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MIND, MUSCLE, AND MACHINERY.

Speaking of the influence of machinery upon the artisan, an intelligent professional man said to us the other day: "It stands to reason that a man who operates a machine for polishing boot heels, for instance, must by the very nature of his occupation be less intelligent than the man who sits at the bench and makes a whole shoe."

Our friend merely expressed in a pointed way what many feel, namely, that the more nearly automatic machinery is, the greater its effect in subordinating the man to the machine; the more it tends to depress the value of mind and manual skill, and so lower the intellectual grade of the operator.

Where so many elements enter the problem—elements whose value and bearing it is difficult if not impossible to estimate—it is no easy matter to pick out one, and say positively how much of a man's industrial condition and mental character is due to it. Indeed, it is quite useless to attempt the solution of such a problem as this by the study of individual cases. Only by considering the relative conditions of masses of men is it possible to arrive at any just conclusion as to the influence of a factor like machinery upon the intellectual condition of those who use it.

Machinery can affect the artisan class in two ways—by its selective action, and by its direct influence upon those who use it. In other words, machinery may alter the average intellectual grade of the men required to do a given work by demanding on the one hand a higher average grade, or on the other by allowing the work to be done by less capable men; and it may less directly affect the membership of a trade either by dulling the intelligence of the operative, or by schooling him to greater alertness and thoughtfulness.

There is one phase of this question which may be touched in passing, and that is the vastly increased demand for the highest grades of skilled labor in making the machinery used in our shops, and in making the machines used in making that machinery. Trustworthy statistics are not to be had in this connection; yet we are confident that the facts will bear us out in the assertion that the skilled machinists and tool makers now employed in the occupations we have mentioned, outnumber many times the skilled men displaced by labor saving machinery.

While the introduction of machinery has in no wise diminished the demand for the higher grades of skilled labor, but has rather increased it, we must admit that it has likewise opened the door for a large increase in the number of low grade men in mechanical employments. To meet this demand we have imported men largely from Europe, from the French provinces of Canada, and to a small extent from China. The wisdom or folly of these importations we do not propose to discuss here. In any case machinery is not to be blamed, so long as it has not diminished high grade employment for men of native birth.

We now come to the main point at issue: Does the using of machinery dull the intellect? Does the machine user lose his manliness in proportion to the perfection of the machine, allow his skill of hand and acuteness of sense to die away, and becoming, as it were, a part of a machine, sink to the level of brute matter? We have heard this charge laid at the door of machinery time and again by people by no means unintelligent. It is one of the current fallacies of the labor question.

We doubt if there was ever a keener or more intelligent body of critics ever set to judge the results, and indirectly the processes, of a nation's industries than the foreign judges of the Centennial Exhibition. They were not prejudiced in our favor, and they had no axes to grind. We may safely quote their testimony, therefore, as to the influence of machinery upon the character of our working classes. One of them, a manufacturer of the first rank, well acquainted with this country and our industries, writes as follows:

"Machinery hall is the mirror of the processes and of fabrication both of the United States and of the Old World. But this mirror presents to the European a painful image. He learns too late the truth of the maxim that time is money, and consequently the importance of machinery in production. Scarcely has the European who goes to America to earn his bread put his foot in the country when already his star cries to him, 'Time is money,' for he sees immediately with what facility the American works, and how much in this respect he himself remains behind. The American produces twice or thrice as much as he, and with less trouble. The reason is that the European works as he has learned to do, that the master continually teaches his apprentice the same routine, while the American seeks unceasingly to simplify the manipulation, to invent, and to apply every possible improvement. The first thing which must be done by the European who comes to work in America is to break off the old routine, and to seek, while practicing himself in the American system of work, to acquire that which neither the good schools of Europe nor his former experience have taught him," and that, in brief, is to be quick, wide awake, and exact in his work. Further on the same observer says:

"My workmen also work with American machines. They have the same tools, but their productive capacity is far inferior to that of the American operative. The same observation has been made to me by superintendents who have established German shoe factories after the American system, and who often cannot succeed with German workmen." We may note here that American manufacturers have no trouble with German shoemakers—after they have been sufficiently educated by the use of machinery.

