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In the Time of Full Mechanisation

By NICOLA | Published: AUGUST 4, 2010

In 1948, Swiss art historian [Sigfried Giedion](#) published [Mechanization Takes Command](#), an epic investigation into the origins, evolution, and impact of mechanisation on human civilisation.

Subtitled “A Contribution To Anonymous History,” the book draws on patent drawings, promotional leaflets, and even business cards to piece together the incursion of machines into domestic, agricultural, and industrial space.

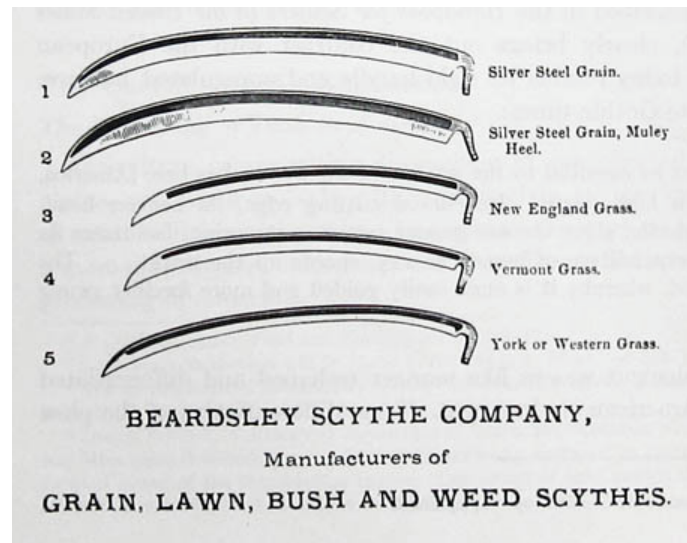


IMAGE: “Differentiation of the scythe: ‘For Every Type Of Grass Or Grain’. 1876. (Asher and Adams, *Pictorial Album of American Industry*, Philadelphia, 1876)” Giedion shows the increasing refinement of hand tools — human-machine prostheses — proceeding alongside early attempts at replacing human labour with machines.

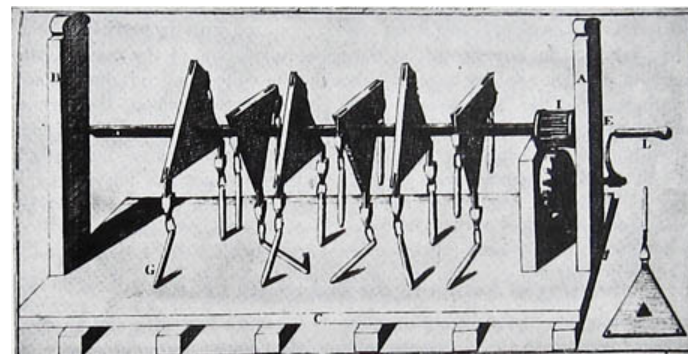


IMAGE: “Beginning of Mechanization: Threshing Machine. 1770s. (*Pennsylvania Magazine*, Philadelphia, 1775). This device typifies the early phases of mechanization in agriculture. It multiplies the number of flails and imitates by mechanical rotation the motion of the human arm. The threshing machine came into practical use in late eighteenth-century England, and was the first successful instrument of mechanized agriculture.”

Along the way, Giedion makes a passionate plea for the preservation of such ephemera, as his already enormous task was made nearly impossible in places due to “an amazing historical blindness” that “has prevented the preservation of important historical documents, of models, manufacturer’s records, catalogues, advertising leaflets, and so on.”

“Later periods,” he concludes, “will not understand these acts of destruction, this murder of history.”

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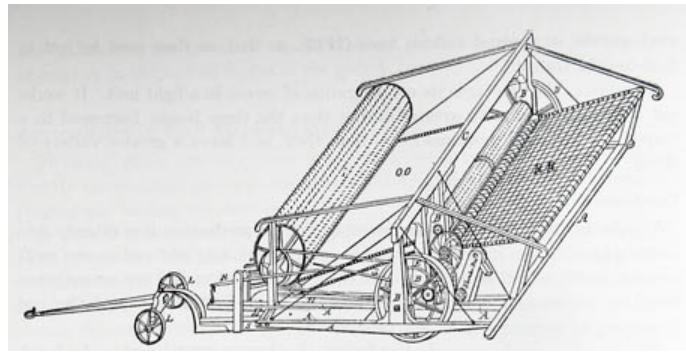


IMAGE: “Continuous Production Line: U.S. Patent, 1836, ‘Machine for Harvesting, Threshing, Cleaning and Bagging Grain.’ Constructed in the wilderness of Michigan in 1836, this earliest combine, harvesting without human hands, manifests the same trend as Oliver Evans’ achievement in the milling production line, 1783. About a hundred years had to pass before the combine, which automatically reaps, threshes, and bags the grain, became available for the family-size farm.”

