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MACHINERY: ITS MASTERS AND ITS SERVANTS.

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"It was through machinery," wrote Toynbee in his "Industrial Revolution," "that the population was drawn out of cottages in distant valleys by secluded streams and driven together into factories and cities."

The "Industrial Revolution" was published as far back as 1884, and since then economists and historians have constantly borne witness to the immense and far-reaching results of the introduction of machinery; but society has, as yet, come to no conclusion on the question, how far machinery as a means of stimulating and satisfying the material and moral needs of a progressive community is really valuable. Unfortunately, there is little hope that society will be able to make up its mind on the point; for even its more progressive members, its statesmen and reformers, have, so far, failed to realize the importance of machinery as a factor in what is optimistically called "modern civilization."

Society is becoming to an increasing extent a machine created and machine supported organism. While moralists and politicians are discussing the social welfare, mechanical appliances are continually producing fresh social problems and are offering new remedies.

It is not surprising that the Victorians, astounded by the great revelations of power which machinery held out to them, could see few blemishes in that great force. Nineteenth century optimism and laissez faire, like twentieth century Collectivism, was largely a machine made product. It was an age of machine worship; now we have become more sceptical.

For it is coming to be recognized that great as are the gifts of machinery in endowing man with new liberties, in amplifying his senses and thoughts, they have been, for the greater part, the endowments of the wealthy alone. The man without means is a machineless man, he is a primitive; he can travel on his feet alone, he can hear only with his ears. The railway and the telephone are the monopolies of the more wealthy.

As men increase in wealth, so is their power over nature augmented, while those very persons who spend their lives in minding machinery, who are often killed, maimed, or poisoned by it, are the very ones least able to avail themselves of its services.

But if the introduction of machinery has been the cause of great and unnecessary human suffering, it has also conferred great benefits upon the working classes through facilities for travel, the provision of cheap books, the material means of education, and generally by

their now wider outlook upon life. As all these are largely due to machinery, the modern social reformer, while repudiating the shallow optimism of the Manchester School, knows that he cannot put back the clock and revive the Middle Ages.

In any case we must realize that machinery has come to stay. The very fact that the enormous increase of population in the last 150 years dates definitely from the beginning of the "industrial revolution," and is, for the most part, due to the development of machine production, shows that any return to less copious methods in the manufacture of the prime necessities of life is out of the question.*

Again, foreign trade, the necessity to obtain by exchange commodities which cannot conveniently be produced at home, demands an ever increasing efficiency and economy in competitive international export production; a necessity which further commits us to the use of highly specialized appliances.

But great as have been the changes effected by machinery in the past, its influence upon the social organism is by no means exhausted, and even greater changes may be looked for in the future.

In endowing man with increased powers over the material world, machinery has only hastened his evolution. Its advent was a necessary and inevitable step of human development, for it is, to a great extent, through the reaction of material progress upon man that spiritual progress will be attained.

Already the fast ocean-going freight steamer, the railway train, and industrial machinery in general, have made possible the growth of world markets, the inter-dependence of nations, and the inter-communication of one country with another, with the result that workers all over the world are beginning to recognize the singleness of their aims, and to feel a disinclination for war.

Thus machinery, which, in the hands of irresponsible people, has proved so potent a factor in creating modern industrial life, with its hideous factories, barrack-like buildings called workmen's homes, and dreary congested manufacturing towns, and which has caused the depopulation of the countryside through the urbanizing of the agricultural laborer, must, by demanding ever greater organization, higher capacity and wider education for its successful exploitation, eventually bring about a change of outlook in the minds of the industrial workers.

They will come to see that machinery, to the manipulation of which they devote so large a portion of their lives, far from being their servant, has, in the hands of the capitalist, limited liability company and trust, been used mainly for the enrichment and satisfaction of a small privileged class and for their more complete subjection.

* Before 1751 (though prior to 1801 we have to depend on estimates only) the largest decennial increase was 3 per cent. For each of the next three decennial periods the increase was 6 per cent. Then between 1781 and 1791 it was 9 per cent.; 1791 to 1801, 11 per cent.; 1801 to 1811, 14 per cent.; 1811 to 1821, 18 per cent. After this the normal rate of increase, owing to emigration, fell to 12 per cent.; 1821 to 1831, 15·8 per cent.; 1831 to 1841, 14·4 per cent.; 1841 to 1851, 12·89 per cent.; 1851 to 1861, 11·9 per cent.; 1861 to 1871, 13·21 per cent.; 1871 to 1881, 14·36 per cent.; 1881 to 1891, 11·65 per cent.; 1891 to 1901, 12·17 per cent. (Census Returns for England and Wales.)

I.—MACHINERY UNDER THE PRESENT SYSTEM OF PRODUCTION FOR PRIVATE PROFIT.

So greatly indeed has machinery increased the capacity of man to utilize the forces of nature for his own purposes, that were no further advances to be expected in mechanical discovery, our present power and knowledge, if rightly used, would be more than sufficient to guarantee a minimum of decent comfort to every member of the community.

Nevertheless it is unfortunately only too evident that although machinery has given us the means of satisfying all reasonable material needs, and this with an economy of labor which gives us ample time to satisfy and develop our more spiritual desires, although we have the means, the end seems very far from attainment.

To realize not only why this is so, but, further, why, far from being a blessing, machinery very often proves a curse and causes much needless human suffering, it is necessary to examine those conditions which more immediately determine why, when, and where machinery shall be employed, how it shall be used, and to what purposes it is put.

