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THE EMPLOYMENT OF WOMEN
IN MUNITION FACTORIES.

By MISS O. E. MONKHOUSE, M.B.E., B.A. (LOND.).

Introduction—At the outset the Author wishes to acknowledge the compliment accorded to her by this Institution of being asked to give her views on the employment of Women in Engineering Works. Her appreciation is increased in so far as the request preceded the passage through Parliament of the measure giving the franchise to women.

At the beginning of the war it was an exceptional thing for women to be employed as general machinists and fitters in engineering shops, but the demand for a greatly increased supply of labour of all kinds for munitions production, and at the same time the necessity for conserving the man-power of the country to the fullest extent, made it necessary for the Government to turn to the largest source of supply of unskilled labour, namely, women. The successful employment of women in engineering works depends not only on the unskilled woman, but in an almost equal degree on the skilled man, and the employer.

[THE I.MECH.E.]

The Employer.—The successful employer of women labour faces the question of dilution squarely, and recognizes at the outset that the psychology of the woman worker is different from that of the man. Next he fixes on work suitable for his new type of employee, and then determines the quickest and easiest way to train her in the work. He assures himself of the extent to which the men will co-operate, and is always careful to provide suitable shop conditions and plant, etc. Having made these preliminary arrangements, he realizes the necessity for carefully choosing the right class of labour, and his next step is to appoint a woman of experience to engage and look after the women, and to select as their technical overseer a foreman who he knows is sympathetic with his new venture.

The Skilled Man.—The skilled men have to do the technical training, and have to use all their brains and skill in order to train inexperienced women. They have to sectionalize work, adapt machinery, and simplify operations so as to make it possible to employ women. In their hands is largely the power to oppose and retard all progress by women on skilled work, because at the outset hardly a single woman is in a position to know when obstacles are being placed in her way. She perforce has to rely entirely on their generosity, and her position in engineering shops to-day shows that she has not relied in vain.

On the other hand, it must be remembered that every man does not make a teacher, and that every teacher of men is not necessarily a suitable teacher of women. Thus the unequal success of women in different shops is due in a measure to this cause as well as to antagonism on the part of the men.

The Unskilled Woman.—The successful woman-worker in an engineering works has a great deal to learn, because in addition to learning her work she has to acquire correct work habits, and face obstacles both necessary and unnecessary which are constantly put in the way of her becoming efficient.

There are, however, three grades of unskilled women who must be taken into account:—

- (1) The educated type.
- (2) The domestic type.
- (3) The ordinary factory type.

The educated type come with trained brains; they know how to learn and how to apply their knowledge. They probably have mathematical training and can be taught in a very short time how to use a slide-rule, a micrometer, and other gauges. Fine limits present no difficulty to them, and in a sense they may be regarded as already half educated for the better class of engineering work.

The second type, namely, the domestic type, drawn mostly from the daughters of small tradesmen, generally have a good deal of sound common sense, are reliable, and enjoy, and so aim at securing, some position of authority. Such people train quite readily into good charge-hands and forewomen.

The factory type are different from either of the other two—they are mainly concerned with making as much money as they can, and preferably on piece-work. For the most part they resent being put on to a new operation because, every time they learn anything fresh, it means a temporary set-back in wages. It has therefore been found best to employ such workers on purely unskilled work of a repetition nature.

But no matter what the type of unskilled women, it must always be borne in mind that their success depends largely on the judgment of the management in selecting a good class of women labour. At the present moment there are, roughly speaking, close on 1,000,000 women employed on the production of munitions of war.

The introduction of all these women into engineering shops meant that a great many difficulties had to be overcome. These may be briefly summarized as follows:—

- (1) A very large proportion of the women employed not being accustomed to factory life and discipline.
- (2) The majority of works managers and foremen not being accustomed to managing women workers.
- (3) The shop conditions for the most part planned with a view to the employment of men.

(4) The use of the machinery to which women have hitherto been unaccustomed.

(5) The difficulties of maintaining discipline in a mixed shop and in entirely female shops staffed by women of no previous factory experience.

(6) The long hours.

(7) The question of physical strength.

Many of these difficulties have been overcome by careful selection of suitable work, a careful choice of labour, proper shop organization, conforming to definite welfare standards, installing or adapting plant suitable to women's use, supplying proper training facilities, sub-dividing skilled work and adapting the hours of employment in accordance with the class of work done.

How Women have reached their present Skill.—At the stage which women have reached at the present moment in engineering, nothing but harm can be done by praising their powers too highly, but there are many individual cases where women have shown very great ability, and have acquired a knowledge of a certain branch of engineering work in excess of what would have been learnt by an apprentice in the same period under pre-war conditions. This state of affairs may be attributed very largely to three causes :—(1) Women have been definitely taught, whereas the apprentices had to pick up their trade. (2) Women have, for the most part, been intensively taught everything in the shop itself under production conditions rather than in the school. (3) The conditions of the time have actuated and spurred on everybody to greater effort, from patriotic motives.

