

all cases with but little encouragement. When, under pressure from the Government, the ring accepted outside help, in many cases the conditions imposed on the sub-contractors were unfair in the extreme. It had been just as difficult to persuade the armament ring to give up what they thought was their monopoly, and to bring in outside works to help in the production of munitions, as to persuade the trade unions to forego trade customs and allow outside sources of labour to be employed, such as women and other unskilled labour. In other words, 'dilution of labour,' and the position difficult to effect as 'dilution of labour,' and the position of both the armament ring and the workmen would have been very different if they had consented freely when it became obviously necessary for the safety of the Empire."

The opinion of many employers to whom I spoke in England is that it is a mistake to concentrate the making of shells, guns, aeroplanes or other similar munitions necessary for the protection of a nation in two or three factories, whether Government shops or private firms, who may have laid themselves out specially for this work. Under normal peace conditions these may be capable of supplying all that is required, but under the abnormal conditions which are immediately set up in case of war, the experience in England proves that too much time is lost in getting going to meet the demand, and that the tendency when special work is confined to few shops is to become hide-bound. For example, at the beginning of the demand for shells the difficulties of gauging were thought to be immense, and hung like a nightmare over everybody connected with it; the difficulty of working with micrometers and accurate instruments was thought to be only for skilled mechanics to deal with, but the results have been that gauging is now performed with complete satisfaction by women or unskilled labour, who six months before never saw a shell.

The same difficulties occurred in England with regard to gauges as we experienced here in Australia. One firm I have in my mind took their first contract for shells in October, 1915; they did not get the gauges till January, and could do nothing till then. It was not till March, 1916, that they were able to turn out 1000 shells per week; while by June they turned out 1600, and increasing each month.

The employment of women presented many difficulties owing to their lack of knowledge of machinery; but the Ministry of Munitions early set in operation a scheme of training centres throughout the Kingdom, where the training is free, on the condition that the student undertook to enter a munition factory at the end of the course, which usually consisted of (4) four hours a day, six days in the week, and lasted six weeks, or 144 hours in all. They were then qualified to enter the factories. The nature of the training is divided into bench work, at the vice, and operating machine tools, lathes, milling machines, etc. But students who show marked aptitude are selected for a further course of specialised instruction.

There are over 40 such training institutes, and the number of women trained has run into many thousands. Of course, women can also be taken direct into the factories and trained there, but the better results from the training centres has been so marked that it is a matter well worth continued observation, as the benefit to the industry that such training centres should be maintained as a permanency after the war for the purpose of training unskilled labour for the simple operations is unquestionable.

So far women have not taken the place of the highly skilled men to any great extent, but they have almost entirely replaced the unskilled and semi-skilled men in nearly all branches of mechanical engineering, not excepting shipbuilding. I saw many women working in a number of shipbuilding yards.

The employment of this unskilled or diluted labour has resulted in a great cheapening of production, and the manufacture of munitions may be said to have come through three stages.

At first it was thought best to adopt existing machines, with special appliances and tools for the purpose in view, expecting to soon revert back to normal uses. This gave way to the second stage of constructing machines which, though suited for munition work, might be easily adapted for normal commercial work. This gave way to the third stage of building machine tools of the simplest description adapted for the one purpose of munition making, with the intention that they can be scrapped or discarded when the war is over, and arranged for one operation only. The making of shells is now generally carried out on that plan of one operation by one operator. This has resulted in great reduction in cost. I have one example of a Gaines holder for a shell fuse. (Fig. 1.) This is made by boy