Again we read: "I am satisfied from my knowledge that

no people has made, in so short a time, so many useful inventions as the Americans; and if to-day machinery apparently does all the work, it by no means reduces the workman to a machine. He uses it as a machine, it is true, but he is always thinking about some improvement to introduce into it, and often his thoughts lead to fine inventions or useful improvements." The chief reason for the tendency of the American workman's mind to run in the direction of invention is very properly found in the inducements held out by a liberal patent law.

A manufacturer of even wider experience, in France as well as in Switzerland, observes that "the use of new and admirable automatic machinery has revolutionized every kind of manufacture, by dispensing more and more with hand labor; but we must not forget that to manage these machines, to adjust them, to get out of them all that can be got, requires workmen better and better taught, careful, experienced, and steady." Subsequently, after referring to the Swiss commissioner's report with regard to the superior intelligence and productive power of American machine users, the writer goes on to say:

"We have constantly made the same observation in our own machine shops. Whenever we compare the work of two mechanics of unequal skill, both using automatic mechanism or performing the same work by hand, we always find the relative excess of production of the more skillful workman over that of the other much greater in the first case than in the second. Manual labor when it is irksome and monotonous dulls the mind. But when a workman who possesses the spirit of order, some training, and the elementary principles of geometry and mechanics, has charge of an automatic machine his mind cannot be at rest. When his machine is in operation, he profits by his leisure to examine the work which it has performed. He detects and remedies the causes which make it irregular; he keeps the detached parts of the machine in order, and the whole well regulated. Thus he avoids waste and interruptions." And in doing all this he necessarily raises himself in the scale of intelligence.

One line of testimony of this sort is worth any amount of guesswork from those who lack practical experience with men and machinery, no matter how learned they may be in other directions. No machine can put brains into a mechanic's skull. The most perfect piece of automatic mechanism cannot educate a natural born fool. But if a man has any brains, if he has any desire to improve himself, the management of a machine, even for polishing boot heels, will leave his mind as open to thought, as free to improve itself, as the best equipped cobbler's bench in the world. One great obstacle to the introduction of improved machinery has always been the circumstance that the average workman has seldom been intelligent enough to use such machinery at once to advantage. How much has the sewing machine done to give an idea of mechanics to our women! To be a successful farmer now, one has almost to take a course in practical mechanics, in order to be able to handle his machinery properly. So it is more or less largely in every department of labor. Machinery has compelled the better education not only of mechanics, but of everybody.

A NEGLECTED INDUSTRY.

A new field awaiting the employment of an immense amount of labor, capital, and inventive talent now exists ready at hand in the neglected flax and linen industry of America. Forty years ago nearly every farmer in the country knew how to raise and prepare flax for domestic use, and many of our fathers and mothers were to some extent engaged in this manufacture. In 1845-55 several manufactories were put into existence in New England to make the various kinds of fine linen goods. Among these were the Stevensmills at Webster, Mass., the Willimantic, in Connecticut, and the American Linen Company, of Fall River, Mass. The latter was established in 1852 with a capital of \$500,000, and had at one time 250 looms running upon sheeting, table linen, and coating and pantalooning, besides the coarser kinds of fabrics.

These mills were enabled to start by the placing of a duty of 25 per cent upon linen goods in 1842, while they had previously been admitted free of duty. But in 1857 the duty was removed and linen again admitted free of duty, and the infant industry was strangled. Nothing of the old industry now remains excepting the Stevens mills, making crash and huckaback, at Webster, Mass. These mills are no longer in the possession of those who originally established them. The Willimantic no longer exists, and the American Linen Company changed to cotton manufacture long ago.

Besides the Stevens, which is much the most extensive mill in the country, making some fifteen kinds of coarse goods, there are the Stark, at Manchester, N. H., the Ludlow and the Bay State, in Massachusetts, all small producers of coarse linen fabrics. These, we believe, are the only mills weaving flax fabrics in the United States. Tow bagging is made in several places in Ohio, Indiana, Louisville, and in Illinois, while the initial steps toward the establishment of a linen mill have been taken in Oregon.

Extensive flax thread mills exist, one at Paterson, N. J., employing 500 hands; one at Troy, N. Y.; and one in New York city, employing 600 hands. Up to 1872 there were nearly a hundred flax bagging mills in the central Western States, but the reduction of duty upon jute caused an almost complete transfer to jute bagging, the material with which the South now covers her cotton.