Training of Women Workers.—There is little doubt that the advantage of getting their training under production conditions has been very largely instrumental in considerably speeding up women's training, and the Author would like now to consider some of the methods in use for training women workers.

Women Trained in Works in a Separate Shop.—It is extremely

difficult to start women in the same shop with men, unless the latter are in sympathy with the movement, and experience has proved that the only satisfactory way is to start women in a shop by themselves under a sympathetic foreman until they have proved themselves. In illustration of this the Author can quote a firm who, up to last April, had no women bench-fitters on aircraft work. They have adopted the above plan, and there are now 200 women fitters in the shop controlled by women charge-hands, all doing exceedingly well.

Overcoming of incredulity on part of Management.—Another type of case which should be mentioned is that of firms who cannot believe that women can do anything but purely repetition work, and regard a woman fitter, tool-turner, or tool-setter as an impossibility. It therefore is no use telling them that they must upgrade their women on to better work; they have to be shown that women are available in numbers who can do such work. In such case the Ministry often sends to the firm an expert woman demonstrator. She will first of all do the job herself in the shop to prove its practicability, and she will then continue to assist the firm by training some of their best operators or helping them to select others who are suitable. There are many firms which, having been assisted in this way, have become some of the most successfully worked shops in the country, not only from the point of view of percentage of women labour but of record output as well.

Other successful methods of training Women Workers.—It would take up too much time to go through at length all the various methods which have had to be adopted in order to make women efficient in the shortest possible time. Government training schools have done much by supplying a nucleus of semi-trained labour to shops desiring either to make a start with women labour or to introduce women on to some new class of work. Just a few large firms have done the ideal thing and set up their own training schools, from which they have a continual flow of semi-trained labour always ready to draw upon.

Characteristics of Women.—All consideration of women's work must be accompanied by a careful appreciation of the mental and physical characteristics of women. They have shown great adaptability and natural skill in successfully undertaking work of an entirely new character, but the varying degrees of success points to the necessity for thoroughly understanding their peculiar temperament if the best results are to be obtained.

Shop Organization.—Firms, who with male labour have been thoroughly successful, have failed when forced to employ women labour, thus proving that they did not understand their new employees. Other managers have not recognized their own failings clearly, and numerous cases can be quoted where the want of success of women labour has been traced to defective shop organization. By this term is meant the question of supervision and direction of the work in the factory—work usually performed by foremen and male charge hands. A foreman may be an admirable foreman of men, and at the same time an unsuitable foreman for women, apart from the question of his technical ability. There is no doubt that women do need special management, and it is folly to disregard the human element, as some do, by asserting that if women are to be employed on men's work, they must be treated the same as men. In one sense this is true. Discipline and strict adherence to work should be expected from women just as much as from men. As a rule men are either too lenient or too stern in their treatment of women, or too busy to study their peculiarities, and experience has shown that women should be controlled and organized by their own sex if the best results are to be obtained.

Shop organization, however, even when performed by women, may be quite unsuccessful if proper judgment is not used when selecting people for this work, and this brings up the general question of the choice of woman labour.

Choice of Labour.—There is no doubt that generally speaking a woman is a better judge of a woman than a man, and successful

firms have realized this and have appointed an experienced woman supervisor, to be responsible for engaging all their women labour. Very recently a case came to the Author's notice of a factory where one side of the labour was chosen by a woman and the rest by a man. There was great complaint of the efficiency of the latter, but none of the former. Investigation showed the cause that those women who were "turned down" by the woman supervisor were generally engaged by the man.

Ordinary Labour.—In the choice of ordinary operatives, stability of character and suitable physique must be the main considerations, but different characteristics must be taken into account when choosing forewomen and charge-hands. It is most essential that such people should have shop experience coupled with a certain amount of technical knowledge, and a thorough knowledge of how to manage women, and ability to hold their own in the shop. Women taking up this work must have tact and discretion, and the necessary power to enable them to work in harmony with the shop manager, whose authority should not be interfered with. Generally speaking, the most successful forewomen and charge-hands have been drawn from the more educated classes. For it must be remembered that women as a whole have been introduced very quickly, in very large numbers, without proper training or proper discipline, and it needs someone with powers of leadership and organization to get the women labour going on a proper footing.

Welfare.—Placing in factories in such large numbers women, many of whom have never been accustomed to factory life or conditions, has also called for special consideration of welfare conditions on the part of the employers. In considering this question two points of view must be taken in account: (1) Effect of Welfare on Production; and (2) Effect of Welfare on the Race.

