the invasion of their trades by women. The men's unions, too, stood out against any organization of women, because, they argued, to organize was to recognize, those outrageous women who turn at the lathe and file at the vice. Mrs Drake, in her excellent book, tells us that a chain maker wrote to complain that when he himself is exhausted with labour, his daughter can still go on.

About 1900, women began to pour into the electrical and other new and progressive trades, such as the cycle and motor trades; but the chief centres of women's employment remained round Birmingham and Coventry. The displacement of men by women generally followed the introduction of new automatic machines. The division and simplification of processes began to take marked effect on the numbers of skilled men. The men's unions complained that the employment of women was a chief cause of their unemployment, because fewer skilled men were required, and this encouraged the employment of a less skilled and less robust type of worker.

Suddenly the war brought an immense demand for women's labour. When the shortage of munitions became known it was evident that unless the supply of munitions could be enormously increased our armies would certainly be defeated in the field. The works had already been depleted of hundreds and thousands of their best men, and there was no supply of labour to fall back upon, except women. The then Minister of Munitions, Mr Lloyd George, made a stirring appeal to women to come out of their homes and help to save their country; but women were already clamouring to be allowed to work in the shops, and well it was for the country that women responded so quickly to the call for their help. Women of every class poured into the works; dressmakers, milliners, teachers, musicians, artists, domestic servants – those who had worked hard all their lives, and those who had never done a stroke of work before. Employers accomplished wonders of organization, in order to accommodate their new workers; hostels and canteens sprang with mushroom growth.

The women put up pluckily with all the discomforts incidental to a huge new enterprise set up as an emergency measure, and the discomforts were often very real and very severe. Canteens were new, and necessarily experimental; food was often very insufficient, and in some localities there was no way of supplementing it; workers had often long distances to travel. The cold at night was sometimes intense, and with the poor food, the cold and the unaccustomed nature of the work, some suffered intensely.

Then it must not be forgotten that in a certain class of factory the danger of explosions was constantly present, and unhappily resulted many times in terrible loss of life.

Then there were the air raids, sufficiently alarming to many people leading their ordinary lives in their well-screen houses; but when hundreds of workers were gathered within the brightly lighted shops, and all the conditions were unusual and exciting, a highly nervous mentality was produced. Great judgment and careful handling were required on the part of those in charge of the workers, in order to repress and allay any symptoms of panic; but the same spirit of enthusiasm was in the girls as it was in the splendid young men, who, in the early days of the war, flocked in thousands to the recruiting offices and put up cheerfully with every kind of rough accommodation only to have the honour of serving their country.

I will not go into a detailed account here of the semi-skilled work accomplished by women, nor recite again the oft-told tale of all the varieties of shot, shell, hand grenades and every implement of destruction made by women's hands. Ninety per cent of the workers in munitions were women in 1918. Their work was generously recognized – their endurance called out sometimes extravagant praise on the part of the press and the public generally; but I wish to emphasize some of the more skilled work that women learned to do, because there is a strong tendency among engineers to consider that women are only capable of doing repetition work on fool-proof machines. There is no doubt that many women developed great mechanical skill and a real love of their work.

### **Skilled Work**

Quite a large number of girls were able to set up and grind their own tools, and a small proportion could set up their jobs from drawings. They could mill all the parts of the breech mechanism of howitzers, screwing the internal thread for the breech block, milling the interrupted screw and screwing the cone that fits into the breech block; milling firing pins and all the parts of gun sights; in each case setting up their own work. In a firm repairing guns two girls dealt with guns varying from the 13-inch naval gun, weighing 50 tons, to the 6-pound tank gun. They could design repairs to guns and mechanism and calculate the factor of safety of a damaged gun by logarithm and slide rule. They were designing suitable repairs, making the working drawings and carrying out the work, and if necessary making the special tools to do it. Others were hand lapping bores of guns, clearing the rifle grooves and making casts of the bores of guns in gutta percha. The girls who did this work were taught in one day to work a 12½-inch lathe. This included setting up the work, dividing on change wheels and cutting an internal screw thread.