Nonetheless, Giedion manages to assemble an incredible wealth of archival detail to retrace the one-step-forward, two-steps-backward story of mechanisation and its impact on “our mode of life.” The book outlines the replacement of human labour and the introduction of [continuous production](#) and [scientific management](#) in terms of furniture, bathrooms, factories, art and — most interestingly for an *Edible Geographer* — in various aspects of food production, processing, distribution, and preparation.

Following a short but fascinating sketch of the “Springs of Mechanization” analysed in terms of attitudes to movement over time (from the representation of movement in the fourteenth century to its “capture” in the nineteenth century), and a thorough case-study of the process of mechanisation in bank locks, starring [Linus Yale](#), Giedion embarks on the meat — quite literally — of the book. In an amazingly titled section, “Mechanization Encounters The Organic,” he covers “Reaping Mechanized,” “The Oven and the Endless Belt,” and “The Mechanization of Death,” to name just a handful of chapters.

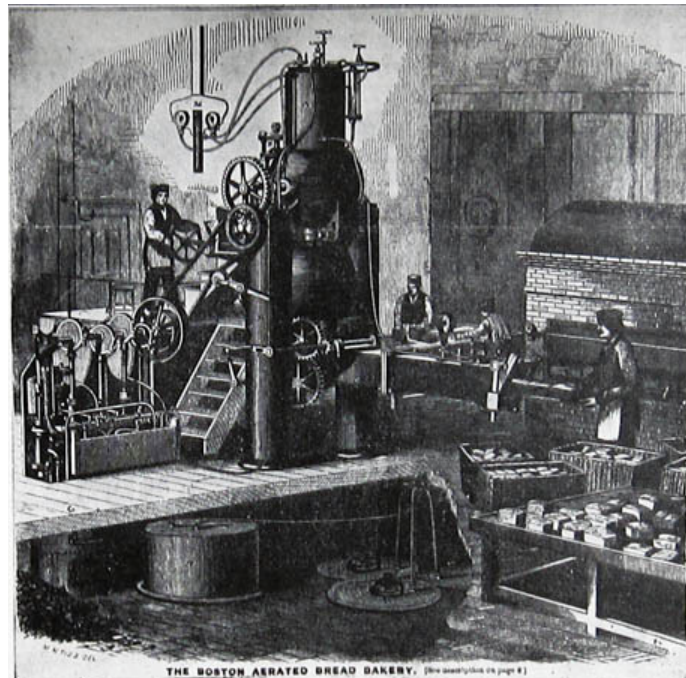


IMAGE: “Bread and Gas: Dr. Daughlish’s Bread-Making Apparatus. Early 1860s. Bread making is reduced from ten hours to a few minutes. The first experiment in mechanizing bread manufacture on a large scale was by John Daughlish, a British physician, in 1856. Daughlish injected carbonic acid gas into the dough under pressure, reducing the nine-hour fermentation period to twenty minutes. Failing to generate the natural warmth of fermentation, this gave a homogenous mixture permeated with fine bubbles, but cold as a corpse. Serious disadvantages in baking ensued. (*American Artisan and Patent Record*, NY, Vol. III, 9 May 1866).”

“How did mechanization alter the structure of bread and the taste of the consumer?” Giedion asks. “What are mechanization’s limits in dealing with so complex an organism as the animal? And how does the elimination of a complicated craft — such as the butcher’s — proceed?”

Giedion singles out individuals such as Oliver Evans, inventor of the [automated grist mill](#) as well as the semi-mythical [Oruktuur Amphibilos](#), to illustrate a natural history of the assembly line:

Humanly and technically, the problem of the assembly line is solved when the worker no longer has to substitute for any movement of the machine, but simply assists production as a watcher and a tester. This was done, quite suddenly, toward the end of the eighteenth century in Oliver Evans’ mechanization of the grain-milling process.

