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DO INVENTIONS INJURE THE LABORER?

One of the arguments made use of by many against the patent law is the old fallacy that improvements in machinery take the bread out of the mouth of the laborer, and the great number of unemployed people at the present time is cited as an example of the effect of the use of machinery enabling one man to do the work of several, who must, it is stated, be thrown out of employment because the one man on the machine does all the work that the others did before. From this it is argued that a patent law for encouraging inventions is a bad law, and should be abolished.

This is one of the old ideas that are continually cropping up, and its fallacy has been so thoroughly exposed by the logic of events that it seems to many as hardly worth considering. We certainly thought so until lately, but it has made its appearance quite often of late in places where we would hardly have thought to have seen it. Petitions have been sent to Congress for the abolition of the patent law; various newspapers have been publishing articles condemning the introduction of new machinery, and seriously proposing a return to the old methods of hand labor, so as to give employment to the thousands who cannot now get it, and it appears from various questions asked by some of the members of the Congressional Committees on patents, in the recent discussion on the amendments to the patent law, that they are, or rather were, believers in this doctrine. We say "were," because we believe that since the discussion before these committees the members thereof have become so well posted on the good effected by patent laws that some of them, who were originally inimical to the law and seriously desired to repeal it or suspend its operation, are now in its favor. The fact, however, that men having sufficient general intelligence to edit a newspaper or to reach the position of members of Congress believe in the theory that machinery is hurtful to the laborer, seems to call for some effort on our part, as the special champion of the inventor and the patent law, to show how erroneous is this idea, and we therefore propose to cite a few instances that occur to us where it would appear that if there were any chances of machinery throwing people permanently out of employment, it certainly would be in the examples mentioned.

As one of the prominent and most familiar examples, let us consider the sewing machine. When Walter Hunt invented his machine in 1838, his wife objected to his introducing it, as she thought, like many others, "that it would throw all the sewing women out of employment." Hunt appeared to think the same himself, and on his wife's entreaties abandoned his invention, thus losing a fortune and leaving the field open to Howe, who was either wiser than Hunt on this point or had less scruples. Now what has been the result of the introduction of sewing machines in lessening the demand for labor? Are there fewer people now employed at sewing than there were formerly? Is it not a fact that the thousands of operators earn much more than they formerly could by hand; that where one stitch was put in a dress when made by hand there are ten now; that the miserable "three-stitches-to-the-inch" style of clothing has disappeared from the market since sewing machines have been introduced; that tens of thousands of women who formerly made the underclothing of their families, now buy it ready-made, because it is made so cheap by sewing machines; and that sewing machine made goods are exported in large quantities to countries that would otherwise supply us, because with their underpaid laborers they could compete with and undersell our manufacturers, and thus throw thousands of our people out of employment?

These statements may, however, be said to be mere assertions, not borne out by facts. Let us see, therefore, what the figures of the census say on this question. In 1850 there were 52,069 tailors employed in the United States, which then had a population of 23,191,876, or one tailor to 445 inhabitants. In 1870, notwithstanding the introduction and use of thousands of sewing machines, there were 106,679 tailors in a population of 38,558,371, or one to 361 inhabitants. So that although the population had not doubled by nearly eight millions, the number of tailors employed had more than doubled. The statistics relating to women's clothing are not so readily obtained, or we have no doubt but that they would show equally as well.

There is, however, another point to be considered. The introduction of the sewing machine has not been made without labor, for according to the census there were 17,372 hands employed in sewing machine factories in 1870, and there were 3,152 dealers in machines in the same year, besides the almost countless hosts of canvassers or "agents" who were perambulating the country, all of whom got their living directly from the sewing machine industry, to say nothing of the numbers of people who were employed in mining and manufacturing iron and steel for the machines and lumber for the tables, and the thousands of others indirectly supported by the sewing machine business.

In our remarks so far we have only cited such points as appeared to have a bearing on the question of the effect on labor of the employment of sewing machines, but have said nothing as to the gain of the people generally by their use. We do not have by us any reliable statistics on the prices of clothing, but if any one doubts the fact that sewing machines have reduced the price of wearing apparel, let him go to a shirt maker and ask the difference in the price that would be charged for making two shirts of the same materials, one to be made entirely by hand and the other by machine.