Effect of Welfare on Production.—Employers have now for the most part fully realized that to give their women good welfare conditions is a sound business proposition. Without such provision

they cannot get a good class of labour. The unwonted heavy muscular effort and constant strain through which they are working makes it essential that their off times should be restful, if good work is to be done after the break. Good canteen accommodation also is most important, and there have been cases where managers have found that to provide one good meal a day free of cost has been more than repaid to them in output.

Welfare on the Race.—But quite apart from the effect of welfare on production is the effect of welfare on the race. From the national point of view this is the most important aspect to consider. For this reason the Health of Munition Workers' Committee was formed, whose special care was to safeguard any deterioration of the race which might perhaps accrue from women being compelled to work in all great industries. They have considered carefully (1) the hours of work; (2) rest periods and provision for meals; (3) sanitary conditions of the factory; (4) physical condition of women workers; (5) questions of management and supervision.

Hours of Work.—With regard to hours of work, experience has shown that a reasonably short shift is the most successful, producing less industrial fatigue as shown by few accidents, better timekeeping, and undiminished capacity of the worker towards the end of the shift so that a better average output is maintained. Another point in favour of shorter hours is the fact that a better class of labour is tempted to join the ranks of munition workers.

The other problems the Committee have considered in full detail, and the result of their investigation has shown that the nation is under a definite obligation to consider women's health and comfort in the factories if they are to protect and safeguard their position as the mothers of the race. Experience has shown that wherever there has been proper consideration for women's welfare in factories that there has been not only no decrease in healthy physical development, but a decided increase in mental capacity. It has been an enormous advantage for women to have had this opening into a wider field

of skilled and semi-skilled work, and the country has benefited by a tremendous increase of industrial efficiency.

It must be remembered that a woman's work is not ended when she leaves the factory. On her largely depends the life and happiness of the nation in creating and developing a happy healthy family life, and it is her privilege to care for the physical and spiritual welfare of the race. Added industrial efficiency therefore at the expense of women fulfilling their primary duties in their homes and to their children cannot result in anything but national disaster, and it is a sacred duty of the State to ensure that women are only used as wealth producers in so far as it does not affect the healthy development of the race.

Discussion on Friday, 15th March 1918.

Miss MONKHOUSE said that, though her remarks were based on the experience of her work in the employment of women in munition factories, she spoke that evening as a private individual and in no sense in an official capacity.

The PRESIDENT heartily congratulated Miss Monkhouse on the reception which she and her Paper had received. He placed her first because the event of the evening was the appearance of a lady as the Author and reader of a Paper at a Meeting of the Institution of Mechanical Engineers. It was doubtless one of the unforeseen consequences of the war, but it was also a sign of the times. He put her Paper second because there was not much to differentiate it from the ordinary run of Papers that were read before the

Institution ; it was on the same level. In giving this verdict, he hoped Miss Monkhouse would not feel that he was treating her hardly. The Paper dealt succinctly from a woman's point of view with some of the difficulties attending the introduction of women's labour in engineering works. It told something of the special arrangements which had to be made for their health and comfort, and something of the special organization which was required to adapt manufacturing processes to women's labour and to the capacity or incapacity of women, he did not know which to say.

The Paper also touched upon the much more important question of the effect of this kind of work on the future of our race, and upon the comfort and happiness of the homes from which these women came. That side of the question was very apt to be overlooked and thrown into the background, and he earnestly commended the last paragraph of Miss Monkhouse's Paper to those of her sisters who were clamouring for the work and privileges of men, despising the far higher work which nature had allotted to them, and the great privileges which their womanhood conferred. All these subjects afforded ample opportunity for discussion which he hoped the members would take advantage of. At the same time he hoped that nothing would be said to aggravate the sexual and industrial difficulties which the nation would shortly be called upon to overcome. They wanted the results of experience from those who knew, suggestions as to the inferences to be drawn from that experience from those who thought, but let there be no controversy as to the right of women to take men's work or as to the policy of enforcing the pledges given by the Employers to the Trade Unions. The Employers would keep those pledges until the Unions released them and substituted agreements more beneficial to both sides. Those agreements must be the work of the Employers and Employed themselves, and suggestions and interference from outside bodies would do no good and might do irreparable harm. There were several lady visitors present and he would very much like one of them to open the discussion.

As no lady indicated her intention to speak, the PRESIDENT called upon Mr. Charles Wicksteed.

Mr. CHARLES WICKSTEED said he would deal with this matter as a man, and an engineer, not only from the point of view of the work which women had done, but as to their future in the engineering trade. His own works were small and he had only 100 girls in his employ, the town having about 30,000 inhabitants. He would state his experience for what it was worth.