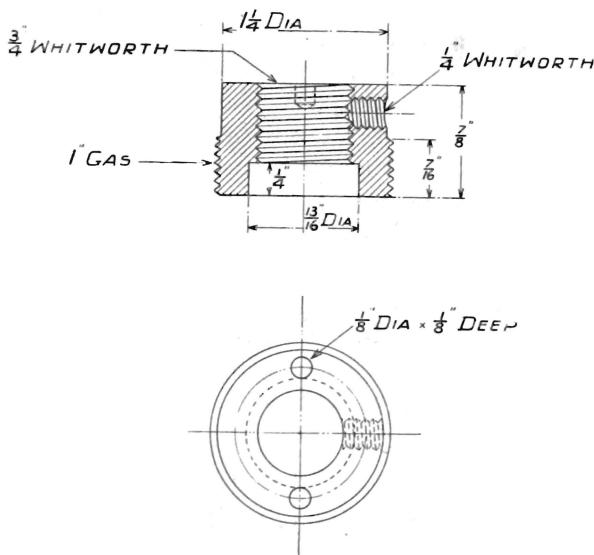


Fig. 1.—Gaines' Holder.

labour; it is cut out of a bar, using a hollow spindle turret lathe. The first boy drills the centre, turns the outside, screws the outside thread, and faces each end, stacks each piece then on a tray alongside him; when the tray is filled it is taken to another boy operating a vertical drill. Here it is dropped into a jig, and the small holes are drilled. From this it passes to another vertical drill, where the side hole is tapped. From this to another vertical drill, where the inside screw is tapped, using a spring tap and self-centring chuck. The whole cost of the labour of these four operations to produce one finished article is less than .3 of a penny each article.

Before leaving the subject of organisation, I would like to refer to something which shows what an advantage a nation has which goes to some pains to adopt a system or organisation, as described to me by one who had knowledge of it—that in Germany for years previous to the war, where practically every engineering shop was controlled by the Government, and had a cupboard in it in which were gauges, working plans and details of such munition work as it was deemed the shop was suitable to manufacture. This cupboard was sealed up, but on certain occasions instructions were received, an inspector arrived from the Government, and a trial trip run once or twice a year for a day or two in the manufacture of these special items—it may be shells or it may be guns. When the Government inspector was satisfied the necessary knowledge had been gained, the operation was stopped, gauges and plans carefully put away again, and the cupboard nailed up. Thus, practically when war broke out, the whole engineering equipment of the country was at the disposal of the Government, and may to some extent account for and explain the meaning of the lavish use of shells and munitions at the beginning of the war on the part of the enemy without producing the exhaustion that was anticipated by those who were not well informed.

— It is a striking fact that the United States of America have recently moved on parallel lines by their legislation for preparedness, having enacted two laws which make a direct appeal to the engineering industrial leaders to co-operate with the Government.

The Army Reorganisation Bill provides, among other things, for the War Department to obtain a complete list of all privately owned plants in the United States equipped to manufacture arms and ammunition, with particulars as to output and capability for making munitions; also list of plants capable of being turned into munition factories, with details of what would be necessary to do so. Further, that the Government were to prepare or obtain dies, gauges, jigs, etc., specifications and drawings necessary to permit the immediate manufacture. And the Army Appropriation Bill, among other things, provides for a council to deal with the re-adjustment of industries to meet military requirements in time of war, to insure increase of domestic production of articles essential in time of war, by the necessary tools, specifications and drawings being prepared and distributed among accredited firms together with annual trial orders which will enable manufacturing plants to turn immediately to the making of munitions in a time of emergency.

From this you will see that America is watching and making use of what she has learned. We must do likewise. Had some such organisation been in force in Australia our shell-making efforts would have been a success, and we would have been in time, instead of being too late, as we were.

The effect of prolonged overtime and long hours on output is being very carefully studied in England, and among other details of the wonderful organisation of the Ministry

of Munitions this has not been forgotten, and a Health of Mmunition Workers' Committee has been at work for some time making observations, collecting data and advising improvements. I have not time in this address to go into it at length, but throw out the suggestion that your Council, or some member, should devote some time to collecting facts and reports on the subject, for submission to the Association. The subject will be found most interesting and instructive. A report issued by the Ministry of Munitions in September last gave Dr. H. M. Vernon's report, to the effect that too long hours injure the output over the whole period of working. Hours of work should be varied according to the character of the work performed.