With regard to the effect of sewing machines on the shoe manufacture we have some interesting statistics that we believe may be relied on. The sewed shoes which are made in the greatest numbers are the ordinary gaiter shoes (women's). These shoes before machines were introduced for sewing them sold at about $2.00 per pair, but now shoes of the same quality can be bought for $1.50, notwithstanding that the materials in them have gone up from 40 to 70 per cent, and that wages have more than doubled. The women who formerly sewed the uppers got 50 cents per day; they now get $1.33 on the machine. Men got on an average $1.25 per day, varying according to their skill; now they get about $2.50—some rather less, many a great deal more.

If we consider the textile industries of cotton goods, woolens, worsted goods, carpets, hosiery, etc., we find that notwithstanding the great advance in the number of labor-saving inventions, the hands employed have increased faster than our population, and that the wages paid have more than doubled, as will be seen by the following figures, taken from page 596 of the Industry Volume of the Census of 1870:

	1860.	1870.
Hands	181,550	255,328
Wages	37,301,710	79,401,367
Product	196,416,400	395,158,565

The last line shows the advantage of the use of the improved machinery now employed, as, notwithstanding there was only an advance of less than one half of the number of hands employed, the value of the product was increased about 150 per cent, although the hours of labor in many factories were largely reduced between 1860 and 1870.

As another instance, take the use of the reaping and mowing machine. In the twelve States where these machines are used most we find that farmers and agricultural laborers have increased from 1,301,863 in 1850 to 2,024,399 in 1860, and 2,641,830 in 1870.

It may be objected, however, that most of the States where mowers and reapers are used are the rapidly growing Western States, and that this is therefore hardly a fair argument to use. We will therefore give the following table, compiled from the census, showing the hands employed in the various manufactories of all kinds all over the United States:

	Hands.	Wages.	Population.
1850	958,079	$236,759,464	23,191,876
1860	1,311,246	378,878,966	31,443,321
1870	2,053,996	775,584,343	38,558,371

From a comparison of these tables it will be seen that, notwithstanding the immense number of labor saving machines introduced in the twenty years embraced in the above figures, the hands employed have more than doubled, and the wages nearly quadrupled, although the population had only increased from a little over twenty-three to thirty-eight and a half millions, or about 67 per cent.

In considering the effect of inventions on the laboring interests of the country we must not forget that many inventions actually increase the amount of labor to be performed, as, for instance, the telegraph and photograph. The census of 1870 gives nearly 17,000 as the number employed in different capacities in the telegraphic offices of the country, to say nothing of those indirectly connected with it in building the lines, drawing the wire, making the instruments, etc. The photographers are also a large class entirely dependent on a modern invention, without which their occupation could never have existed, and they in their turn keep a large number of people employed in preparing chemicals, paper, plates, mats, frames, etc., for their use. The rubber business also employs tens of thousands of operatives directly in the manipulation of the rubber, leaving out of consideration those engaged in other countries in the collection and shipping of the raw gum, and the thousands employed here in the sale of the manufactured articles. If to these we add the immense number of people employed in connection with the railroad and steamboat interests of the country, which are wholly dependent upon the inventions of the steam engine, locomotive, and steamboat, it will appear plain to the meanest capacity that inventions, so far from throwing people out of employment, have rather increased the demand for their services.

PROFESSOR JOSEPH HENRY.

The death of Professor Joseph Henry, which occurred on May 13, has not been unexpected, for he had attained the ripe age of eighty years, and the signs of failing health for some time past have indicated the near termination of a life fruitful in great works. During last winter he contracted a kidney malady which severely prostrated him, so that at the recent meeting of the Academy of Sciences, in Washington, he was barely able to leave his room and preside for a very brief period over the deliberations of that body. His address as president was read by Secretary Hilgard, and the tendering of his resignation therein, together with the many suggestions he offered for enhancing the welfare of the Academy, bore the impress of his evident foreboding that those were his parting words.

Professor Henry was born in Albany, N. Y., on December 17, 1797. His education was such as could be obtained at the ordinary common school, and he developed in his early years no especial aptitude for study. Entering the Albany Academy he acquired enough knowledge to fill the post of district school teacher, but this he did not retain long, returning to the academy to resume his studies, and finally becoming an assistant of Dr. Beck in the chemical researches of the latter, and also professor of mathematics in the above named institution. In 1826, while holding this position, he began his magnificent original investigations on electricity and magnetism, the first regular series on natural philosophy which had been prosecuted in this country since the days of Franklin. These researches gave him a wide reputation, and led to his call in 1832 to the chair of Natural Philosophy in the College of New Jersey, at Princeton. In 1846, at the organization of the Smithsonian Institution at Washington, Professor Henry was appointed its Secretary, which post he since constantly held. He was also one of the members of the Lighthouse Board of the United States, president of the National Academy of Sciences, besides a member of a large number of foreign learned societies.