In a still-surviving factory staffed by women, they are employed on all parts of the engine of a motor tractor. They are cutting out the crankshafts from the solid forging, using the drilling and slotting machines, and they are making all the tools, jigs and fixtures required for the work of the factory, setting up their work and designing some of the tools. This factory is generously continued by the employers, in order to give the women, who worked so well during the war, the opportunity to continue their training in the hope of employment as soon as trade conditions are more settled.

The women acetylene welders established a good reputation early in the war, and they have been steadily working on jobs interchangeable with men. In a firm specializing on lathes women are machining all the parts of a 6½-inch and an 8-inch lathe; they are doing the bench work, and assembling and fitting. Other girls have been successfully employed in designing and making machine tools. Another in one of the technical workshops could make every article that came into the shop from beginning to end, and she could mill gauges true to .00003 inch.

### **Experiments**

In metallurgy some useful experiments were made in the causes for failure of metal and alloys and the methods of producing reliable metals. In an experiment tank models of the hulls of ships and seaplanes were tested with a view to improving their form. In electro-technics tests were made of Admiralty instruments, ammeters and volt-meters, resistance boxes and standards, the practical part of a research on the heating of buried cables, and the preparation of plans for the installation of a new generating set.

### **Optics**

In optics, research work has been done in the comparison and improvement of various methods of testing. Tests have been made of the optical properties of rough samples of glass, of finished lenses and prisms, and also in ceramics for the crucibles in which the molten glass is contained. In the cutting and polishing of optical glass almost every process is done by women. First, the thick squares of glass are cut out by a revolving disc whose edge is faced with minute particles of diamond; next, by hand tools the women roughly round the square, then grind to concave or convex surface, and finally polish by numerous careful processes. The accuracy of the lenses is judged by the colour bands, a perfect band of colour meaning an accurate surface and a broken ring of colour or supplementary rings meaning that the lens must be further polished. The making of the entire binocular is women's work, and an industry built up since the war. First the sand cores are made, then comes the rough ending of the casts. The vulcanizing, the colouring, the assembling and fitting are all women's work; and they have also learned how to test the accuracy of the finished binocular. On mirrors, women have been working with great success. They back the mirrors and do a great deal of the polishing and the fitting. We are all familiar with the beautiful beams of light travelling over the sky in the search for Zeppelin and aircraft. Here on the Tyne we may feel a great pride in the mirrors and searchlights, as most of us know that Tyneside girls polished the mirrors and so added to the brilliancy of the searchlights.

### **Ministry of Munitions Exhibitions**

In the year 1916 exhibitions of women's work in engineering were held under the direction of the Ministry of Munitions, and in several large industrial centres. The immense range of work they were shown to be doing must have come as a great surprise to many employers. The exhibits included aeroplane engines, fittings and woodwork, parts of internal combustion machines, magnetos, part of the breech mechanism of guns and their sights, tool-room work, gauge making, light body

armour, face visors and masks of fine steel links, and in addition all the ordinary munition work, such as shot, shell, cartridges, fuses, grenades and bombs.

The exhibitions proved conclusively that women are able to work on almost every known operation in engineering, from the most highly skilled precision work, measured to micrometer, down to the rougher sort of labouring jobs. To enumerate all the varieties of work intervening between these two extremes would be to make a catalogue of every process in engineering.

If any further confirmation were needed to establish the importance of the work achieved by women in England it was supplied in a novel and noteworthy form. Engineering firms were invited to apply for the services of skilled women operators, who would be sent out to demonstrate the amount of output that can be produced in certain classes of work. It was a remarkable admission, that women with their short experience should be deemed capable of assisting employers in the difficult tasks of speeding up production in their own special profession.

### **Reasons of Success**

In considering the causes that led to the work of women producing such good results, one does not wish to claim any remarkable ability or outstanding qualities. The success was due to the sensible training given to women, and they had the advantage of receiving a short intensive training in the technical schools set up by the Ministry of Munitions and in private firms. They had the great privilege of being taught their work by skilled men who ungrudgingly gave their experience in teaching the women and without whose assistance it would have been impossible to train them. These technical schools proved that a short intensive training will turn out a sufficiency of useful workers, and that an intelligent girl can learn almost any mechanical process in a few weeks, a prolonged apprenticeship not being necessary, at any rate for women whose working years will generally be much shorter than those of men.