Why Machinery is Produced.

Its existence is, in the last resort, dependent upon the inventor. Few large employers of labor, although they may know very well what they want, have either the time or ability to think out or perfect machines which will meet those wants.

But, like any other commodity, machinery obeys the laws of supply and demand; and since the demand for labor saving machinery comes from the capitalist with a view to cheaper production, its appearance primarily depends upon its prospects as a profit maker.

Thus the tendency is for inventors (who, like any other producers wishing to sell in the open market, must produce saleable goods or starve) to devote their inventive faculties to the evolution of labor saving machinery.

It follows then that, with the exception of such small demands as are made for appliances for scientific and other non-commercial purposes, the inventive brains of the world are in great part confined to the production of such machinery as will expeditiously supplant the dearer and less dependable manual labor.

Though great epoch making discoveries have, in response to no capitalist demand, from time to time revolutionized the industrial world, by far the greater part of invention has not been done by the actual "discoverers," who are but few and far between, but by the ordinary run of engineers, who, one inventor developing this, another modifying that, improve upon the original conception until a highly efficient machine, the product not of one man, but of many, is evolved.*

* See "The Evolution of Modern Capitalism," J. A. Hobson, ch. iv. § 5.

This is the process of evolution of most industrial machinery. The highly specialized machines of to-day are but the result of many inventors working upon the original discoveries of the eighteenth and early nineteenth centuries.*

But even the original discoverer, although he may not be directly affected by the unsocial profit seeking demand of the manufacturer, falls a victim to the system of society created by private capitalism. For since in many cases he must obtain the aid of the financier before he can even perfect his invention or produce it as a saleable commodity, it invariably happens that the financier exploits him and his invention for his own individual profit, with no idea of social service. Even when the inventor is in a position to be his own capitalist, living in a world of profit seeking, he does as he sees others doing, and puts his invention on the market in such a way as will ensure his realizing the highest returns. Although the immediate general use of the invention might be of the greatest advantage to society, its sale is regulated by one consideration only, that of making as much money as possible. The method being first to place it on the market in small quantities at a high price, this price is maintained until it has drawn its full toll from the comparatively few members of society who can afford to buy at that price. It is then sold at a lower figure in larger quantities till that wider grade of demand shows signs of being satisfied. Then, if the cost of production will allow of it, the process of lowering the sale price and increasing the output is again repeated; and so on till it is discovered at what price and in what quantities it will return the highest profits to its exploiters.

Thus we see, firstly, that the inventor himself cannot rightly lay claim to be solely responsible for the invention of his machine, and demand the full economic advantage afforded to society by its use, but is himself a social product whose power to invent is due to the fact that others have invented before him, and thus given him something upon which he may improve; secondly, that unless he is one of those few rich inventors who are independent of the capitalist, he cannot, even if he would, extort what has been called his "rent of ability" from the sale of his machine, but is compelled to ask the financier's help to enable him to put it on the market. In which case he often finds that, after paying the cost of production and such profit as the manufacturer, the middleman, and the financier claim as their respective shares of the booty, there is very little left for himself.

In fact many an inventor would be pleased to get anything at all. The intelligent workman in the factory who devises some small improvement in the method of production often sees his invention put into use without himself being a penny the richer.

And, lastly, we see that since it is generally left to the tender mercies of the capitalist to shape the direction in which inventive genius shall be expended, and to determine when and how an

* Even in 1857 cotton spinning machinery was supposed to be a compound of about eight hundred inventions, and the carding machinery a compound of sixty patents. (Hodge's evidence before House of Lords Committee, 1857).

invention shall be given to the world, society as a whole is in a very weak position, and must often wait his pleasure for some invention the immediate adoption and development of which would be of the greatest social service; and that when it is eventually placed upon the market, it is engineered in such a way as to ensure that society shall pay the full price.

This, then, is how the system of production for private profit reacts harmfully upon both the individual inventor and the whole community.

When and Where Machinery is Employed.

While there exist certain industries where work of great accuracy is essential and which consequently are almost entirely dependent upon machinery for their existence; while on the other hand there are many undertakings of a quasi-artistic nature in which the human equation effectively forbids the employment of mechanical methods, such as some metal trades and in pottery and glass-making, where personal skill is still needful, it will be found that the great mass of machinery has been devoted to supplanting routine manual labor.

A most striking proof of the connection between cheap labor and handwork is furnished by the case of a large printing works, visited by an investigator appointed by the Interdepartmental Committee on Physical Deterioration, 1904, where women were employed in folding one of the illustrated weekly papers. Folding machines which required men to tend them were standing idle in the department and were used only when folding had to be done at the times when the Factory Law prohibited the cheaper labor of the women.

"The general economies of machinery," says Mr. J. A. Hobson, "are found to be two. (1) The increased quantity of motive force it can apply to industry. (2) Greater exactitude in the regular application of motive force (a) in time—the exact repetition of the same acts at regulated intervals; (b) in place—exact repetition of the same movements in space. All the advantages imputed to machinery in the economy of human time, the utilization of waste material, the display of concentrated force, or the delicacy of manipulation, are derivable from these two general economies." ("Evolution of Modern Capitalism," Hobson, ch. iv., p. 66.)

Hence, wherever the efficiency of labor depends chiefly upon the output of muscular force in motive power, or precision in the regulation of such force, human labor will, sooner or later, give way to machines.

