Volume 4. Forging an Empire: Bismarckian Germany, 1866-1890
The Economic and Social Significance of Gas Motors (1870s)

This passage points to the problems smaller businesses faced in obtaining the mechanical power necessary for manufacturing. The gas motor was an affordable alternative to the huge steam engines operated by large industrial concerns. The gas motor was first constructed by the Frenchman Jean Joseph Étienne Lenoir (1822-1900) in 1860. The German engineer and entrepreneur Nicolaus Otto (1832-1891) developed Lenoir's idea into the conventional combustion engine in 1876.

Only capital is capable of purchasing and operating the colossal steam engine, around which the rest of the [weaving] facility is grouped; this also requires capital but is not inseparable from it. [. . .] The small weaver [. . .] would be relieved from the excess pressure of capital, if only we could allot him the amount of basic operating power designated to his loom. One could attempt something similar in the realm of spinning, even though it has already succumbed far more with respect to the machine than weaving. [. . .] Other fields [. . .] are carpentry, the locksmith's trade, belt-making, plumbing, brush-making, pump-building, etc. What these trades are lacking is partly the power, partly the machines for the work. However, the individual craftsman would already be able to acquire the latter now that prices are really low; but he always lacks the operating power. If the carpenter could get the operating power for a circular saw, a band saw, a planing machine, or a dovetailing machine at a reasonable price, he would be able to work with these machines just as well at home as he does now at the furniture factory that has pulled him in. In this way, by using his mechanized workspace for a wide variety of applications, he would be able to maintain or regain his skills, which he is losing as a factory worker. The result would be similar with respect to the other trades mentioned. What machine construction should therefore accomplish in order to remedy a substantial part of the deplorable state of affairs is to supply affordable, smaller-sized operating units – in other words, small power tools operable at minimal cost. If we give the small master craftsman basic power at an equally affordable price, just as capital has at its disposal the huge and mighty steam engine, we will preserve this important social class, we will strengthen it where, fortunately, it still exists and resurrect it where it is about to vanish. [. . .]

The sense that a smaller division of basic power is appropriate makes itself felt in a number of places and forms. One of these forms is renting out power, which some have attempted successfully in large cities. This, however, leads to a concentration of workers in one building, the

cooping up of families and workers in unhealthy rooms, resulting in the old evil in a new guise. At any rate, it is far inferior to the method of providing small craft shops with small individual power tools. Several excellent examples in this category can already be enumerated: gas-powered motors, in particular, but also hot-air engines, small water-column machines, and – still at the stage of a promising experiment – kerosene gas engines. [. . .] Therefore, these smaller power tools have to be considered among the most important new machines as they contain the seeds for completely reorganizing a part of industry. [. . .] Pneumatic and gas machines can be used almost everywhere and, moreover, are being continuously perfected. These small engines are the true power machines of the people. [. . .]

Source: F. Reuleaux, *Theoretische Kinematik. Grundzüge einer Theorie des Maschinenwesens* [*Theoretical Kinematics: Rudiments of the Theory of Mechanical Engineering*]. Braunschweig, 1875, pp. 525-29.

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