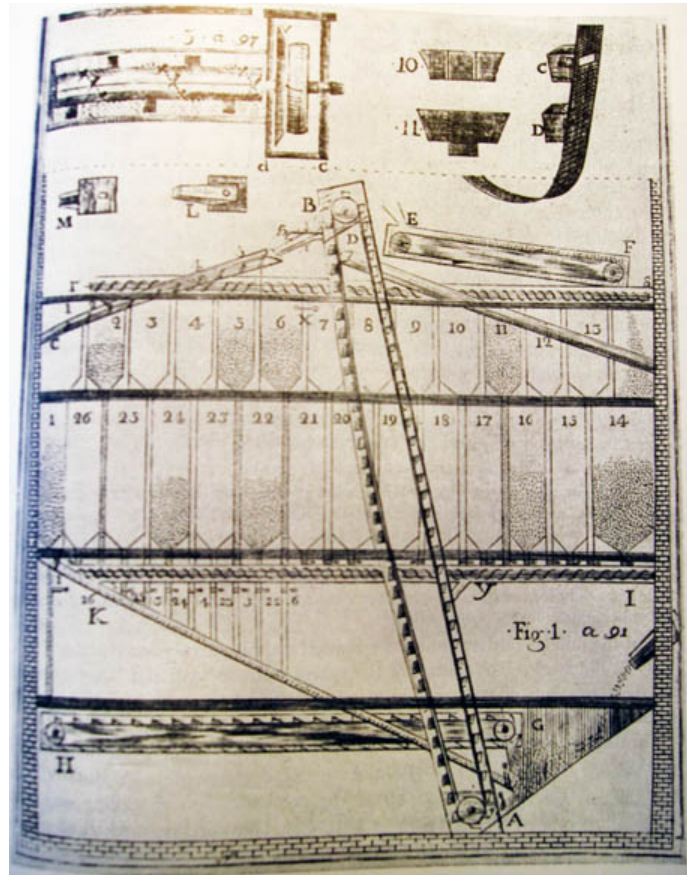


IMAGE: “Oliver Evans: Archimedean Screws and Bucket Conveyor for Elevating and Transporting Grain, 1783.” Apologies for the particularly poor quality of this photo.

What makes Evans’ prototype grist mill so interesting is that its innovation is simply to combine existing — indeed, ancient — technology into a continuous mechanised line of production. This was an idea that, according to Giedion, “had no analogy in its time,” and its unrecognisability actually formed the basis of a legal challenge to Evans’ 1790 patent.

After an initial blustering rejection — “you cannot make wooden millers” and, besides, “the whole contrivance was a set of rattle traps unworthy the attention of men of common sense” — millers adopted the automated mill and, naturally, sought to avoid paying Evans royalties. Thomas Jefferson himself deemed the device to be “nothing more than the old Persian Wheel of Egypt, and [...] the same thing as the screw of Archimedes,” which is correct, but utterly misses the point.

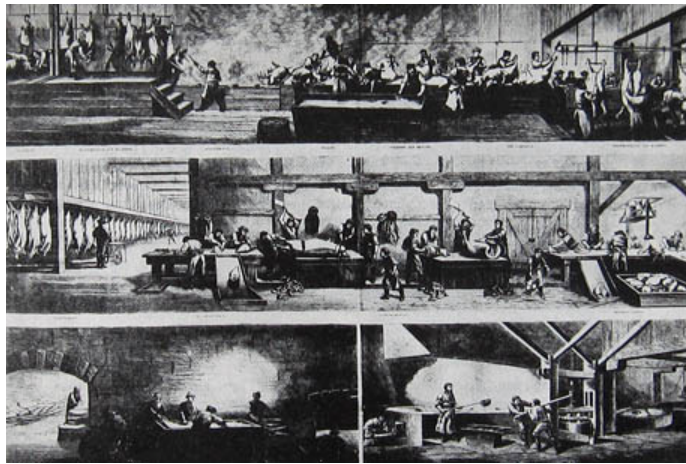


IMAGE: “Pork Packing in Cincinnati, Panoramic Painting, 1873. Reproduced from *Harper’s Weekly*.” Although moving the hogs on an overhead rail is the only automated element of the production line shown here, the packing houses have already begun to divide labour, so that “each man performs a single operation. ‘One splits the animal, the next takes out the entrails, the third removes heart, liver, etc., and the hose man washes it out.’”

Giedion goes on to trace a contemporaneous “assembly line attitude” — characterised by a desire for mass production and speed through the [division of labour](#) and the removal of friction — in non-mechanical assembly lines, such as “the manufacture of biscuits in a victualling office of the British Navy,” and “in the great Cincinnati slaughterhouses” of the thirties.

In other words, assembly line production gradually becomes a new imaginary, emerging across a variety of manufacturing processes to be met with a combination of fear and breathless amazement, followed by widespread adoption and further refinement.

Giedion cites this 1836 account of a pre-mechanical assembly-line at the British Navy biscuit bakery, Deptford, by Peter Barlow, in *Manufacture and Machinery in Britain*, which is worth re-quoting in full:

The dough, which consists of flour and water only, is worked by a large machine ... It is handed over to a second workman, who slices them with a large knife for the bakers, of whom there are five. The first, or the moulder, forms the biscuit two at a time, the second, or marker, stamps and throws them to the splitter, who separates the two pieces and puts them under the hand of the chucker, the man that supplies the oven, whose work of throwing the bread on the peel must be so exact that he cannot look off for a moment. The fifth, or the depositor, receives the biscuits on the peel and arranges them in the oven.

The business is to deposit in the oven seventy biscuits in a minute and this is accomplished with the regularity of a clock, the clacking of the peel, operating like the motion of the pendulum.

