

stances practically the whole labour has been displaced by fuel labour. We may assume that the same amount of "work" is done, of "foot pounds" absorbed, in making 7,500,000 pins to-day as in Smith's day; but there is this difference, that now we obtain our foot pounds from the energy of heat evolved in the combustion of fuel, whereas in Smith's time it was obtained from the food consumed by one hundred and fifty-six men. Numerous other instances, all showing the same tendency to substitute fuel energy for human energy in the doing of work, could be furnished; and the reason for this substitution, and the effect of it, is always the same, viz., to reduce the cost of production of commodities.

Perhaps it may be objected that such displacement of human labour by fuel labour is not beneficial to the human race; that the workers thus thrown out of employment are necessarily placed in hard straits. But this objection, though at first sight reasonable, is not valid. Though the workers are displaced in particular handicrafts and occupations, yet the great increase of production caused by the employment of fuel labour in such trades, causes a vast development of employment for human labour in related occupations and trades. The introduction of fuel labour has been of great benefit to the human race, as is shown by the unparalleled increase of population that has taken place during the present century since the introduction of fuel labour. Population will increase just as fast as, and no faster than, the means of subsistence increase. Now the effect of the introduction of fuel labour has been hugely to reduce the price of commodities, and to increase wages; in other words, the means of subsistence has been brought within the reach of a much larger number of people than formerly, and have been supplied more amply and fully. Therefore, population should increase. That it has increased wonderfully, statistics amply prove. In the 300 years from 1300 to 1600, the population of England and Wales did not double (2,500,000 to 4,812,000); in the 200 years from 1600 to 1800, it did not double (4,812,000 to 9,335,000); but between 1801 and 1888, it has increased over three times (9,335,000 to 28,600,000), besides the very large numbers that have been thrown off by emigration. The nineteenth century has been much more favourable to the expansion of the human race than any preceding century, because the introduction of fuel labour has rendered the means of subsistence so much more easily attained.

To the Engineer—the Civil or Mechanical Engineer—the view of labour set forth in the preceding pages can hardly fail to be of interest. Our work consists mainly of devising means for substituting other energy for human, in the doing of all kinds of work, and in preparing ways for the more complete attainment of this. All kinds of steam-driven, hydraulic or electrical machinery, have this object in view; so too, has the construction of all railways, canals, electrical railways, cable car systems, etc. The root idea is always to economise energy, to substitute a less costly for a more costly energy, to make the energy we are at present using do more work if possible than it formerly did. The effect of this is to reduce the cost of producing these commodities that are necessary for the sustaining and developing of human life, and to supply those commodities in greater profusion. Our work has been so thoroughly done,—triple expansion marine engines have so reduced the cost of conveying commodities, and cheap energy the cost of producing them—that politicians have felt themselves called upon to interfere, and by taxation to nullify the results that our labours would otherwise produce. "Protection," as it is called, counteracts what science achieves. But the discussion of this would lead to matters foreign to a society of engineers; and, therefore, having reached this point, this already lengthy paper may fittingly be brought to a conclusion.

GRANVILLE C. CUNNINGHAM,

*M. A. S. E., M. C. M. Soc. C. E.*

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