This is the condition of the linen industry in the United States at this time. Of the raw flax used by the crash and

thread mills, 4,000 tons are imported and 1,000 tons are home grown, chiefly from the northeastern portion of the State of New York. A considerable portion of the imported is Russian, a part, that of the best, is Belgian, a part Canadian, and some Irish. The use of American flax is for the most part to adulterate the better imported kinds, and thus lessen the cost of the product. There is a general complaint that the American fiber is less skillfully cared for, and carelessly cured and prepared, and certainly its value, 9 cents a pound, indicates that either too little attention is given to the growth of the flax or to the preparation of the fiber. The imported flax fiber, simply separated from the coarse stalk and with the tow still in it, and not of a fine quality, has a value of 12 and 15 cents per pound in Belgian and Russian ports. Upon this there is still an additional cost of 30 per cent duty, besides cost of transportation, making the cost of a good quality of Belgian flax at this port nearly 20 cents a pound. But little of this is used, and that to give a better finish, a longer and stronger fiber to thread, but is largely adulterated with the cheaper Canadian, Russian, and American. The crash mills would use the American fiber altogether if its character could be depended upon; but from its careless manipulation and want of attention to growing and dressing it is of less value and more difficult to use.

What is required at this time is that our farmers attend to the requirements of fertilizers and the rotation of crops necessary to grow the fiber to perfection, and then sow the proper amount of seed, 2 to 3 bushels per acre, pull it before it is over-ripe, steep it, and spread it just long enough to separate the fiber completely, and the present demand for flax may be easily supplied at home.

This is the first step, and if it cannot be secured without the assistance of a flax association, such should be organized. The importation of raw flax is about 4,000 tons annually, at a cost of about \$1,250,000, the importation of linseed about \$6,000,000 annually, and of linen goods about \$15,000,000 annually.

The value of the flax industry to Russia is above \$100,000,000 annually, the exports of linen goods by England is upwards of \$50,000,000 annually, while the number of looms in Great Britain in 1870 was 39,733, and in 1875, 51,601, having increased tenfold since 1850.

The establishment of a linen industry in America is not a work of a day, but the fact that the country has every requisite of the world for its successful establishment should incite our people to make the necessary effort. Much inventive skill would of necessity be called into action to supply labor-saving appliances, and considerable capital, labor, and patience would be required to obtain success. The government should be willing to accord it the same assistance, by way of a duty upon imported goods, which it afforded the silk industry, and with that there need be no risk of ultimate success.

A KEELY SEANCE.

Forty gentlemen, representing, as we are informed, a million dollars' worth of the stock of the Keely Motor Company, recently gathered at the Fifth Avenue Hotel, in this city, for the purpose of hearing a statement from Mr. Keely "as to the present condition and future prospects of the company." The proceedings began with a report from the board of directors to the effect that they were "convinced of the entire integrity of Mr. Keely, and ultimate success of the new motive power," but that the affairs of the concern were now at a standstill, owing to the funds having been exhausted eighteen months ago. The directors had personally contributed \$9,000, and now called upon the stockholders to put in about \$4,000 more, which, according to Mr. Keely, was all that was required to "carry the enterprise to a point of patenting and render it able financially to take care of itself." This address was not enthusiastically received.

Mr. Keely then remarked that after an elaborate research of two years he was now able to prove the practicability of his system. The difficulty had been in getting apparatus which would produce vibratory inductions. The system being now changed, all that was necessary was to intensify to get the vibratory inductions to produce power. Still it was an infinite success. It necessitated (*sic*) to carry undulatory action to intensify the undulative process to intensify the undulative force. He had demonstrated by rotating machine the action of vapor under vibratory rotation. Success had been encountered at every point. All that is needed now is a tube that will stand 25,000 pounds pressure. The volume of half a pint of water is more at vibratory induction than a gallon at undulatory process. The peculiar feature of the new machine is inducing operation without connecting the vibrating medium. The success had been triumphant. The motor is not microphonic or acoustic, and hence his investigations differed from those of "Mr. Ediphone," who did not work by globular transmission. Keely produced evolution by vibratory induction. The machine was strong enough for undulatory process for single reaction free of compound reaction, which is disadvantageous. By September 1st he would show the stockholders the "luminosity of the ether," and it followed that the moment scientists saw that they would be convinced. A pressure of 28,800 pounds had been maintained, and the motor was a great success.