The doctor's report—which is the result of detailed inquiries made by a number of investigators—declares that in no case should women work longer than sixty hours a week, including overtime.

He adds: "Observations suggest that an equally good total output could be maintained if the actual working hours were reduced to fifty-six or less per week. Illustrative figures dealing with the output of 100 women turning fuse bodies give remarkable results.

During six weeks in November and December the average number of hours worked was 68.2, the relative output was 100 per hour, and the total weekly output 6820.

After Christmas there was a reduction in hours, and the result was that during eight weeks in February and March the average hours per week were 59.7, the relative hourly output 123, and the total weekly output 7343.

Thus, with a reduction of eight and a half hours per week in working time the output was increased by 523, or 8 per cent.

Similar results were obtained in observation of the work done by men. A party of men numbering twenty-seven, and engaged in sizing fuse bodies, was taken, with the following results:—

During the six weeks before Christmas, November 8 to December 10, they worked an average of 61.5 hours a week. Their average relative output was 100, or 6,150 per week.

During the three weeks, May 1 to 21, their hours averaged 56.2, their relative output 124, and their total weekly output 6,969.

Here again, with a reduced working time of 5.3 hours per week the total output was increased by 819, or 13 per cent.

In another report by the Medical Office of Health for Woolwich it is stated that as a result of the increased prosperity in Woolwich, the houses are better furnished, the provision of bedding is more satisfactory, and the children better clothed. With the better financial conditions many of the homes have become improved almost beyond belief, which goes to prove that if we want to eliminate the slum type of human being and the slum type of home, the surest and quickest way is to give the workman a good living wage.

I would also add that the limitation of the hours at which public houses are open, and the curtailment of the sale of intoxicating liquors in Great Britain, have had a marked effect on the increase of output. With the hours in which liquor may be sold confined to from 12.30 to 2.30, and 6.30 to 8.30, there is less opportunity of those inclined that 6.30 to 8.30, there is less opportunity for those inclined that way to waste time and money. A Blue Book published in October gave statistics showing that since 1905 there was a decrease of 13,577 in the number of licensed premises in England and Wales; the total number of convictions for drunkenness in England and Wales in 1915 were 135,811, compared with 183,827 in 1914, the largest decrease recorded in 40 years.

In an official return of convictions for drunkenness the following weekly averages appeared for the first six months in 1915, as compared with the same period in 1916:—

In Greater London	1077	decreased to	569
In Liverpool	207	„	107
In Glasgow	522	„	299
In Leeds	24	„	10
In Sheffield	22	„	11

These are eloquent statistics.

It was several times suggested to me that on visiting the cities and centres where munition factories were located I would see plenty indications of extravagance and display on the part of the workers who were now earning big money. I want to say that in my own limited experience and observations these suggestions were in no way confirmed. I visited many cities in the Midland and North of England and Scotland, and can truthfully say I saw no general indication of extravagance or lavish waste of money; on the contrary, my impression was that the people were spending their money in improving their home life and conditions. Certainly there were indications of more enjoyments, such as picture shows, etc., but one can hardly blame them for that when the average condition of the homes in which the workers of England have to live is remembered.

What did strike me, however, was the fact that people are saving their money in a remarkable way. The National War Savings Committee has proved most successful. Up to September 23rd, 1916, the total number of 15/6 certificates (which are sold at any post office, and are worth 20/- in five years) purchased by workers, was £36,771,463; and of small value Exchequer bonds to a total value of £31,000,000 showing that in these two items alone the people's war savings had actually amounted to nearly £68,000,000, in addition to Post Office Savings Bank accumulations and other sources.

This shows that of the large expenditure the nation is incurring for the prosecution of the war, a vast sum is changing hands and going into the workers' possession, and it will have an immense influence on future developments after the war is over towards preventing a return to the old conditions which obtained before the war.