He had provided lavatories with soft and hot water to wash with, as no girls had been employed in Northamptonshire in the engineering trade before, and he did not wish them to be laughed at for going through the town with dirty hands. As soon as he could, he provided them with a splendid canteen; and a dormitory for the country girls. They were happy and healthy and told him they had improved in health and strength since they had been with him. He merely mentioned these facts to show that as far as he knew they were being employed under the most favourable conditions.

They were engaged in manufacturing 4·5- and 6-inch shells complete, except the copper bands. It had given him much pleasure and also much trouble in getting the place satisfactorily to work. Considering what could be reasonably expected of the girls they had done exceedingly well, and it was one of the happiest experiences of his life to see how quickly they took to the work, how neatly they handled the shells, and the zest and interest they had shown in their work. He had had all sorts of troubles, however, apart from the troubles of the Government inspection and the inexperience of his staff and the frailties and complete inexperience of the girls. He hoped his foremen never swore, but one of them came to him one day and said, "If I had known as much about women before I was married as I do now, I do not believe that I should ever have got married." For some time the things the girls were capable of doing were incredible. He often could not possibly conceive how they managed to get wrong. Traverses were left in and lathes broken wholesale, until in his aggravation he had said one day, that although it was difficult to make a thing "fool proof," it was impossible to make it "girl proof." They had been improving ever since, however. Belt traverses had replaced

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gear traverses, and better equipment, better discipline and more experience had produced better work. Each girl turned out two 4·5-inch shells complete every day or one 6-inch shell complete with the noses. The wasters were less than 1 per cent., and things were going on as nicely now as they formerly went wrong. He worked three shifts and only had one tool-setter for twenty-five girls. At night there was only a labourer and a tool-setter in the place, and yet the night shift turned out within 5 per cent. as much work as the day shifts.

One of the troubles that continued was the bad time-keeping of the girls. He had on an average two girls absent in every shift; if this were even it would matter little, but sometimes there were five or seven absent, making it quite impossible to keep going certain machines difficult to work. He found the women lost four times as much time as the men did, and fifty out of the 100 left in twelve months, against ten out of the 100 in the case of the men. This comparatively bad time-keeping of the women was inevitable unless one were to assume:—

First: That they were as strong as men.

Second: That they must neglect their domestic duties at home and the care for their own constitution, or as Miss Monkhouse expressed it, "The welfare of the race." The girls were not so truthful, or so honest, or so reliable as the men, and now and then they seemed to lose themselves.

Mr. WILLIAM H. ALLEN asked if Mr. Wicksteed was alluding to his own girls.

Mr. WICKSTEED replied in the affirmative, and said he had heard rumours that girls in other works were no better.

He had no sympathy with the nonsense published in the newspapers about the prodigies women had become, and how they could be taught in a few weeks that which had taken many years for a man to learn. Miss Monkhouse said, that "the tool-setter was as important as the woman worker." She might have said, "Without the skilled tool-setter the works would be closed in a

day, and without the skilled mechanic behind the tool-setter they would be closed in a week." The fact of the matter was, the girls were not engineers at all, they were only tool attendants; and when it came to the question as to whether they ever would be suitable for the engineering trade, he had come to the conclusion that, although women would always be able to do the fringes of engineering work to advantage, such as duplicate work involving light inexpensive machinery or hand work, they were entirely unsuited for engineering proper. Engineering required a long training that could never be given to women. If six boy apprentices were taken, five of them would go through their time; if six girls were apprenticed none of them would. They would tire of the work, their mothers would take them away for some unknown reason; the doctors would say the work did not suit them; their sister-in-law would want their help or the mother would be ill; they would get married, or leave for various other reasons. The one thing that would be certain would be, that none of them would go through their apprenticeship. The present girls put on at high wage to work a single operation on a special machine had no chance of becoming engineers. Contrast her position with a boy who was sent into the shop at a most receptive age at a nominal wage, and put on a simple job on his own account, or as a help to a man—his eyes open desiring to be doing and attaining something. He, naturally, soon became self-helpful and experienced in the rudiments of engineering, on which foundation he rose step by step after years.

In conclusion, Mr. Wicksteed said that men need not be afraid of the competition of women as engineers, and that he was convinced that the girls would all be dispensed with after the War; so convinced was he of this, that he was co-operating with the girls to provide them with a reasonable weekly allowance for the time of unemployment that might follow their dismissal. The girls paid 3s. a week and the firm contributed a like amount. The unemployment allowance being from 10s. to 15s. a week as desired, so long as the fund lasted.

Mr. ROBERT B. CREAK said there were three points in the Paper

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which had struck him as important. The first was that Miss Monkhouse had mentioned the value of training schools in bringing women to a high point of efficiency. If that were so in the case of women, might it not be much more so in the case of boys, after what they had heard from the last speaker as to the natural capacity for mechanics of boys versus girls. The second point was the value that had been found in the employment of women on shorter shifts. He was inclined to think that the same value in the matter of increased output would also occur if men's shifts were somewhat shorter, especially in the early morning. The third point that had come out in the Paper was the value from a money-making, and an output point of view of welfare work. Here again he thought the same would prove to apply to men's work as well as to women's.