Mr. Keely's remarks in this strain—and the sentences above given are quoted *verbatim*—continued for some twenty minutes. Although, as is obvious, they were nonsense, unalloyed by even the semblance of sense or logical connection, they were listened to with profound gravity, though toward

the end a puzzled expression was generally apparent on the faces of the assembly.

The Secretary, Mr. C. H. Schuellermann, then began a series of appeals for funds. He said that if the \$4,000 necessary was not subscribed the 124 shares of stock in the treasury, or else territory, would have to be sold. One half of the New England States, valued at \$450,000, had only elicited a bid of \$1,500. The motor was a grand success, and there was no doubt but that a 150 horse power machine would be going by September 1. He vigorously remonstrated against funds being raised by contributions of stock for resale. "Stock isn't money," he remarked. Finally he reached the true inwardness of the meeting by announcing that Mr. Keely's salary for nine months, \$1,800, had not been paid; nor had the Secretary's—a like sum. This rather disheartened the stockholders, as it was not clear, if \$3,600 were taken from the prospective \$4,000 to pay Keely and the Secretary, how such expensive undulatory processes and vibratory inductions could be got for the remaining \$400. There being a general repugnance to a subscription list, the stock contribution was finally agreed to, and the price of shares fixed at \$20 each; but when we departed no eagerness was manifested to contribute stock, and there seemed to be a widespread aversion to buying any.

The Keely stockholders, so far from being ignorant or uneducated, are an apparently intelligent body of gentlemen, all belonging to the upper walks of life, and probably are as good a representative body of the business men of this city as could be collected. It is, therefore, all the more surprising that individuals of this stamp should be so lacking, not merely in special scientific knowledge, but in ordinary acumen, as to become the dupes of Keely. Yet they have undoubted faith in the deception as a business venture, and have invested large sums of money upon the chance of its ultimate success. Their reluctance to come forward in answer to the Secretary's appeals for them to "protect their property" with more cash, seems due to a dawning impression, not of the infeasibility of the scheme, but of the fact that it involves very much more disbursements than accords with Keely's previous glowing predictions.

AN INDUSTRIAL PARADOX.

Common sense is a capital guide—when it is properly educated; otherwise it is the basis of all delusions. The uneducated common sense of mankind invariably avers that the world is flat; but, the Rev. Jasper to the contrary notwithstanding, we know that it isn't. The common sense of the working class, by no means the least intelligent part of the community, has invariably objected to the introduction of labor-saving machinery. To them the case is plain. If ten men are doing a certain kind of productive labor, and some one invents a machine wherewith one man can do as much as the ten have been doing, nine men must lose their job. Henceforth for them Othello's occupation's gone. That is common sense. But fortunately it is not common experience. Here comes in the industrial paradox: So far from the nine men going without work, the probability is rather that they will have more work to do, at higher wages, and ten other men will be called in to help them. That is the way labor-saving inventions usually work.

The common sense of English spinners told them that Arkwright's jenny would ruin their business; so they smashed it. The weavers did the same by Cartwright's loom. Yet these two inventions doubled the number not merely of English spinners and weavers, but the number of working Englishmen of all trades. The wealth of England as to a principal part of its trade and commerce is mainly their doing. The early commercial and industrial prosperity of our own country was very largely based upon cotton; but where would our cotton crop have been without Whitney's gin to clean it and Lowell's loom to weave it? The demand for American cotton was as nothing without the one, and could not be met without the other. By their great saving of labor they gave occupation to thousands, and cheapened the apparel of millions.

Quite as marked has been the influence of labor-saving machinery in the production of breadstuffs. But in estimating that influence it will not do to calculate how many men it would have taken to sow by hand and reap with a sickle the two thousand million bushels of grain we raised last year, and then say that the excess over the number of farm hands employed were so many men shut out from work by machinery. It is to labor-saving machinery that we owe the possibility of any crop at all in the larger part of the great grain producing regions of the interior. Without machinery to plow and sow and reap and carry the product to market, the inducement to open up the Western wilderness would have been as slight as the possibility of its execution. The West owes every thing to machinery. In our great grain-producing States, in spite of—more correctly, in consequence of—the rapid introduction and improvement of agricultural machinery, the farmers and farm hands increased in number more than 50 per cent during the ten years ending 1860; and about 30 per cent during the next ten, notwithstanding the losses incident to war. This was 13 per cent more than their share of the gain of the entire population. Yet there never was a time when labor-saving machines were introduced more rapidly or in larger numbers.