It would require a volume to explain all of Professor Henry's investigations and discoveries in detail. The following, however, is a brief enumeration of the more important ones: First, a sketch of the topography of the State of New York; second, in connection with Dr. Beck and Simeon De Witt, the organization of the meteorological system of the State of New York; third, the development for the first time of magnetic power sufficient to sustain tons in weight in soft iron by a comparatively feeble galvanic current; fourth, the first application of electro-magnetism as a power to produce continued motion in a machine; fifth, an exposition of the method by which electro-magnetism might be employed in transmitting power to a distance, and the demonstration of the practicability of an electro-magnetic telegraph, which, without these discoveries, was impossible; sixth, the discovery of the induction of an electrical current in a long wire upon itself, or the means of increasing the intensity of a current by the use of a spiral conductor; seventh, the method of inducing a current of quantity from one of intensity, and *vice versa;* eighth, the discovery of currents of induction of different orders, and of the neutralization of the induction by the interposition of plates of metal; ninth, the discovery that the discharge of a Leyden jar consists of a series of oscillations backwards and forwards until equilibrium is restored; tenth, the induction of a current of electricity from lightning at a great distance, and proof that the discharge from a thunder-cloud also consists of a series of oscillations; eleventh, the oscillating condition of a lightning rod while transmitting a discharge of electricity from the clouds, causing it, though in perfect connection with the earth, to emit sparks of sufficient intensity to ignite combustible substances; twelfth, investigations on molecular attraction, as exhibited in liquids and in yielding and rigid solids, and an exposition on the theory of soap bubbles. These originated from his being called upon to investigate the causes of the bursting of the great gun on the United States steamer Princeton. Thirteenth, original experiments on and exposition of the principles of acoustics, as applied to churches and other public buildings; fourteenth, experiments on various instruments to be used as fog signals; fifteenth, a series of experiments on various illuminating materials for lighthouse use, and the introduction of lard oil for lighting the coasts of the United States; sixteenth, experiments on heat, in which the radiation from clouds and animals in distant fields was indicated by the thermo-electrical apparatus applied to a reflecting telescope; seventeenth, observations on the comparative temperature of the sun spots, and also of different portions of the sun's disk; eighteenth, proof that the radiant heat from a feebly luminous flame is also feeble, and that the increase of radiant light by the introduction of a solid substance into the flame of the compound blow-pipe is accompanied with an equivalent radiation of heat, and also that the increase of light and radiant heat in a flame of hydrogen, by the introduction of a solid substance, is attended with a diminution in the heating power of the flame itself; nineteenth, the reflection of heat from concave mirrors of ice and its application to the source of the heat derived from the moon; twentieth, observations in connection with Professor Alexander on the red flames on the border of the sun, as observed in the annular eclipse of 1838; twenty-first, experiments on the phosphorogenic ray of the sun, from which it is shown that this emanation is polarizable and refrangible, according to the same laws which govern light; twenty-second, on the penetration of the more fusible metals into those less readily melted while in a solid state.

In relation to the electro-magnetic telegraph, it has been clearly shown that Professor Henry was the originator of the only practicable method of sending telegraphic signals through long distances, and that he was the first to put into actual operation a telegraph of this kind. The inventions of Henry are all embodied in the Morse instrument, and if the former were to-day discarded it would be impossible, in a commercial sense, to send telegraph messages. Morse's instruments, on the other hand, might be withdrawn from use without serious difficulty. Indeed, the instrument upon which Morse most strenuously based his claims as originator of the telegraph, namely, the recording stylus, which produced a signal on paper, has already gone almost entirely out of use, and Henry's system of reading by sound is preferably employed. The honor of originating the telegraph undoubtedly belonged to Professor Henry, and had Congress, as it well might have done, granted him a patent for his inventions, although he never applied for this protection, at the time of his death he would have enjoyed a monopoly, as patentee, of all the telegraphs, railway signals, fire alarms, and electro-magnetic machines of every kind now in the United States, for he was the father of them all. It is hardly necessary to point out how enormously wealthy this would have made him, but he preferred to take his reward in the knowledge of having benefitted humanity, and in the enduring renown which posterity will accord to him.