But there are other factors which determine whether machinery shall supersede hand labor. There is the effect of the Factory Acts. These have had influence in two ways:—

Directly, by hastening the introduction of labor-saving processes in small firms, when it might otherwise be delayed. Here machinery is often only employed when restrictions as to hours of labor begin to be felt. The restrictions placed upon child labor by limiting the legal working day in tobacco trades caused the introduction of steam power to turn the spinning wheels. The same result followed from the Act of 1864 in lucifer match factories; and at the present day the most complicated American machinery is used in some lucifer

match works, hand labor merely feeding the machines and placing the match boxes in their outer covers. This machinery has evidently been introduced owing to trade competition, but there is no doubt that besides the effect of the restrictions on child labor, the special rules in force in regard to lucifer match factories have stimulated the introduction of machinery which reduces the danger of phosphorus poisoning to a minimum.

In letterpress printing works and in paper and envelope-making works machinery has been introduced to obviate the inconvenience arising from the restriction on overtime employment.

These are but single instances of a tendency which must be at work wherever employers are precluded from competing with one another by means of long hours and low wages. The only resource then left to them is to compete by means of improved industrial methods ; and thus :

Indirectly, by giving competition an upward tendency, the Factory Acts have produced a demand for more and continual improvements in machinery.

Again, machinery is expensive ; the return on outlay if great, is slow, and to some extent doubtful. In order that the factory may be run profitably, it is imperative that the demand for its products shall be continuous. Much expensive machinery will only save labor when it is used to assist in producing a large output which can find a steady market.

During the last fifty years a larger and larger proportion of machinery has been devoted to the construction of further machinery for industrial purposes. That is in itself a highly speculative undertaking, and therefore it has become increasingly necessary in the interests of profitable production that sporadic competition should be suppressed and demand regularized and we see in the trust and combine a final effort on the part of the capitalist to achieve that artificial regularity of production, which the expenses and maintenance of enormous machine plants have rendered inevitable.

Finally, then, machinery has come to be devoted almost solely to labor saving ; which function it can only perform successfully when both the quality and quantity of its product are steady and constant and not open to sudden, unforeseen fluctuations.

The Conditions under which Machinists Labor.

Machinery, if its use be not carefully regulated and supervised, is often highly dangerous. At present mechanical production in this country results in the sacrifice of no less than over a thousand lives and over ninety thousand reported accidents in each year : 4,221 persons were killed and 116,439 injured in one year (1903) in all industrial accidents. ("Riches and Poverty," Money, p. 124.)

Although agitation has already produced some regulations for the fencing of dangerous machinery, and done something to protect the worker from the ruthlessness of competitive individualism, each year brings forth its long list of casualties and deaths.

In 1908, the total number of accidents occurring in factories and workshops in England and Wales amounted to 122,154, of which 1,042 were fatal. In 1898 the total reported was 57,562, of which

727 were fatal. 727 cases of poisoning are reported for 1908 as against 653 for 1907.

The Board of Trade Report on Railway Accidents during the year 1908 shows that 384 railway servants were killed and 5,140 injured by accidents on the lines. In 1904, ten were killed and 542 injured whilst coupling or uncoupling vehicles. In 1907, one shunter in every thirteen was killed or injured at his work on the railway; and yet the automatic coupling and some improved and uniform brake for goods wagons still remain to be adopted by the railway companies of England. It is because it would put the companies to *too great expense* that nothing is done in the matter.

In the Factory Report for 1908 it is pointed out, in connection with the steady increase in the number of reported accidents that, besides the constant tendency in factories to substitute power machines for manual work, and to increase the speed of machines generally, there is a further tendency noticeable in many factories, which also affects the accident rates. Very many new milling machines have recently been installed to do work that was formerly done by the safer and slower shaping, planing, and slotting machines, and by certain types of lathes. The use of power presses is also increasing. These dangerous machines are now used for much work that was previously done by forging and casting processes and by hand.

The actual number of accidents is far greater than the official returns would lead us to suppose; for many slight accidents are not reported, though such casualties may often develop later into a permanent partial disablement. The published returns of the fatal accidents to railway servants fall far short of the truth, because only those accidents which cause rapid death are reported as fatal.

The Deputy Chief Inspector of Factories for 1908 states that higher speed, increased use of machinery, and better reporting have all had a tendency of recent years to keep up the number of recorded accidents, and to obscure to a certain extent the fact that working conditions as regards machinery are relatively safer now than they were some years ago. The changes in the law introduced by the Notice of Accidents Act, 1906, are not yet properly understood, and, comparatively speaking, very few "dangerous occurrences," *i.e.*, certain accidents without injury to persons, have been notified. A number of accidents due to cuts and scratches, which are of daily occurrence in large works, and so slight as not to interfere with work for more than an hour or so at the time, now become reportable under the Act, because, owing to want of care or proper dressing, inflammation or blood poisoning is often set up, and causes prolonged absence from work at a later period. Several inspectors attribute accidents to recklessness and disobedience on the part of workers, though the lady inspectors do not agree with this opinion as regards laundries. It is no doubt true, however, that serious accidents are sometimes brought about by the workers' own recklessness; but this is contributed to in some industries by the system of piecework now so prevalent.