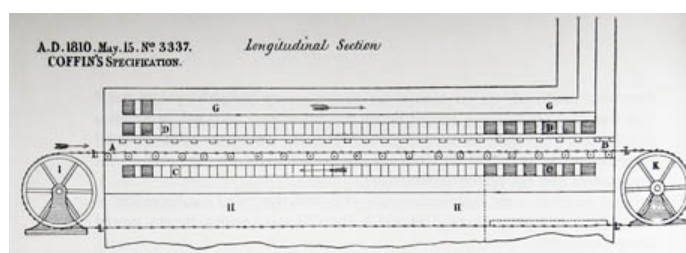


IMAGE: “First Oven with Endless Belt, 1810. Admiral Isaac Coffin. Invented by a Bostonian who became a British admiral, this oven for baking sea biscuits supplied a link towards the

continuous-production line.”

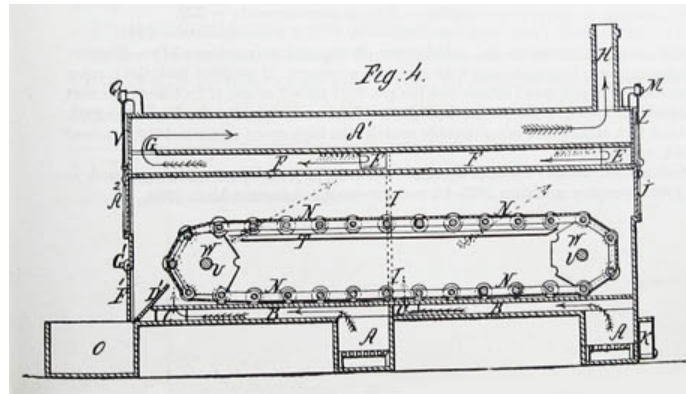


IMAGE: “Oven with Endless Chain. 1850. Section. Some mechanical bakeries appeared in the 1860s, after the tunnel oven’s construction had been ingeniously refined. Yet none was successful: the production line in bread making only became effective in the time of full mechanization, which perfected automatically controlled tunnel ovens heated by gas or electricity. By this time the earlier experiments were forgotten, and efforts had to start from scratch. (U.S. Patent 7778, 19 November 1850).”

Meanwhile, from the early 1800s, the introduction of railways in the United States provided a new paradigm for the mechanical imagination: the endless track. Giedion shows how Admiral Coffin’s 1810 *Oven with Endless Belt* (also deployed in the cutting-edge business of sea-biscuit manufacture) heralded a rash of track-based innovations in food production:

In the late ‘fifties, the more difficult process of bread baking became mechanized at various places in England and America; and in America, at this time, even fruit was dried in steam chambers with the help of a conveyor by a now forgotten method (Alden process); in the late ‘sixties overhead rails, in combination with various machines, are found in the great meat-packing houses of the Middle West.

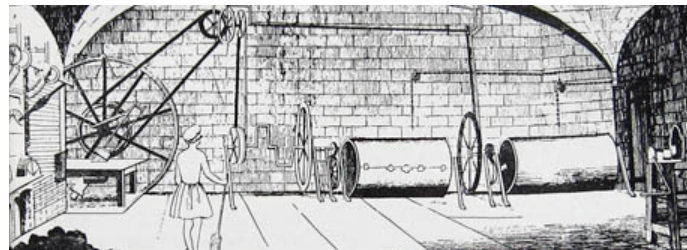


IMAGE: “Mechanized Bakery, Mouchot Bros. 1847. The kneading machines are powered by dogs who work a treadmill outside. (C. H. Schmidt, *Das deutsche Baeckerhandwerk*).”

Kneading was also mechanised by the 1850s – but Giedion points out that for European bakeries, in particular, these innovations were ahead of their time: “the ordinary needs” of the baker’s customers “were not large enough for the advantageous use of machines.” By the time demand had advanced to meet mechanical production capacity, many early innovations had been forgotten and awaited re-invention.

Similarly, the limitations of preservation and distribution technologies often restricted the usefulness of advances in food production efficiency. Giedion thus notes that, “The time of full mechanization is identical with the time of the tin can.”