MEDDLERS IN ARTS IN WHICH THEY ARE NOT SKILLED.

In his enumeration of the mischievous effects of the patent law as it now stands, before the House Committee on Patents, Mr. Raymond dwelt at some length on "a useless and pernicious class of patents," which the system encourages; namely, patents issued to "ignorant and officious meddlers in arts in which they are not skilled."

As a very bad case of such meddling Mr. Raymond pictured a backwoods Irishman, who, while taking his biennial trip along the railroad track to town, sees that some of the nuts attaching the fish plates of the rail are loose, and remembering that "the squire" made a great deal of money out of a patent, proceeds to invent a nut lock. We are to infer that a proper patent system would put a summary stop to this sort of foolishness. Here are some hundreds of skilled railway engineers and constructors, presumably competent to supply all the needs of a well regulated railway, and an unskilled Irish laborer steps in to instruct them in their art! Worse yet, he takes out a patent for his invention, so that if they should want to use his invention they must pay him a royalty therefor! Could anything be more atrocious, more oppressive to the high and mighty railway interest? And the influence of the patent law is to set every other man in the land studying over some device by which he can meddle in some art or other, regardless whether he is skilled in it or not. No wonder the advocate's mind revolts at it!

The mischief done by such meddlers is incalculable. Only the other day there was an art that had reached a marvelous stage of development. Some of the cleverest men of the century had been engaged upon it; and with a most scientific adjustment of reeds, organ pipes, bellows, diaphragms, and what not, they had succeeded in making a machine that could speak a number of words very distinctly. Then along comes a fellow, utterly unskilled in physiology, acoustics, organ making, and all that sort of thing, who takes a simple plate of sheet iron and makes it talk like a Christian. At one stroke a promising art is dashed to the ground, never to be revived. What chance had the most learned talking machine maker in competition with an unskilled meddler who could make a tin box cover imitate any sound that human ingenuity could bring before it?

There is another fellow, a teacher of deaf mutes, who has lately been meddling in an art in which he was not skilled. Already his uncalled for interference has had an enormous effect upon one of the most useful and flourishing enterprises of the age. He was not a telegrapher, not even an electrician; yet he has presumed to invade the domains of both those useful classes of the community. And the patent law encourages him! Curiously the first, though less successful, telephone maker was likewise a teacher, utterly unskilled in telegraphy and its kindred sciences. In this connection we might mention also that meddlesome portrait painter, Morse, who made such a revolution in the business of conveying intelligence, a generation or so ago.

Indeed it would seem that nine out of ten of the men who have contributed most to the progress of invention have been meddlers in arts in which they were not skilled. There was that early schoolmaster by the name of Whitney, who invented the cotton gin and revolutionized the agriculture of the South and the cotton manufactures of the North. He never raised a cotton plant in his life, nor did he ever weave an inch of cotton. Even more serious have been the effects of the agricultural meddlesomeness of another taker out of patents, McCormick by name, the inventor of the reaper. His interferences in arts in which he was not skilled, under the encouragement of our patent system, fairly mark an era in the history of his country. Under a patent system of Mr. Raymond's revising such things would not be allowed to happen.

Fulton was another meddler. In his day the business of transportation had become enormous for a new country, and the broad canvas of our shipping whitened every sea. What did he know about ship building? He never built so much as a canal boat. Yet he presumed to introduce a new order of naval architecture, a new method of propulsion, a new era in commerce. Not less unwarrantably meddlesome was Stephenson when he set his iron horse in motion. For many more than the hypothetical "coo" did the new engine threaten to be "verra bad;" and the Raymonds of the day had no lack of clients who deemed it an outrage that this man should be permitted to interfere in arts in which he was not skilled to the destruction of long established and prosperous industries. He had never owned or driven a passenger coach; nor had he any experience in the management of a wagon train.

A still earlier fruit of the English patent system was the steam engine of James Watt, whose influence has been felt in every art known to civilized man—in arts in which he was not merely unskilled, but which without him might never have been called into existence. Bessemer was another meddler—a bronze worker, who never made a pound of steel in his life until after he invented the process which revolutionized that important department of manufacture, making it possible to produce four tons of steel at what had been the cost of one.

We venture to say that Howe never so much as sewed on his own trowsers buttons before he began to make the first sewing machine; and everybody knows the results of his meddling.