A most striking development in England is in what is termed Welfare Work, or rather Welfare Supervision.

Previous to the war, there had been many efforts made by individual employers to improve the condition of their employees, but these were more or less of a spasmodic nature, and depended generally on the charitable or philanthropic inclination of one or more members of the firm who instituted them; with the exception of a few notable instances, such as Lever Bros., Cadbury, and Rowntree, they were not successful, and instead of producing good results only resulted in arousing the suspicions of the workers. For example, the profit-sharing schemes which were initiated some years ago proved a failure. But with the war new conditions have arisen. Men of all descriptions, semi-skilled and unskilled, have poured into munition works, while the women have come in hundreds of thousands into works which never previously employed them.

The Ministry of Munitions early saw that if the health of the workers was to be considered, and their efficiency of output maintained, some regulation was necessary that they be safeguarded, and steps were taken to improve the conditions under which both men and women were working.

A committee was formed under the Ministry of Munitions to consider and advise on questions of industrial fatigue, hours of labour, and other matters affecting the personal health and efficiency of workers in munition factories and workshops.

Enquiries are being made into the conditions under which women and young persons are working, and wherever necessary immediate steps are being taken to have them set right. Attention is given to the provision of canteens, cloak room, rest room, and suitable lavatories. All this requires that adequate provision is maintained in the factories to ensure proper conditions for women and young persons who are working. This has been met by the appointment on quite a large scale of women superintendents, or welfare supervisors, whose duty it is to keep a friendly eye on the personal welfare of the employees under their care, and to investigate complaints made by workers, keep an eye on the conditions under which they work, to see to the conditions under which they live, and also to keep an eye on the provision of canteens for proper food, and that too much time is not lost in travelling to and from their work. In fact the scope for a competent, tactful welfare superintendent is almost unlimited. If she is capable, it has been found that she can relieve the employer of a great deal of initiating and difficult detail work: she can hear complaints, and investigate dismissals; she can be used to engage new labour; foremen refer to her questions of discipline, slack work, or bad timekeeping, and the workers have learned to bring their troubles to her. The general opinion of managers when they have been adopted is in favour of the system, and experience seems to be showing that, instead of being an expensive luxury, the welfare superintendent is really a useful investment, leading to economy, by increasing health and efficiency.

There is no doubt that this development has come to stay in the large factories and workshops of England. The developments brought about by war are inevitably going to lead to legislation which will establish as a fixed rule of industrial conditions that attention to the improvement of the workers must be an integral part of an employer's business, requiring a staff to deal with it as much as the

buying of his raw material, or the selling of his manufactured article. In other words, that the day has passed in which factory hands may be regarded as so many tools, to be used as occasion demanded, and then cast aside. It must now be realised that the physical health and moral content of the worker demand unresting attention at the hands of every employer if the best results are to be obtained.

That there is plenty of room for the welfare superintendents was quite apparent during many visits to the works. There was nothing to find fault with, only praise at the conditions and conveniences in the national shell factories and those new factories established for the purpose of war, but in many of the controlled establishments which never employed women before the conditions were not all that could be desired, and I often thought that it was only the keen desire of the women to get at the work from a patriotic impulse that enabled them to continue under the disadvantages they were under.

I might give one instance which appealed to me in which I found myself at variance with a body of employers. In a certain city of Yorkshire, which I remember visiting 17 years before to get to a works, one had to pass a very considerable distance from a tram line along open green fields. Visiting the same works last year it was difficult to locate it. The green fields had gone; in their place rows and rows of two-storey brick tenements had been built, all monotonously of the same pattern. The spacing between each row was narrow, and paved with cobble stones, forming a gutter down the centre. This was the only playground for children, and clothes drying. To one coming from Australia it was depressing, and one felt that it was impossible to expect good work from anyone compelled to live their life under such conditions. Yet I found the employers in the district were quite proud of the nice houses that had been built.