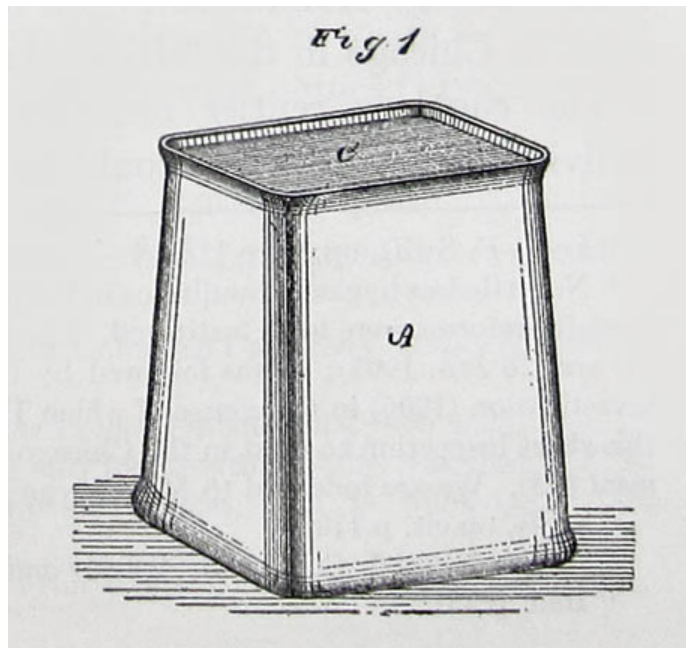


IMAGE: "Wilson's Original Patent Corned Beef Can, 1875. (U.S. Patent 161,848, 6 April, 1875)."



IMAGE: "Making Cans for Use in Packing the Meat, Chicago, 1878 (Frank Leslie's Illustrated Newspaper, 12 October, 1878)."

Mechanization Takes Command, despite its triumphant title, is full of these asynchronous advances, technological dead-ends, and machines that worked less well than the humans they aimed to replace. On some levels, it is an archaeology of failures, redundancies, and missed opportunities.

Indeed, the most striking insight of this section of the book is the way in which the resistance of "the Organic" to mechanisation actually shaped modern production processes.

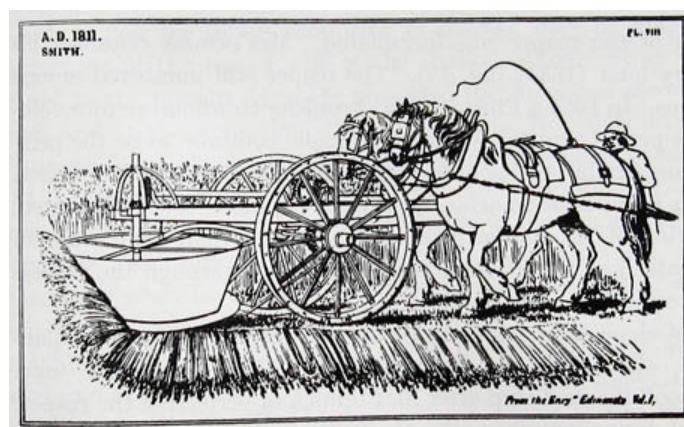


IMAGE: "Introduction of the Mechanical Reaper. British Patent, 1811. One of the many efforts to mechanize reaping, which failed because of too simple an approach. (*The*

Edinburgh Encyclopedia)

After tracing its conceptual forebears back to Oliver Evans' grist mill, the British sea-biscuit factory, and "J.G. Bodmer's layout of a Manchester machine tool factory," Giedion explains that the pork packing industry saw "the birth of the modern assembly line," in large part because the devices invented to mechanise slaughter "proved, with few exceptions, unfit for practical use."

"Even when dead, the hog largely refuses to submit to the machine," as Giedion puts it.

The machines invented in an attempt to tame the hog nonetheless provide some of the book's most captivating illustrations — an array of devices that conjure up [Rube Goldberg](#) and medieval torture chambers simultaneously.

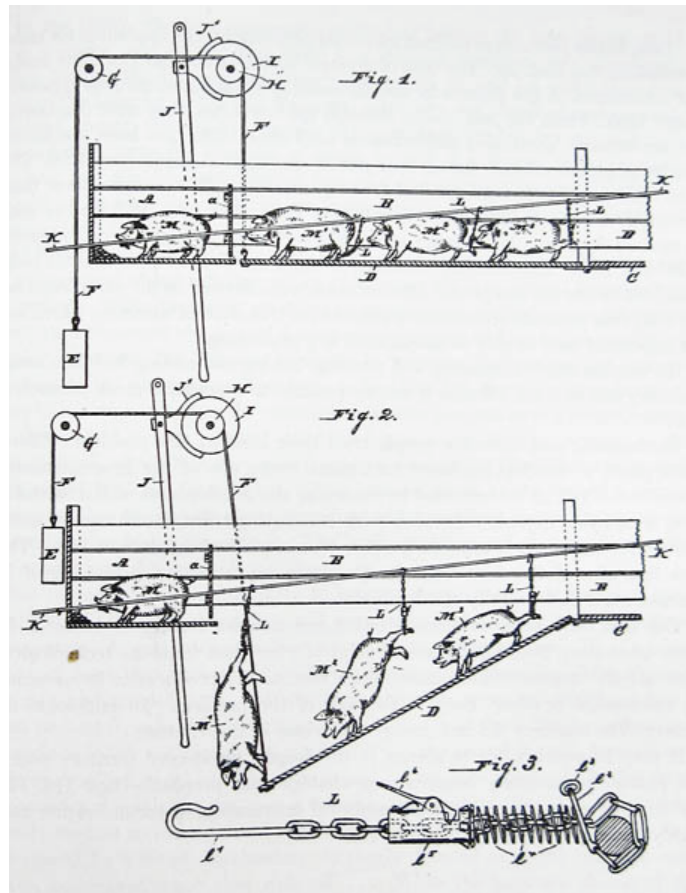


IMAGE: "Apparatus for Catching and Suspending Hogs. 1882. 'The hog M acts as a decoy for the others, and much time and labor are thus saved.' (U.S. Patent 252,112, 10 January, 1882)."