Now, boys and men are benefiting from the methods that proved so successful with women. Men and boys must not forget that women prepared the way for this sort of intensive training, and that their entry into works also brought about the improved conditions in the works; the hostels and canteens continue though the women for whom they were originally planned have gone, the immense and beneficial changes, due to their employment, have become an established fact in the works.

Great hopes were entertained by many women that a new profession was open to them, where they could earn good wages and where they would have some scope for their skill and intelligence. But with the signing of the Armistice all such pleasant hopes were destroyed, the training schools were closed to women, the trade unions reminded employers of the Government pledge to restore trade union rules, and within a few weeks the demobilization of women dilutees was general.

### **The Trade Unions**

About 1½ million women had received a certain amount of training in schools that has cost the country over £30,000,000 [a staggering figure, amounting to £636,300,000 in today's money, according to The National Archives – HH]. All these prospective wealth producers are scrapped; the country is much the poorer. The

engineering industry is again barred to women by an agreement made between the Treasury and the trade unions. Although 90 per cent of the workers on munitions were women, yet, in the agreement of February 1916 between the Treasury and the trade unions, no women were sitting on the conferences that preceded the agreement. Consequently, the women's point of view was never raised.

The Labour Party, while demanding full political equality for women and the right to sit in the House of Lords and to practice at the Bar and as solicitors, will not grant to women industrial equality by permitting them to work on the same jobs as men, to have adequate representation on committees, or to enter the higher ranks of those industries which the war has shown they are perfectly fitted to work.

It has been a strange perversion of women's sphere – to make them work at producing the implements of war and destruction and to deny them the privilege of fashioning the munitions of peace. The women who worked so hard to win the freedom of the world may not have freedom at home to engage in an industry where the wages are promising. It is fully acknowledged that men will not go back to prewar conditions; they must have shorter hours, more leisure, more wages. But as for women, they are merely told to go back to what they were doing before, regardless of the fact that, like men, they have now a higher standard of life, that they also wish to have their economic independence, and freedom to make their way without any artificial restrictions.

#### Appendix

The number of women employed in National Shell Factories in April 1918 was 12,939. Of these there were:

Forewomen 62  
Tool room 127  
Charge hands 245  
Machine operators 7,676  
Labourers 1,315  
Viewers 1,193

The total number of women in National Projectile Factories in April 1918 was 20,667. Of this number there were:

Forewomen 68  
Charge hands 432  
Machine operators 9,418  
Labourers 2,858  
Viewers 2,740

The above figures were obtained from the Report of the War Cabinet Committee on Women in Industry.

#### Discussion

Lord Weir of Eastwood, Honorary Fellow, proposed a vote of thanks to Lady Parsons. He said no one was better equipped than Lady Parsons from the point of view of experience to read a paper on women's work, because during the war she had been most prominently identified with what, after all, was one of the greatest movements

of the war – a movement the full and ultimate significance of which was not yet fully appreciated. He thought the women's movement in industry marked a very big change in the whole social structure. His own interest in women's work during the war had been very great because he had been asked by the prime minister to develop the employment of women on skilled work, and he very thoroughly believed that for the highest class of work it was possible to train women in a very much shorter time than men. He did not wish to talk of political matters, but he thought he might venture to prophesy with complete safety that the present position in which trade unions granted full equality to women in everything, with the one exception of opportunity, would have to be given up. The great movement should be encouraged and developed. The vote was carried by acclamation.

A written message of support from Mrs Oliver Strachey (Ray Strachey) was then read. . . 'She was absolutely convinced that there was in many women, as there was in many men, an innate love of machinery.'

Mr James Driver of the Technical College, Loughborough, said that during the latter part of the war, women had demonstrated in a most remarkable manner their ability to enter the engineering profession successfully. . . . There was little doubt that an engineering factory could be completely and successfully 'manned' by women, and it would be exceedingly interesting to see the experiment tried.

[\*NECIES = North East Coast Institution of Engineers and Shipbuilders]