The "economies" resorted to by the individual employer in his desire to reduce the costs of production to a minimum are respon-

sible for a large proportion of accidents. In the Annual Report of the Chief Inspector of Factories and Workshops, 1904, a table is given showing that the greatest number of accidents in laundries occur when the operative is most fatigued, in the hour before dinner and in the later period of the afternoon spell. The long hours of arduous work result in carelessness, and so in accidents.

In the same report for 1906 it is pointed out that whereas the total number of accidents affecting men and boys stands in 1906 at the mean figure for five years, the number affecting women and girls has risen by nine above the mean figure. This is due to the growing use of ironing machinery and the increasing employment of young unskilled girls in working and cleaning it. The report of the Departmental Committee appointed to enquire into the dangers attendant on building operations, 1907, shows that a large number of accidents are preventable, and are due to the lack of competent foremen and skilled supervision and the putting of unskilled men to skilled work for the sake of cheapness.

Further, in 1908 there were only 200 inspectors to supervise 260,000 factories, an average of 1,300 for each inspector, and it is notorious that when factories have been immune from inspection for a considerable time even the statutory accidents fail to get reported.*

Moreover, apart from casualties, the optimistic conclusions of Professor Marshall as to the beneficial effects of machinery in lessening the strain upon the worker engaged in monotonous occupation † is open to the objection that though machinery undoubtedly diminishes the purely muscular strain, there is evidence to show that it taxes the nervous vigor of the operative quite as severely as the old manual work, for the intensity of modern competition forces the organizers of labor to extract as much out of their employees as they possibly can. Even where there has been a reduction in the hours of the working day, it does not follow that the amount of energy required of the workers is any less.

But many workers still toil for excessive hours. The prosperous artisans who have nominally won the nine hours day form but a small minority. The men who work on the tramcars in our

* According to a return published by the Board of Trade the total number of deaths from industrial accidents reported in 1908 was 4,224, a decrease of 253 on 1907, but an increase of 29 on the mean of the five years 1904-8. A decrease is recorded in every group of occupations except mining and quarrying. The results show the mean annual death-rate from accidents per 10,000 employed in each group of trades, and are given in the following table:—

Seamen	...	...	...	...	...	...	50·4
Miners	...	...	...	...	...	...	13·2
Quarrymen	...	...	...	...	...	...	10·6
Railway Servants	...	...	...	...	...	...	7·5
Non-Textile Factory and Workshop Operatives	...	...	...	...	...	...	2·2
Textile Factory Operatives	...	...	...	...	...	...	0·8
For all Occupations enumerated above	...	...	...	...	...	...	6·3

The industries included in this table employed over six millions of workpeople.

During 1908, 35,000 workmen were killed and 2,000,000 injured in the United States of America. One person in every eight families sustained injuries. The Labor Bureau Report suggests that America is behind Europe in safeguarding the lives of operatives, and declares that one-half to one-third of these casualties could have been avoided by rational factory legislation, inspection, and control.

† "Principles of Economics," pp. 314, 322, Professor Marshall. Second edition.

cities are often on duty for at least fourteen hours a day, without including meal times. Nearly all the great railway companies have thousands of men at work for twelve hours at a stretch, with a great deal of Sunday labor. Until the coming into force of the Miners Eight Hours Act, 1908, many even of the coal hewers were underground for more than nine hours a day; and there are other classes of machine workers, such as blastfurnace men and steel workers, whose day's labor normally is at least twelve hours. Even when, as in the case of the engineer, the normal hours of labor have in some places been reduced from sixty to fifty per week, this reduction has been largely neutralized by overtime.

The Effect of Labor Saving Machinery upon Employment.

It is not only with the loss of life and limb and the exhausted bodies of the overtaxed factory hand that the penalty of modern industrialism is paid.

Such existence even as the workman is able to maintain when in employment is always affected by the uncertainty of his occupation, an uncertainty dependent upon external causes, over which he has no control whatever. Subject, perhaps, merely to the whim of his employer, to a change of fashion, to the very advance of those methods of machine power and process which should rightly bring him shorter hours and lighter labor—his living is in the highest degree precarious.

Under the stress of competition, and, perhaps, in some way due to such Acts as the Workmen's Compensation Act, there is a growing tendency among employers to scrutinize very carefully the men whom they take into their service, in order that, in return for the standard rates of wages they have to pay, they may get the most efficient workmen. Thus it becomes increasingly difficult for the worker in any way below the average to obtain employment at all.

Though it is true that the supplanting of hand labor by machinery has not lessened the demand for labor as a whole, yet it is undeniable that the individual worker often suffers under the change. The floating of new inventions results in dislocation of employment and in unemployment, with all the suffering they entail.*

The displacement of the hand weaver by the power loom, the slow but sure death of the chain and nail trade in the "Black Country," the substitution of cheap female labor in the Leicester boot factories to attend power driven machinery in the place of the former male hand work, the rise of the motor driven cab, are but instances of this inevitable tendency.†

* See "Unemployment: a Problem of Industry," by W. H. Beveridge. 1909, p. 111, under "Employment of Declining Trades"; Minority Report, Poor Law Commission, 1909, p. 1147; "Final Report on Industrial and Sanitary Conditions to Pauperism," by Steel Maitland and Squire.

† In 1908 as many as 2,925 taxicabs were licensed to ply for hire in the streets of London, an increase of 2,202 upon 1907. In the same twelve months the number of hansom cabs licensed decreased by 1,205; since 1903 the number of hansoms has declined by 2,752. Besides the actual cabdrivers, the motor car is displacing grooms, harness makers, stablemen, and others.