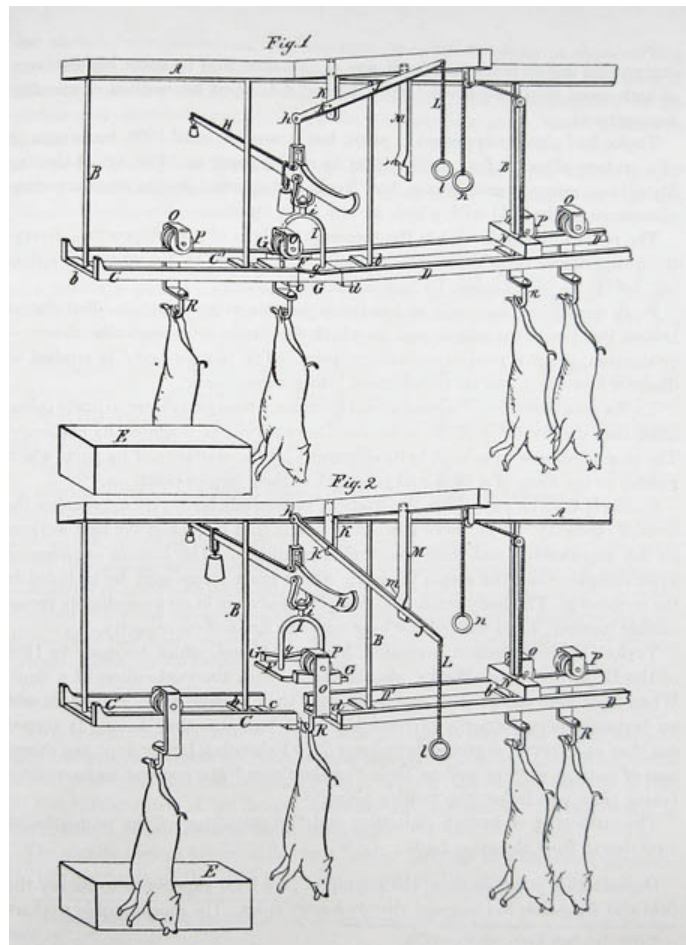


IMAGE: "Automatic Hog-Weighing Apparatus for Use in Packing Houses, Cincinnati, 1869. (U.S. Patent 92,083)."

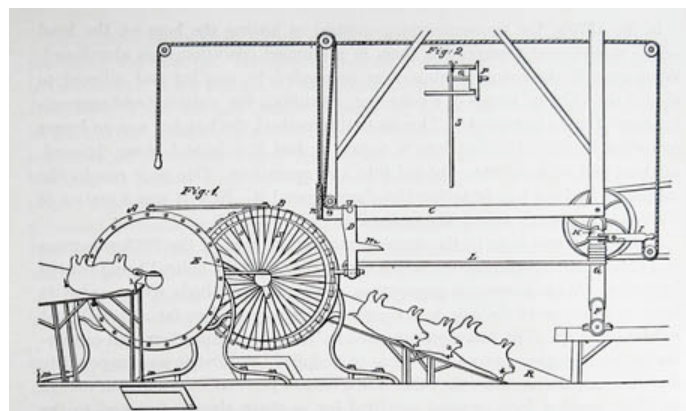


IMAGE: "Hog-Cleaning Machine. 1864. The flexibility of steel and rubber are used to operate upon an organic body mechanically. 'The capacity of this machine is from five to fifteen thousand per diem... The apparatus consisting, essentially, in the employment of substances of the requisite elasticity to yield to the irregularities of the body, while adhering thereto with the force necessary to remove the hair.' (U.S. Patent 44,021, 30 August 1864)."