Mr. JAMES HARTNESS (Past-President of the American Society of Mechanical Engineers) said that this was the first opportunity he had had as a Member of the Institution to be present at one of its Meetings and he could not resist the temptation to bring a greeting from the Council of the American Society of Mechanical Engineers to the Council of the British Institution, and a greeting also from the members of the American Society to the members of the British Institution. He also further wished to greet them as an individual member. The greatest part of his work had been in connexion with the organization of the American Society, but the best part of his life and the most stimulating part was when he had no duties to perform which prevented him from mixing with his fellow members, and when he could enjoy the real life and benefits of the organization.

He would like to say a word on the Paper. He had been here for a month, as some of them might know, in connexion with aircraft standardization work, and during that time he had seen things which had caused him to come to some very definite conclusions with regard to women's work. If he could take back to America an impression of what he had seen in that direction, it would have a most stimulating effect in emphasizing to

America the things which it was necessary for her to carry out. He had been through the shops in this country, and he had seen men work and he had seen women work in an emergency. He had lived in the shops for many days, and he knew what the work was. He was convinced that women could not work that way for money. There was a something far higher than that; the women thought of the service they were rendering to England, and that must not be forgotten.

As to the number of men and women who left the shops during the year, as mentioned by the first speaker, he thought the position would be the same if the conditions were reversed. Let them assume that the women were accustomed to the shops, and that it was new to employ men there. In America they lost 50 per cent. of the new men who came in, and it was not to be expected that women, who were new to the work, would show any less percentage. He could not speak to the other points in the Paper, but he could not resist the temptation to give a greeting from the American Society to the British Institution as he was going back to America after a short stay in this country. He had been here some fifteen times before, and was a guest of the Institution in 1910. It had always been a pleasure to keep in touch with the Institution and to keep both bodies in touch with each other.

Mr. RICHARD W. ALLEN, C.B.E., said he had hoped to be able to prepare for comparison his experiences of two years' working as an employer of women. He would, however, like to tell Miss Monkhouse that the large number of women in his employment had his entire sympathy. The Paper had evidently been prepared by one who knew the subject thoroughly. It might be regarded as a Paper giving the years of experience of the difficulties that had to be encountered from day to day and week to week, and if the majority of employers in munition factories were asked to write a Paper on the employment of women, it would practically be word for word what Miss Monkhouse had said.

The Paper dealt with the subject from all points of view, and very rightly the employer was first mentioned, because success very

(Mr. Richard W. Allen, C.B.E.)

largely depended on the sympathy of the employer. Unless that existed, it could not be expected that sympathy would be extended by the management and foremen. He well remembered the earlier stages of the war when the question of the difficulties of obtaining men in munition works arose, coupled with the request of the Government departments to increase production and take on new production. His firm had a visit from a certain gentleman from the Ministry of Munitions who told them they would have to employ women. It was rather a knock-down blow at first and they did not see how it could be done, but loyally they agreed, and explained the position to the various foremen, who acted like sportsmen, and the firm had never looked back. His firm was engaged on complicated and difficult work for the Navy and also for the Air Service.

It had been remarked by previous speakers that women might be suitably and easily employed in repetition work to a very large extent, but experience had shown that if the employers exercised patience and taught the women properly, they could be equally well employed on general engineering work as in manufacturing. There was a very wide difference between engineering and manufacturing, but if they had patience with the women they would in the end be successful. A number of people were against the employment of women, but this feeling arose because they had not given them a proper chance.

Reference had been made to the difference in work of the women and apprentices. In the past, and in many cases, apprentices had been carefully taught, but the women had been brought into some factories with little or no tuition, consequently in some cases they had been rejected as being of little use, whereas if they were properly taught—and it was most important that they should be properly taught—he believed success would be obtained with women in engineering as in manufacturing work.

It might be interesting to give an idea of the work that women were engaged upon at the works with which he was connected. An example was a complicated aviation engine. His firm had prepared an exhibit for the Ministry of Munitions and it was on show

somewhere in London, and he advised a visit of every member to this exhibition to inspect the examples of what women could do after they had been trained. The work was performed most accurately and to very fine limits. They were also dealing with a variety of work for marine purposes including steam-engines, steam-turbines, oil-engines, etc., for the Admiralty, and they were training women to blade the turbines and to a considerable amount of various fitting work, with great success.

Reference had been made during the discussion to the question of turning women out as engineers, and although this could probably be achieved, he understood the Paper under discussion was confined to the employment of women in Munition Factories.