I only mention this instance to emphasise my point that it is in the education of the employer as well as the employee that the adoption of welfare supervision is going to prove beneficial to the engineering profession. But the number of welfare workers is increasing every week. Special arrangements are made for instruction and training in it, and no doubt before long there will be practically a complete revolution in the ideas which used to govern the relations between employer and employee, all towards the better condition of the latter, and at the same time the better work done by the employees.

But the future of welfare will largely depend on the general acceptance of the principle embodied in the short Act which deals with the question, namely, the association of the workers themselves with any aim and projects for their own improvement.

One of the developments now taking place is that conferences of employers and employees are being held, the main object of which is to discover whether it will not be possible, after the war, to arrive at some arrangement by which workmen will agree to cease restrictions on output, and employers agree to fix rates of wages and bonuses for increased production that shall not be reduced when it is discovered that men are thereby earning high wages. In the past the chief fear of workmen on piecework has been that if they increased their output the employers would reduce the scale of wages. This fear was, in fact, often well grounded, and restriction of output followed as the workmen's safeguard; also there was a large body of employers who found it difficult to get away from the idea that a certain wage of about 35/- per week was the value of a workman, and that remuneration should be based on that. I found, in conversation with many employers on the Clyde and in England, that there is spreading rapidly, as the outcome of the work in war time, a feeling to get away

from these opinions and a willingness to recognise that the workman is entitled to whatever increase in remuneration he can earn by increasing his skill, knowledge and output, and that the interests of both employers and men are co-related, and must be treated as identical in that increased output means equal benefit to both, and be remunerated as such—and good results are confidently expected from these conferences, especially as many of the Labor leaders now recognise that restriction of output is economically unsound, and will be more so after the war, when great production will be necessary to compete with other countries and re-create the wealth and uphold the supremacy of the Empire.

No question is causing more discussion in engineering circles at the present time, both in Great Britain and in Australia, than the one: What will be the scope for the employment of women after the war? No one has given a satisfactory reply, and none can be given at this time; it is quite impossible to form any definite conclusion—for one thing the war is not finished yet, and many developments will take place before it is; the employment of women is daily increasing in numbers, and in the nature of their work they are all the time proving their capabilities in work, which none ever thought they would be able to tackle, but necessity knows no law, and before the war is over we may see hardly one branch of industry left in which they will not have shown their usefulness.

I can only give an opinion based on personal observation, from which I gather that of the total number of women employed:—

- 10 per cent. are purely voluntary, actuated by war enthusiasm, who, having no need to work, will drop out as soon as the pressure relaxes.
- 30 per cent. are women who, while having to work for their living, are normally engaged in other classes

of work such as typistes, shop girls, milliners, domestic servants, etc., who will return to their previous employment.

25 per cent. are women who are working to help to fill the billets of their husbands, brothers or male friends, and will return to domestic duties on the return of the soldiers and the re-establishment of homes now dispersed or closed.

10 per cent. are women who have been employed previous to the war in similar work, and will again be employed on their work on resumption of normal trade. This leaves

25 per cent. women who, having learned engineering work, will be available for use in engineering branches of trade.

These should be easily absorbed without causing any difficulties, because there will be a great shortage of men, as many will have been incapacitated through accidents to limbs, others it is a matter of deep regret will never come back, and others yet again will not wish to take up their old work, while the great demand for labor, which is certain to be felt owing to the necessity for re-building the wastage in shipping, bridges, motor cars, machinery, etc., will mean for a long time to come that there will be work for all, and all the skilled men available will be required to handle the skilled operations, leaving the unskilled and women labor to handle the simple operations. To me it seems the development of the employment of women is going to result in an increase of employment and demand for the skilled man at the higher wage, and the encouragement to the employer to develop the use of machinery for the greater development of the engineering enterprise of the nation.

The manufacturers of England have been awakaned out of their conservatism. On all sides one sees the ruthless scrapping of tools which had served their owners well, be-