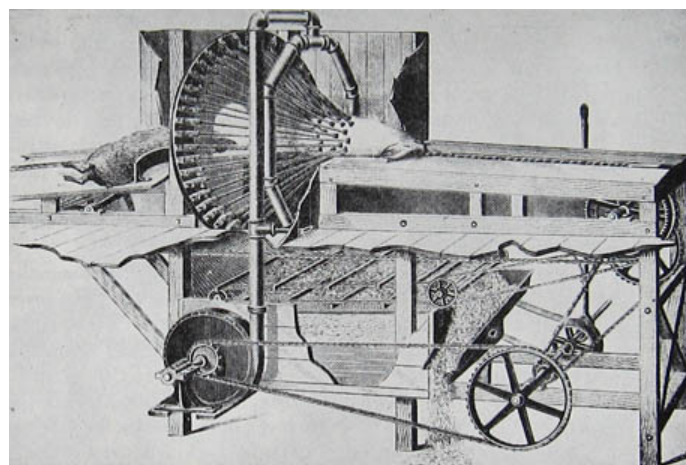


IMAGE: "Pig-Scraping Machine. c1900. 'An endless chain drags the pig through a series of little knives, attached to adjustable springs... They will fit themselves to the form of the pig without very much trouble. Capacity, 8 pigs per minute.' Mechanical scraping never became completely satisfactory. (*Douglas's Encyclopedia*, London)"

Given the hog's resistance, Giedion writes, "for the speeding of output there was but one solution: to eliminate loss of time between each operation and the next, and to reduce the energy expended by the worker on the manipulation of heavy carcasses."

In other words, the inability to automate led to Fordist perfection in terms of assembly line efficiency:

In continuous flow, hanging from an endlessly moving chain at twenty-four inch intervals, they now move in procession past a row of standing workers each of whom performs a single operation. [...]

What was revolutionary and what could not have been invented in earlier periods, in other countries, or even in other industries, was the way [assembly line techniques] were used to speed into mass production an organic material which defies handling by purely mechanical means.

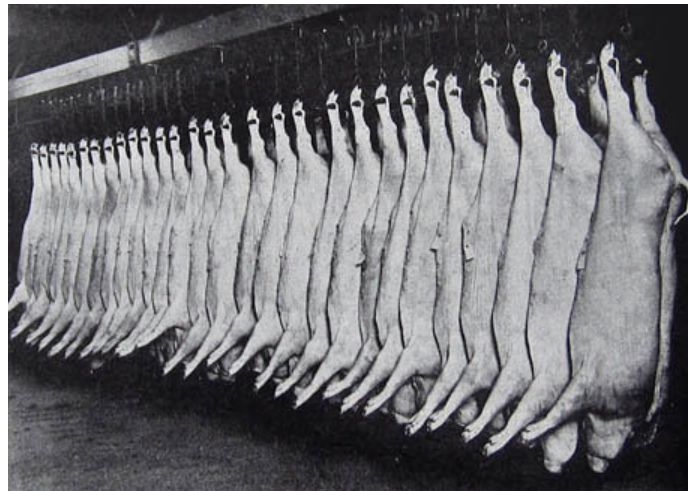


IMAGE: "Carcasses in Chicago Slaughter House (Courtesy Kaufman and Fabry)."

Reading Giedion's description of the human assembly line of the 1850s slaughterhouse, while gazing in amazement at the impressive and slightly horrifying ingenuity of the mechanical tools developed to process food, I couldn't help but be reminded of [Nikolaus Geyrhalter's 2005 film of industrial food production, *Our Daily Bread*](#).



IMAGE: Today's pork packing assembly line, still from [Our Daily Bread](#).

Geyrhalter's film consists of long, dispassionate, commentary-free shots of food's industrial sublime: chicks debeaked, olive trees

shaken, hogs eviscerated, salmon vacuumed, pesticides sprayed, and cattle slaughtered, again, and again, and again. The grey noise of the machines provide the only audio accompaniment; still shots of the expressionless faces of the workers eating their industrially produced snacks in the break room form the only interlude.



IMAGE: Still from [Our Daily Bread](#).

“What makes it fascinating,” says [Geyrhalter](#), “are the machines and the sense of what’s doable, the human spirit of invention and organization, even at close quarters with horror and insensitivity.”



IMAGE: Cattle are killed and flipped in today’s beef production line, still from [Our Daily Bread](#).

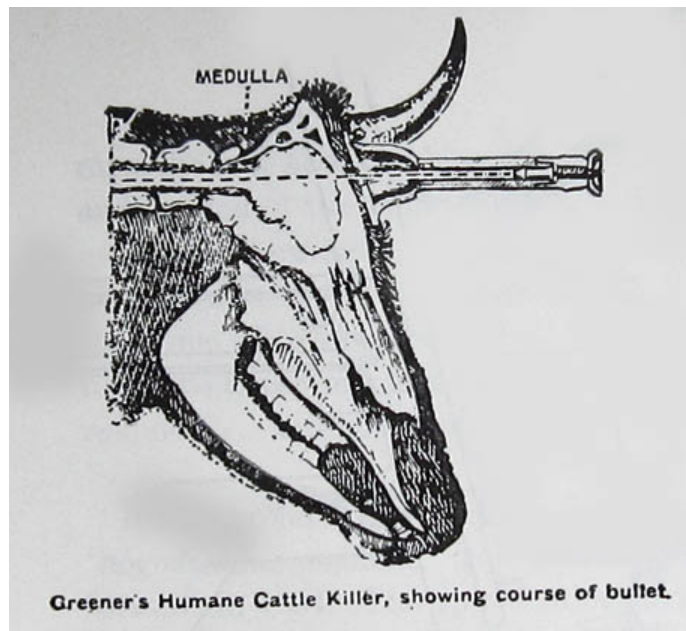


IMAGE: “Greener’s Humane Cattle Killer (*Douglas’s Encyclopedia*, London).”