With regard to the three different classes of women mentioned in the Paper, he had only had experience of the first and the second, and he could entirely endorse what was said in the Paper with regard to women who had received a higher education. They certainly did come to the top very much quicker, and they were able to grasp the complicated nature of the work they had to deal with better than those who had received little or no education. Perhaps it was unwise to pat the girls on the back too frequently, but being a man who admired the way women had taken up this work, he could not help doing it. When they attended to their work diligently and turned out the work expeditiously, it warranted some little approval now and again; but it was desirable not to do this too often as they were inclined to be a little jealous. He was quite convinced, as was mentioned in the Paper, that one of the most important things was to make the girls happy while they were in one's employ. They should be given good dining halls and all the various conveniences, and in that way they could be made to realize that they had their employer's sympathy. Then he was certain the women would never fail an employer. In conclusion, he assured the Author that as far as his firm was concerned, they would do everything possible to help the girls forward.

Mr. WILLIAM RANKINE remarked that, although a great deal had been said of what women were doing in the factories, nothing

had been said of what they were doing in the training centres. Miss Monkhouse stated that probably the greatest success had been attained where the training school was in the works. That might be so, but many modern workshops had not the accommodation for establishing training centres, and as a result the women must mix up with factory conditions right away, and find opportunities for picking up what was necessary for them in the factory itself. In the training centre, however, away from the works, the women were first medically examined, and that was an essential feature, because it resulted in unfit women being rejected at once and not being disappointed after several weeks' work. If the girl was found medically fit, she was sent into the centre equipped with modern machinery and in charge of skilled men and trained teachers. An engineer might know his subject very well, but knowing a subject and imparting it to others was quite a different matter, and it was in this way that the girls often did not get so well trained in the shop as in the centre. Again, the advantage of training centres was that in dealing with women of higher education they were dealing with women who had been accustomed to a refined life; and if a girl went straight into the factory she was spoiled through the sudden changed conditions, although she might have the making of a good worker in her. In the training centre she became gradually accustomed to the different conditions in which she would have to work.

Again, if a girl went straight into the factory she might meet with some opposition, and probably it might also happen that the tool-setter under whom she had to work was not sympathetic, and that would upset her and spoil her chance of success. With the training centre it was different. The instructors were there for a definite purpose, to train the women and nothing more. When they were trained they went into the factory, and even though they might then meet with some opposition they were more confident and better able to hold their own. It was his duty to get into touch with employers and get to know the class of work for which they wanted women. He visited the factory, saw the work and examined the tools, and then proceeded to the training centre and

set up machines to train girls for this work. When they got to the factory the girls could generally set up their own tools, but it did not follow that those women should be expected to do another class of work.

When difficulties occurred in the shops, the girls always had the training centre to fall back upon. They often came back after working hours for help, and they worked there to get over these difficulties. They did not get paid for that, but did it for their own satisfaction and for the benefit of their employer. They also were taught to use various types of micrometers, verniers, depth gauges, etc., whereas in the factory there was usually no time for the foreman to trouble about teaching these things. In the centre there were facilities for teaching the uses of all these types of measuring instruments, and it was by this means that the girls went into the factories with a confidence which they did not possess when starting without any previous training.

Mr. WILLIAM H. ALLEN (Vice-President) regarded the Meeting as epoch-making, because it was the first time that a lady had read a Paper before the Institution. He hoped it would not be the last. It was a Paper of particular quality, and he did not exactly agree with the President in what he said with regard to it. The ordinary run of Papers before the Institution were scientific, but this was the first Paper on Labour that had been presented to the Institution. He saw eye to eye in everything that Miss Monkhouse said, but when she said that everything depended on the sympathy of the foreman, he thought they must begin with the directors. The directors must have sympathy, and it must pass down from them.

A necessity beyond all others was a proper supervisor. It was necessary to get a woman, who should be a mother and a sister, to understand the girls and to put them in their proper place in the works. His son, Mr. Richard Allen, had omitted to mention that the firm employed 900 girls. Two years ago Mr. Lloyd George sent some one down to their works to ask how many they were employing. They thought they could then employ about fifty, and

little anticipated that in two years they would be employing nearly a thousand. It was from his experience of this number that he was able to say something of the advantage of having a good supervisor. In Bedford they had been fortunate enough to get Mrs. Lilly, who had chosen all these girls and placed them in their different positions, and they had not had to reject one single girl that she had engaged. There had been no trouble with the girls in any way; provided they were left alone, they did their work.

He could not quite understand from Mr. Wicksteed whether he was for or against the girls. He threw his arguments in right and left, but on the whole he thought he was for the girls. He was not with him, however, in thinking that this class of employment would cease for them after the war. Far from it, and he would give the reason. We were a sea-faring nation and our little island could never support itself, notwithstanding all that had been done by the Board of Agriculture and by our farmers who had made two blades of grass grow where one blade grew before. We should never be able completely to provide ourselves with food, and we should have to purchase our food with our industry. Before the war the Germans had most of the trade; the Mother Country was not large enough in industries to supply all the markets which could buy her goods. What was going to be done after the war? Surely they were not going to allow the Germans in again. Therefore they must consider the propriety of employing girls to help in industry in the future as they were doing at the present time.