Except through Trade Union action the worker has derived little or no benefit in wages from improvements in machinery, from cheaper output; the surplus profit produced by greater efficiency of production and transit goes inevitably into the pockets of the capitalist and landlord. Hours of labor grow no shorter, toil becomes no less degrading and onerous, that compensation which at times flows so generously into the coffers of the monopolist, benefits in no way the employee, when the industry in which he is engaged is discontinued through no fault of his own. His wages are beaten down, his labor often supplanted by that of his wife and children, with the consequent injury to their health and physical deterioration in following generations.

For it is evident that the married woman who all day long has to work hard in a mill or factory can have but little energy left at the end of the day for housework, for looking after the needs of her children, or even for fitting herself for the rearing of a family.

The children accordingly are given unsuitable food and but scanty attention. They are not brought up at all; they are dragged up, or left to get along as best they can. It is a common thing for mothers while away at work to lock their children in; sometimes they are left to run about as they like without anyone to look after them.

Although the continuous physical strain of work in a factory is injurious to child-bearing, the mother in her desire to go on earning to the last possible moment does not leave work a sufficient time before her confinement. This often results in premature births and the stunted growth of the offspring, and more fatal even than this is her early return to the factory, which means that the infant, at the most critical time of its life, does not get that attention which is absolutely necessary to its wellbeing.

How women's labor may supplant that of men is seen "in an aggravated form at Leicester, and, perhaps, at its worst at Dundee. In the boot and shoe factories in the former town successive changes in the processes of manufacture have thrown men out of employment because their places are taken by women and young persons, and this also drives a number of married women to seek work in the factories, since they have to try and earn wages instead of their husbands." (Evidence before Poor Law Commission, 1909, Q. 96,610, par. 4 [iii].) At Dundee there is "plenty of female employment, which results either in loafers living upon their wives or decent men being kept there who had far better go elsewhere." (Report on Effects of Employment, etc., in Scotland, by Rev. J. Pringle, pp. 27, 106.)*

Even in some branches of the engineering trade women are now finding employment. In the Westinghouse and other large works round Manchester, women, both married and single, have been introduced in large numbers to tend the light drilling machines at which the Trade Unions used to find employment for men getting on in years and unable to take heavy work. In Stoke-upon-Trent women and girls are very largely employed in the pottery industry. "In some branches of this trade they are being employed to an increasing extent upon work which, a few years ago, was performed almost

* See generally "The Wife and Mother as Breadwinner," Minority Report of Poor Law Commission, 1909, p. 1164.

exclusively by men; they are now actively in competition with male labor, and, as they are able to do similar work for lower wages, they are gradually driving men from certain sections of the trade."

But there are some instances in which women's labor has been superseded by complicated machines tended by men. The folding of newspapers, which used to be all handwork done by women, is now done by machines managed by men.

It would seem that when routine manual labor is displaced by simple machines the tendency is for women to be employed to mind them; but where complicated machinery is installed it is necessary to engage men to look after it.

Besides this sapping of the nation's life through the impaired vitality and efficiency of the mother, the evolution of highly specialized machinery has produced another very grave evil, the misuse of boy labor. Boy labor being cheaper than adult, work has been sub-divided and arranged, with the increasing aid of machinery, so that it can be done by boys; and "there is a constant tendency for certain industrial functions to be transferred from men to boys, especially when changes in the processes of manufacture or in the organization of industry are taking place rapidly. The result is the over employment of boys and the under employment of men. (Evidence before Poor Law Commission, 1909, Q. 96,921, pars. 1 and 2.) This kind of labor is uneducative (in the sense of producing no increase of efficiency or of intelligence) and unpromising (inasmuch as it leads to no permanent occupation during adult life), and at the age of seventeen or eighteen the boys are turned adrift. A few of them become skilled workmen or laborers in other trades, a few enter the army, but the majority are destined to swell the ranks of the under employed or unemployable.*

An enquiry was made in 1908 by the staff of lady inspectors into the main features of employment of children in carding of hooks, eyes, and buttons in Birmingham. It could not be completed owing to the transference of the inspectors to the north-western division. Enough was done in the way of investigation to show that children of from seven to thirteen years of age are employed to a very considerable extent, often at late hours by artificial and insufficient light straining to the eyes, in this monotonous and tiring work in their own homes; that the work is largely dependent on child labor, and is so poorly paid that "with the assistance of several persons it is scarcely possible to earn a penny an hour," being a last resource of poverty where there are children to help. The employment cannot at present be regulated, as it is excluded from the scope of the Factory Act by Section 114 and from the Children's Employment Act, the parent being the employer. Sometimes the work was found to be supplementary to Poor Law relief. Further enquiry seems to be needed, and can be undertaken when the staff is completed for the Birmingham division. In connection with the enquiry mentioned above, Miss Squire (one of the lady inspectors) visited a considerable number of houses in Birmingham in which the work was carried on.

* See generally "The Misuses of Boy Labor," Minority Report of Poor Law Commission, 1909, p. 1165; "Report on the Subject of Boy Labor," by Cyril Jackson, 1908.

She found these outworkers grouped in the neighborhood of the factories, and remarks that the hooks and eyes are found in the poorest streets and the buttons in streets of a less miserable type. The sanitary condition of many of the courts and streets of the worst was "lamentable, and the conditions as to floors, walls, and furniture of many of the homes appalling." (Annual Report of Chief Inspector of Factories and Workshops, 1908.)