So we might go on enumerating to the end of the chapter. The inventors of improvements in the means, methods, and appliances in general use are most commonly men skilled in the arts which they improve; not so the inventors of radically new means and processes. These as a rule are outsiders—meddlers, Mr. Raymond calls them; and a patent system which should bar them from patenting their inventions because they are not skilled in the arts which they seek to supersede or radically improve would shut off the most useful and productive outflow of inventive genius. It is true that these men are apt to be at the outset as poor as Mr. Raymond's Irishman. It is true, too, that the hope of making money is the chief inducement which leads them to patent their inventions. True also that such inventions often subject great interests to temporary inconvenience, and put a stop to profits arising from the use previously of satisfactory devices. Nevertheless the world gains enormously by them; and a people as intelligent as ours will not consciously favor any measure likely to debar or discourage the makers of such inventions, meddlers though they be in "arts," in which they are not skilled.

CLEARANCE AND COMPRESSION.

People used to understand by "clearance" only the distance between the piston and the cylinder head when the former stands at stroke end, it being necessary to allow a little such "clearance" at each end of the stroke to prevent possible accident in case the connecting rod brasses wore and let the piston make a slight overstroke. Later, when it came to be understood that "clearance" caused a difference in the working of the engine, the term began to be applied to the volume and not to the length of the space, and to include in addition the volume of the admission ports; so that now "clearance" in calculation means the whole volume between the piston at stroke end and the slide valve. The area of the space back of the piston is not cylindrical, nor that of the admission channel regular; but both may be measured by filling them up with shot or with water.

In calculating it is more convenient to express clearance in fractions of the piston displacement than in actual measures; thus it will run from, say, 0·02 up to 0·1, generally being least in large engines and in those having poppet or Corliss valves.

It is found convenient to prevent the exhaust steam escaping from the cylinder during the whole return stroke; but as the exhaust port is closed before the stroke end, there is steam on both sides of the advancing piston, which compresses the exhaust steam imprisoned until the clearance space contains steam sometimes of higher pressure than that in the boiler.

If there be no practical compression, the clearance space is, at the end of the return stroke, full of low pressure steam (of not more than 2 or 3 pounds per square inch), and the boiler steam rushes in and works on the piston about as though this exhaust steam were not present. But owing to the clearance the new steam does not do as much work as though the piston moved through the whole space. Often the cylinder steam is drier where there is clearance. But neglecting this and considering an expansive engine: If the clearance be $\frac{1}{10}$ and the cut off $\frac{1}{8}$, the rate of expansion will be

$$\frac{1\frac{1}{10}}{\frac{1}{10}+\frac{1}{8}} = 4\tfrac{8}{9}, \text{ instead of } \frac{1}{\frac{1}{8}} = 8.$$

Compression has very little influence on the rate of expansion, nor on the work done, but a good deal on the back pressure and on the steam consumption, and somewhat on the state of the steam. Thus, when the steam enters the partly empty clearance space it often gets drier, but where there is compression the amount of drying is less, especially when the clearance is full.

The cushion steam is first compressed by the piston until the stroke end (or near it if there be lead), at which the clearance spaces are filled with steam at the "cushion pressure;" then, if this cushion pressure is below that of the boiler, as is usual, the cushion steam is further compressed by the entrance of the fresh working steam from the boiler; thirdly, it enters the working space of the cylinder, and is generally cut off; it then continues to expand while doing work upon the piston; and fourthly, it suddenly expands, doing no work, except overcoming back pressure.

The working steam goes through all its changes nearly as though there was no clearance. The cushion steam goes through a series of changes without condensation.

Comparing two cylinders having the same total volume, but in one of which the piston stroke is shortened so as to give, say, $\frac{1}{16}$ clearance, and in which there is also compression, the ratio of expansion is the same; the mean forward pressure is independent of the compression, but is lessened by the clearance; the steam consumption is diminished $\frac{1}{16}$; the back pressure increased; the work done on the piston per pound of steam increased $\frac{1}{15}$; the useful work increased in a more complicated ratio, according to the amount of cushion; compression diminishing steam consumption, but also lessening the whole useful work done.

Calculation and experiment will adjust the amount of compression so as to reconcile small steam consumption and great useful work done.

It may generally be stated that there is always a loss by clearance, but that judicious compression reduces it to a minimum.

RICE GLUE.—The fine Japanese cement is made by mixing rice flour with a sufficient quantity of cold water, then boiling gently, with constant stirring.