Miss Monkhouse said that there were one million girls employed in munition factories, but Mr. Kellaway had stated that the number was a million and a half, and he ought to be right. He would therefore take that figure. They had come literally out of the streets and had not been away from their homes before. He suggested that girls should be properly apprenticed; why should they not be? It might be a great change in the status of England to do such a thing, but it would be to our enormous industrial advantage to have those one and a half million women helping in the engineering industry after the war. He hoped the trades

unions would not be offended with him for making such a suggestion. There would be work enough for everybody, both men and women, for years to come.

He only wished to refer to one other matter, and that was the remark in the last sentence of the Paper in which the Author urged that women should only be used as wealth producers in so far as that did not affect the healthy development of the race. That was most important. He hoped we should never go back to the pre-Shaftesbury days. They might all remember that the Earl of Shaftesbury, one of the greatest philanthropists who ever lived, spent the whole of his life in ameliorating the conditions of children and women, and upon his memorial in Westminster Abbey were inscribed the two words "Love" and "Serve." Think of the degradation of women that took place in Wales in the "Sixties." He had seen them in the mines himself, on their knees with chains between their legs, dragging the trams along after them. Surely we were not going back to anything like that?

In all works like his own where the work was plain and straightforward, the conditions were good; but in shipbuilding, for instance, it was a different thing altogether. German girls were working on shipbuilding at least a year before we started. Sir Lynden Macassey said he could not do without them as so many men had been taken away and girls had to be put on. It should be seen to, however, that women were not overworked so that they could not bear their womanhood. Unfortunately in the munitions book recently published there was a picture of a woman striker. It went to the heart to see this, but there was the woman all out of shape and form. What could she do with her womanhood when she was compelled to labour like that, just as they did in the pre-Shaftesbury days.

He invited Miss Monkhouse down to his works in order that she might find all the fault she could, because it was only by so doing that they could improve. She could then see the way they treated their girls, and when he was asked how he treated the girls his answer was, "Like my own daughters." He tried to do the best he could for them.

Mr. L. A. LEGROS said he had had a little experience in the employment of women in pre-war days on extremely accurate work, and therefore, apart from the knowledge he had gained at the Ministry of Munitions, some remarks from him on the Paper might be useful. In the first place the work which he endeavoured to get done by women with success was that of cutting the very accurate punches for producing printers' type. It was work which had to be done to the limit of a quarter of a thousandth of an inch over irregular and curved outlines. It was extremely difficult to reduce that work to a matter of dimensions and figures, and in order to get this work done by women he was obliged to train women himself. In fact he trained four, but to be quite honest only made a success with one; but that one was able to train others for several single operations, though not for the whole of the operations of either trade. It took him about two hours a day for six months, but he trained that woman to do three trades, the pay for which had been £5 10s., £4, and £3 10s. per week respectively, and therefore what might be called highly skilled trades. After the successful girl had been trained she could do any particular job in all three trades. In cutting these punches, whereas the best time by men before was 1 hour and his own time was 23 minutes, he had seen this girl cut one in 15 minutes. He admitted that the machine had been altered considerably from the style of machine which the men had worked with. It was made more fool-proof but not, as one of the speakers had said, "girl proof." The girl had to use her intelligence the whole time in order to avoid breaking the point of the tool, and she had to do her own sharpening and tool-setting. Then he came up against the difficulty that the men objected very strongly—this was in pre-war time, and so he was at liberty to talk about it—to women doing the work. The first thing they did was to supply soft cutters. The woman in charge showed him one of them and he told her to do nothing; but he hardened them himself, and next day the foreman came and complained that the women had been trying to harden their own cutters. Eventually that foreman found he was in the wrong place and he had to go. The fact that such work

had been done accurately and quickly by women had been a very great help to him afterwards in the Ministry work, because it had opened his eyes to what women could do. Women had been employed as surveyors on railways in Russia, and they could do accurate work in biological laboratories dissecting under the microscope; so long as they were not expected to lift weights of more than, say, 56 lb., or to exercise more strength than would be expected of a boy of 16 or 17 years of age, women were quite capable of holding their own for care, speed, and accuracy.