It is thus clear that machinery in the hands of the capitalist, by the very fact that it gives him a greater power of production, results, under our chaotic system, or rather want of system, in over production and dislocation of industry and employment; a state of things which, with ever greater powers of production, is increasingly likely to occur, for although improvements in machinery may not lessen the total aggregate of labor, the haphazard irregularity of its introduction and use is undoubtedly one of the chief factors in producing unemployment.*

Most, if not all, of the evils which have followed on the introduction of machinery can be traced to its exploitation by irresponsible persons for their private ends.

The recognition of this fact, shown by the passing of the Factory Acts in the teeth of individualistic opposition, needs but to be extended to its conclusion to make machinery the servant and not the master of society.

II.—MACHINERY AS A SOCIAL SERVANT.

Since, generally, machinery is only introduced into industry when it is cheaper than hand labor, it follows that successful agitation for higher wages must often result merely in the place of the agitator being taken by a relatively unskilled machine tender at a lower wage.

The employer finds no great difficulty in obtaining such machinery and cheap labor. "The number of known or discoverable inventions for saving labor which is waiting for a rise in the wages of the labor they might supersede, in order to become economically available, may be considered infinite."

Though considerable skill may be required to supervise some complicated machinery, so numerous are the intermediate types that a mere boy, who begins by minding the simplest drill or automatic lathe, may progress through practice into a qualified fitter.

Thus even such benefits as do accrue to the worker in organized factory trades through co-operation and maintenance of a standard rate, are in danger of being frustrated by agitations for still higher wages.

* No doubt, as a matter of theory, it is possible that the introduction of machinery or the equivalent industrial change might result in the production, not of more commodities, but of the same amount of commodities for much less labor; but, as a matter of fact, in almost all cases it has been found that there has been a larger volume of trade by reducing the cost of production.

See the evidence of Mr. Sidney Webb before the Royal Commission on the Poor Laws, 1909, Vol. IX. 93,251, 93,325-93,328, et seq.

The possibilities of machinery are almost limitless. In the making of steel rails, for example, from the moment the ore is pitched into the furnace until the rail is finished, everything is done by machinery. The ingots are gripped from furnaces, laid on rollers, carried along to be pressed, and rolled out with steel fingers automatically putting them into position, entirely without human intervention.

It is in such highly elaborated industries that many of the strongest trusts spring up.

The average employee of great skill in some narrow routine of machine tending is, on the whole, less competent than any other worker to transfer his labor power to an entirely different occupation. The Steel Trust, writes Mr. J. A. Hobson, "is the owner of its employees nearly to the same extent as it is the owner of its mills and plant, so subservient has modern labor become to the machinery under which it works. Once the trust has fairly established itself, it begins to regulate production, and may suddenly close half the mills, works, or elevators. The owners of those closed plants get their interest from the trust just as if they were working, but the labor of those works suddenly, and without any compensation for disturbance, is "saved," that is to say, the employees are deprived of the services of the only kind of plant and material to which their skilled efforts are applicable." ("Evolution of Modern Capitalism," Hobson, p. 222.) In all this the growing inadequacy of tentative regulation and sectional trades unionism to cope with the increasing power of gigantic monopolist corporations is becoming more and more evident.

The only practical solution lies in increasing collective action. Society must own and control machinery, or machinery (and the plutocrat) will own and control society.

For what Purposes Machinery should be Invented.

There is little difficulty in determining what are the basic needs of society to-day. Adequate housing, good clothes, sufficient heating and wholesome food are alike lacking to the majority. To explain that all these minimum necessities of a decent existence are withheld from the masses of the community through want of purchasing power is beyond the scope of this Tract; these matters have been dealt with very fully in Fabian Tracts of a more immediately economic character.

The vesting of large capital resources in the hands of the State and municipalities will endow them with the power to obtain the services of those inventors whose talents are now prostituted in devising mere labor saving appliances. The inventor must become a national servant and the devising and satisfaction of national needs a recognized branch of State activity.

For example, the application of electricity to communal needs, to power and transit, is but in its infancy. Such a new motive force, if distributed to factories and railways on a large scale through the medium of great power stations, with a view to furthering industrial development and not to dividend making, would do more to dispel trade depression than any mere tinkering at tariffs. And this is only

possible to the State which, with its command of capital, can afford to wait for that far greater return which would result eventually from the general re-stimulation of industry.*

The consumer also benefits immensely from large supplies of power for heating, lighting and cooking provided by his municipality at a reasonable price. And the experience of many boroughs who have furthered electrical development within their area has proved so greatly are the benefits of electricity appreciated, that even under the existing restrictions of area and regulation, the municipal service can be efficiently conducted with positive advantage to the ratepayers.

All this, however, calls for new devices and new invention. The inevitable growth of collective industrial activity will probably necessitate the institution of a College of Invention, to be established, perhaps, in connection with the existing Patent Office, where skilled experts will be engaged to assist inventors in their researches, and laboratories and plant for experimental purposes will be provided.

This suggestion is not as chimerical as might at first appear. Already many large trusts, and nations in their naval and military capacities, employ permanent staffs of research workers, and it only needs that this principle should be extended to guarantee an efficient satisfaction of communal needs and to produce a considerable advance in the material condition of the people.†

When and Where Machinery ought to be Employed.

The effect of the general introduction of electric motive force in strengthening the economic position of this country in competitive international trade can hardly be exaggerated.