But it may be said that this is not a fair illustration; a vast multitude of new farms were brought under cultivation during those twenty years, and these made the increase of farm hands possible. True, but the same effect was produced, in even greater ratio, in purely mechanical indus-

tries, where the displacement of manual labor was still greater. During the same years the increase in the number of hands employed in manufactories of all kinds more than doubled. Yet those were years of wonderful progress in the invention and improvement of machinery.

Again, it is objected that those were flush times, times of undue expansion in all directions, times of over-stimulation and over-production, and that we are suffering the consequences now. To a large extent true; but machinery was not to blame for that. If it were, manufacturing countries would be the worst sufferers now, which is not the case. Nor is it true that employments into which the largest proportion of labor saving inventions were introduced are now worse off than others. On the contrary, those are the employments best off to-day, the employments which show fewest men out of work. It is chiefly in those lines of manufacture in which new and improved machinery has so improved and cheapened the product as to exclude foreign competition and gain the world for a market, that business is most active to-day. Witness the shoe trade. Within twenty years invention has turned over to machinery not less than 85 per cent of the work, yet that machinery has made occupation for more men than it has displaced. By improving the quality and lessening the cost of shoes, in spite of a large increase in the cost of stock and the doubling of the wages paid to the factory hands, machinery has gained for American shoes a market wide as the world. As a natural consequence many more shops are required to meet the increased demand, more workmen are employed, higher wages are paid, and multitudes are furnished with new employment in tanning the additional leather required, in putting up and transporting the additional product, in making the machinery used, and in collateral branches of productive industry. Thanks to labor saving machinery our leather industries have been raised to the front rank, along with those of iron and cotton and flour; and from having other countries make our shoes the tables have been turned, and our people are employed by the thousand in making shoes for other nations. The same may be said of scores of useful products; and with many others there would be no possibility of their furnishing employment to any of our people were it not for our superior machinery. How, for instance, would it have been possible for us to compete with the hand looms of England and France in the weaving of carpets? Without power looms for this purpose we should have to import all our carpets; with the labor saving inventions of American mechanics, we make our own carpets, and so give employment to thousands of our own citizens. Only by means of inventions, which enable a few of our well paid men to do more and better work than many ill paid foreigners, is it possible for our industries to control our own markets, let alone those of other lands.

We hear it said that machinery subordinates mind and manual skill to brute matter, and so debases the worker; that men are made of less account thereby and wages depressed. Where is the proof? Where will one find the rates of wages higher, the working day shorter, the intelligence of the native working class greater, than here in America, where machinery is most used? And where in America is the artisan better off than in our manufacturing towns? The laboring classes have been distressed by hard times the world over of late years; the American workers, however, least of any; and of these, machine users have suffered far less than manual laborers. Trustworthy statistics could be given to prove the assertion made a moment ago, that the wages paid in shoe factories are now or lately were double what they were before machinery was introduced. For the sake of variety, take a less striking case. In the introduction to the American edition of the Swiss pamphlet "Look Out for Yourselves," the editor says that the books of a New England mill, which has employed from 350 to 450 hands for 45 years in the manufacture of the same grade of standard sheetings, show that the product per hand has more than doubled since 1835, and nearly doubled since 1855. Meantime, while the hours of labor have been lessened, the average daily pay of the operatives has increased since 1855 over 22 per cent for females and 46 per cent for males. This on the basis of even the low prices of January, 1878. Fortunately improvements in machinery have more than kept up with the increase in wages; and the relative cost of making cotton goods here compared with the cost in other countries is so low that we not only supply ourselves but are able to export, and thus secure employment for many that might otherwise have to go idle.

A volume of similar illustrations could be given if needed. The reverse would naturally be expected, but experience shows that instead of lessening the demand for labor, labor-saving machinery so called invariably increases the demand. The effect of machinery in compelling rapid readjustments of labor, and in crowding the incompetent and unimprovable to the wall, thereby intensifying the struggle for place, and the ultimate effect upon the intelligence and versatility of the artisan class, must be left for discussion hereafter.

Tennessee Steel Works.

The first open hearth steel ever made in the South was turned out June 6th by the Roane Iron and Steel Company of Chattanooga. The cast, an experimental one of six tons product, by the Siemens-Martin process, was a perfect success in quality. Specular ore from near Cartersville, Ga., was used. When in full operation the company expect to produce 150 tons a day.