Coming to the work that women were put to in the fitting shops, he said there was a very great deal of bad training done by people who ought to know better. In many works women were put on to filing up pieces of plate. Instead of having the line marked out and being shown how to hold a file, it frequently happened that they were given pieces which were required in large numbers, and were supplied with a steel filing gauge. If a skilled man were to use a filing gauge he would put the work in the vice on the front side of the gauge, and only just touch the gauge with the file when he got down to the size. In quite nine works out of ten he found the foremen did not trouble about explaining this to the women; the only idea was to get the work done with the minimum of immediate trouble. The women were encouraged to use the hardened steel gauge on the near side of the work, with the result that the plate chattered and the file got worn down with rubbing on the hardened steel filing-gauge. He examined the reason for this because it occurred in so many cases, and the foremen said it was difficult to get true work if the women were allowed to put the job on the other side of the filing gauge, as they always filed uphill. He had had to tell the foremen in all these cases that the reason was because the vices were put at the same height as for men; they had not realized that the correct height for a vice was the height of the elbow, and for women this might mean two inches lower or more according to the standard of labour in the district.

As a sample of difficult work done by women, in the ordinary course, he mentioned an instance relating to the wire stays for

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aeroplanes which had a small square formed on them in the process of manufacture just under the screwed head, by a planishing operation similar to that adopted for making a sewing-machine needle. To file $\frac{1}{8}$ th inch square each way was not quite a beginner's job. A number of these wires were wanted urgently, and the lady in charge of the fitting shop said she would get them made by her girls who had been intensively trained. An American came round the works and said that, although he had seen many things done by girls in this country, he had never yet seen a girl who could file flat. They were able to show him in this shop three or four girls on the work he had mentioned, and measurement showed that their work was being done square and flat and to gauge for size.

With regard to the different classes of work suitable for women, for such rough and heavy work as driving overhead cranes a circus girl was the ideal sort of woman. For light and accurate work, girls who had been ladies' maids, or who had worked on delicate lace-work, turned out extremely good at small work and marking-off. If they could work on such flexible, stretchable material as textile fabric, they could do better at marking out on harder materials such as wood and steel.

Reference had been made by Mr. Wicksteed to the time taken on shells, but the times which he had mentioned were comparatively very slow compared with what he (Mr. Legros) had seen women do with special machinery. The average machining time of a 9·2-inch H.E. Mark IX shell, taken over a shift, including making base-adaptor, pressing and turning copper band, and riveting and facing off base-adaptor, was 170 minutes, of which 45 minutes were occupied in machining the base-adaptor; that was less than half the best time taken in other works by men, and the shell-works that was making this record contained 95 per cent. of women. This remarkable result was, it was true, largely due to the machines, but also to the quality of the women labour employed, and to the efficiency of the management.

There was one point in the Paper which he would have put differently if he had been writing on the subject himself, and that

related to the classes of women capable of being employed on munition work. Miss Monkhouse had alluded to educated women in one class only. There were two classes of education; one was the ordinary school education on classical lines which could be paid for by the yard, so to speak, and the other was the manual and technical education which was so much harder to obtain. He could not have obtained success in the difficult work connected with printing type with girls of the mathematician type because the most important matter was to use the hands exactly in the right manner to produce the right effect; this could only be done by girls who had been trained as artists, sculptors, engravers, woodcarvers, etc.

There were women capable of becoming tool-makers and gauge-makers to be obtained by careful selection, but it was necessary to hunt them out of the schools of sculpture and other technical schools round the country. In this way girls had been obtained who were capable of making aircraft propellers, work which was now being done throughout by women, in certain works, and work which a short time ago was considered to be exclusively that of the highly-skilled pattern-maker.

The attainment of specialized skill was largely a question of intensive training, and this had been alluded to as being the right method for men as well as for women. In that connexion he might mention that at Panhard and Levassor's works in Paris there was a school attached to the works, run by old and disabled men, through which all the apprentices were passed; they had to spend so much time in the school in elementary work including fitting, turning, reading drawings, marking-off, pattern-making, etc., before they were allowed into the shops. When they had finished their apprenticeship they were definitely discharged, to acquire broader knowledge elsewhere for at least two years, in order that they should gain experience of other works and other methods. He had been told that the company had more than a sufficiency of their own apprentices returning to them after a few years' absence with added experience of other works.

Miss Monkhouse had alluded to the necessity for care in

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selecting women. This applied even more strongly to the selection of the woman in charge of the welfare section. At one works the speaker had visited, unfavourable reports had been received. The lady superintendent was a highly educated woman in the academic sense, but not in the ways of the world. The works manager, who had engaged women previous to her appointment, had only one rule—"no laundry girl need apply"; this had not been followed by the lady superintendent, and her choice had often proved inferior to the previous rough and ready standard of the works manager, with the result that the type of worker had not been so well maintained.

So far as his (Mr. Legros') experience went, the best teacher for higher grade women was a sympathetic man with the requisite manual skill, but the best teacher for the rank and file was a woman intensively trained for the particular branch of trade, and the best service and output was obtained from women under female supervision.