History shows us how the iron industry, which in 1740 was "dwindling into insignificance and contempt," was increased a hundredfold by the introduction of steam power. In all metal manufacture it was the new motor which rendered necessary improved machinery. "The immediate result of this requirement was the bringing to the front a number of remarkable men, from Brindley to Nasmyth, to supply mechanism of a proportionate capacity and nicety for the new motive power to act upon." ("Evolution of Modern Capitalism," Hobson, p. 88.) And, therefore, it may safely be concluded that any great development of electric power will also have its effect in enormously extending that routine work which can suitably be performed by machinery.

There is another class of machinery which, since its exploitation would be of no pecuniary advantage to the capitalist but merely of great social value, is so far almost entirely undeveloped, and that is all the various kinds which might be utilized to take the place of

* See "Public Control of Electric Power and Transit," Fabian Tract No. 119.

† The institution of State experimental and testing stations for agriculture is fully dealt with in Fabian Tract No. 115. The National Physical Laboratory at Bushy is another instance; in particular the new special department of aeronautics there, to which problems of aerial navigation are to be submitted by the army and navy for investigation and assistance, is an example of the principle in operation.

human labor employed upon the necessary but more degrading work of society.*

This is an almost entirely unexplored avenue of invention, and will remain so while the inventor has no inducement to turn his attention to the solution of such problems.

To find out what can be done in this direction one has but to explore a modern battleship and see how most of the more physical and unintelligent labor in serving the guns is now done mechanically, leaving to the human agent the more "spiritual" work of training and firing.

Hydraulic or electric ammunition hoists are not employed with any idea of relieving the sailor of the less intellectual forms of labor, but merely for the sake of greater efficiency; but the very fact that they are used shows that other machines might be employed in the same way as substitutes for other forms of what is merely brute labor. And not only the ammunition hoist, but the evolution, from the three decker, of the battleship itself, is but an instance of what can be done to meet a social need, if society is only allowed to express and satisfy such needs.

On the other hand, with increased collective ownership and control, the restitution of leisure and opportunity to the workers must tend to enlarge that quasi-artistic field of production in which machinery cannot appropriately be employed. Such personal things as domestic crockery, fabrics of all kinds, ornaments, furniture, etc., which were formerly produced by craftsmen, will, as a better state of living leads to a more cultured demand, tend to pass once more into the hands of the art worker.

The necessity for regularizing production which has concentrated capital in the hands of the trust must find its logical consequence in collective ownership.

There exists in America to-day a system of regulating the introduction of invention by the simple expedient of buying up possible competitive devices; and as it is the unregulated, spasmodic introduction of new processes which convulses the labor market, it is reasonable to hope that the statesmen of the future may in a similar way find it possible to regulate the introduction of new machinery.

A greater regularity of employment, the performance of an increasing amount of onerous and degrading routine work by mechanical devices, the stimulation of international trade, are results which may be expected to follow on the collectivization of machinery.

The Conditions under which Machinists should Labor.

Under no conditions whatever should labor which produces preventable accident and death be tolerated. Factory inspection, at present utterly inadequate and inefficient, must be strengthened so as to bring every workshop under direct and continuous Government control. The Factory Acts demand wide extension, and all

* See Mr. H. W. Macrosty in *Economic Journal*, March, 1909, p. 6. A manufacturer was asked why he did not introduce certain mechanical devices which would have replaced some very toilsome forms of hand labor. He replied, "Why should I? . . . it will not reduce my cost nor increase my output. . . . So long as I can get the same results with the cheap labor I now employ, why should I change?"

those industries which inevitably cause "occupation diseases" must be either carried on by mechanical or innocuous manual methods, or abandoned altogether.

The acquiescence in habitual lead poisoning, mercurial, phosphorus, and arsenic poisoning, and anthrax is neither more nor less than national murder.*

Among many other urgent problems awaiting the attention of our "National College of Invention" there is none more important than the devising of appliances to terminate this national iniquity, which sacrifices annually so many lives. Even now, with our existing Factory Acts, the internal condition of the workshop leaves much to be desired. To the thousands of deaths caused by accidents and diseases of occupation must be added hundreds of thousands of cases of direct injury to health arising from work in unhealthy factories and workshops.

For the first time since the "Industrial Revolution," machinery must be devised with some reference to the physical and nervous system of its operator.

With the better organization of labor and stimulation of enterprise, the objection to automatic stokers, feeders, carriers, and endless bands, all of which reduce the total amount of unskilled labor, will be removed.

The spectacle of an electric power station where coal is reduced to gas, passed into an engine, and its energy transferred through a dynamo into the mains, under the supervision of only three persons, will no longer be suggestive of unemployment; but every new invention for saving labor will be hailed with joy as a release from toil and a gift of more time in which to do individual work.

* The figures for 1903 are as follows: killed or died from industrial poisoning (lead, mercury, phosphorus, arsenic poisoning, or anthrax), 70; injured or suffered from industrial poisoning, 875.

For 1907: killed or died from industrial poisoning, 40; injured or suffered from disease, 653.

For 1908: killed or died from industrial poisoning, 40; injured or suffered from disease, 727.

See also Mr. Ward's Paper on Industrial Occupations, read to the Royal Statistical Society, May 16th, 1905.

Dr. Legge (Medical Factory Inspector) has supplied tables showing the number of reported cases of lead poisoning for the years 1899 to 1908 inclusive, particulars of fatal cases of plumbism for 1908, and a detailed analysis of the reports by certifying surgeons on cases in 18 groups of industries according to severity, frequency of attack, and main symptoms. The figures are somewhat higher than they were in 1907, the greatest increase being noted in connection with the smelting of metals, where the cases have risen from 28 to 70. Referring to the increase in the number of poisoning cases noted above, he thinks it is perhaps indirectly due to the inclusion of lead poisoning in the third schedule of the Workmen's Compensation Act, 1906, in two ways—(1) by causing the prevalence of pre-existing plumbism to come to light; (2) by the tendency this has fostered in these trades to replace men suspected of lead impregnation by new hands, amongst whom the incidence of lead poisoning is greater than amongst old workers. Miss Vines has investigated a large number of cases of poisoning amongst women workers in potteries. She describes the bad effects of this poisoning, quoting details of many of the cases met with, and showing how little compensation does to mitigate the sufferings caused by it. She draws attention also to the hard position of lead workers who, although not suffering from lead poisoning, are suspended from working in a lead process as a precautionary measure, and who therefore get no compensation and frequently cannot obtain other work.

So long ago as 1896 the Fabian Society presented the following resolutions on factory legislation to the International Socialist Workers and Trade Union Congress, most of which have still to be put into effect :

Considering—

That it is one of the chief duties of the State to secure the health and safety of the workers, but that this duty cannot be effectually fulfilled unless it is undertaken in a scientific manner.

The Congress demands—

1. That every Government shall institute committees of experts (including machine workers) to study the best means of preventing accidents from the different kinds of machinery.
2. That every Government shall also establish laboratories for the investigation of the safest processes of manufacture.
3. That, supported by the opinion of his expert advisers, the Minister responsible for labor shall have power to issue departmental regulations in such matters as the fencing of machinery, precautions to be taken in manufacture, etc., and also, subject to revision of his orders by the Legislature, to prohibit processes as dangerous.
4. That the white lead industry and the making of matches from yellow phosphorus—dangerous occupations for which safe and effectual substitutes are acknowledged to exist—shall be at once prohibited.

The extent to which these resolutions have been acted upon is indicated by the following Home Office Orders.

Regulations were issued in 1898 concerning the manufacture of earthenware and china, the dusting of china for transfers, and the glazing of bricks with lead.

In 1899 concerning the sorting and carding of wool and goat hair.

In 1904 concerning the loading and moving of goods in docks, and, in 1907, the spinning of hemp and jute.

Besides these, the Alkali Works Act, 1906, imposes regulations on certain chemical works from which noxious gases may be emitted, and the White Phosphorus Matches Prohibition Act prevents the manufacture, sale, or importation of matches tipped with white phosphorus.

During 1908 new regulations were made for dealing with dangerous trades, in which brasscasting and vitreous enamelling are included. As to brass, the Midland Division is the one that will be most affected by the introduction of the new regulations in place of the old special rules, and steps are being taken to secure compliance when they come into force on January 1, 1910. Efficient means for the removal of fumes from the casting shop is one of the most important of the new requirements, and Mr. Redgrave reports that considerable structural alterations will be necessary. Very few works in the Walsall district will be able to comply with the standards required for the exemption allowed to casting shops with 2,500 cubic feet of space for each worker. Regret is expressed at the way the special rules are observed in the Staffordshire Potteries. The owners show too great a tendency to delegate responsibility to the foremen, while the workers themselves are indifferent. In the same period ten sample suspected materials were referred to the Government Laboratory for determination as dangerous or safe. Electricity and Indian wool were also regulated by order.

With regard to the prevention of accidents, the railway men succeeded in obtaining a Royal Commission which sat in 1899 to consider the question of accidents. The unanimous verdict of the Commission was "that lives are lost which might be saved and men are injured unnecessarily." As a result, the Railway Accidents Act of 1900 was passed.*

CONCLUSION.

The path of immediate practical reform lies in the direction indicated by the above resolutions. The limitation of hours, the restriction of juvenile and dangerous labor, alike tend to protect the worker as producer; but the provision of steady employment and the interests of the worker as consumer have still to be considered.

If it is evident that the existence of a class of unemployed, willing, but unable to find work, is the necessary result of the present industrial system, in which every improvement in machinery throws people at any rate temporarily out of employment by rendering their labor superfluous, it follows that only by the State organization of labor, by regulating the introduction of machinery, by increasing the purchasing power of the people, and by absorbing a large portion of the surplus product for the general collective good, can employment be finally regularized.

This, too, will strengthen the worker's power as consumer.

The concentration of enormous purchasing power in the hands of a few persons, most of whom have done nothing to justify their position, results in the workers wasting their brains and bodies to satisfy the whims of the idlers.

The motor car, if put to work where it was most wanted, might have meant the revival of agriculture in England, and been an incalculable stimulus to social intercourse and recreation. As controlled by the irresponsible demand of wealthy individuals, it began merely as one more luxury for the rich (its least important function); and it is still only the overflow of this supply which reaches the organic part of the nation.

Machinery is but a part, though an immensely important part, of our social life; and until the community realizes its responsibility to itself and takes steps to gain control over its own destiny by owning and controlling the materials which give it existence, it is unlikely that machinery or any other national asset will be employed otherwise than by the powerful few to extort profits out of the necessities of the many.

* For further information see "Dangerous Trades," edited by Sir Thomas Oliver. Murray; 1902. 25s. n.

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