Similarly to Giedion’s patent drawings and etchings, the mechanical ingenuity of industrial food production as shown in [Our Daily Bread](#) is both spell-bindingly curious and utterly terrifying.

The same enlightenment ethos of rational, inventive efficiency that inspired Réaumur to design an “Artificial Mother” that would mechanise egg incubation reaches its apotheosis in Geyrhalter’s fluorescent-lit, sterile chicken hatchery. Meanwhile, the mechanics of artificial insemination appear to have changed little in a century.

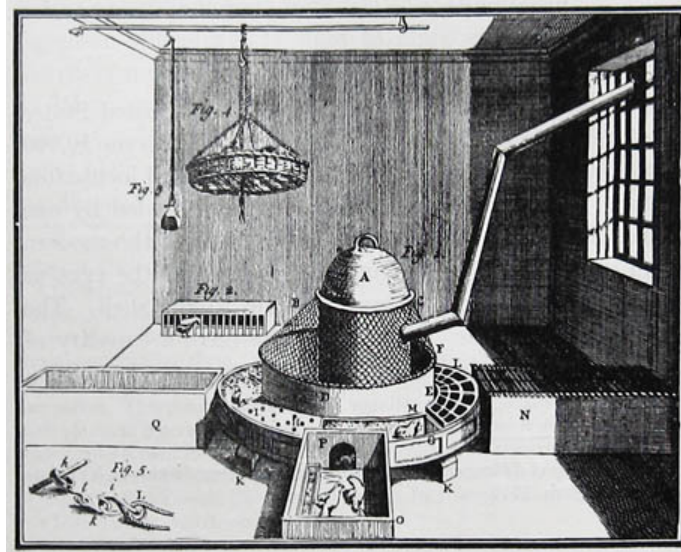


IMAGE: “Réaumur: Artificial Mother. c1750. “This plate exhibits the inside of a hot-room designed to bring up chicks in, and which may be as usefully employed to hatch them. A, marks the cover of a stove whose body is cylindrical. By taking off that cover one puts wood into the stove when it is wanted.’ (A. F. de Réaumur, *The Art of Hatching and Bringing Up Domestic Fowl at Any Time of the Year*, London, 1750).”



IMAGE: Still from [Our Daily Bread](#).



IMAGE: Still from [Our Daily Bread](#).

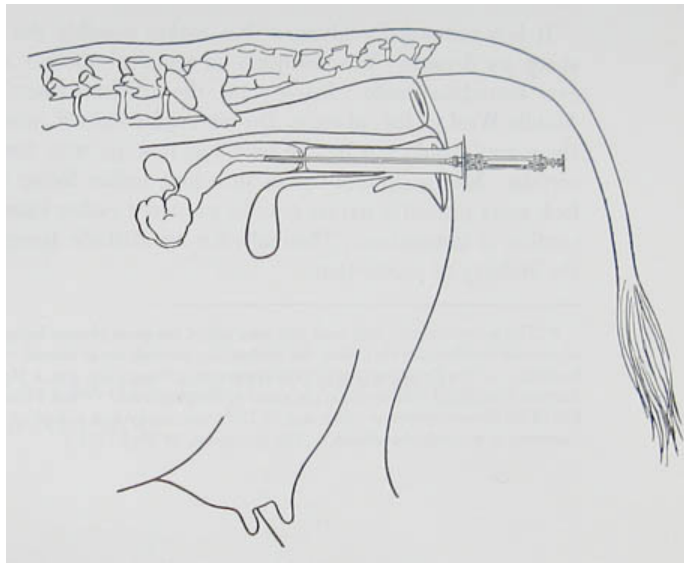


IMAGE: "Mechanical Insemination. 'In the time of full mechanization, especially in the 1930s, the Soviet Union experimented extensively. Six million cows and ewes were mechanically impregnated there in 1936. Without going so far in practice, the United States developed a great range of devices suited to the various species.' (U.S. Department of Agriculture Circular 567, W. V. Lambert.)"

The story both Giedion and Geyrhalter tell, of the application of mechanical ingenuity to food production, is undoubtedly impressive and starkly beautiful. Both position themselves as impassive observers: Giedion prefaces his study by claiming to take "no stand either for or against mechanization as such," while Geyrhalter declares that he "wanted to collect and make accessible images from this world in as objective a manner as possible."

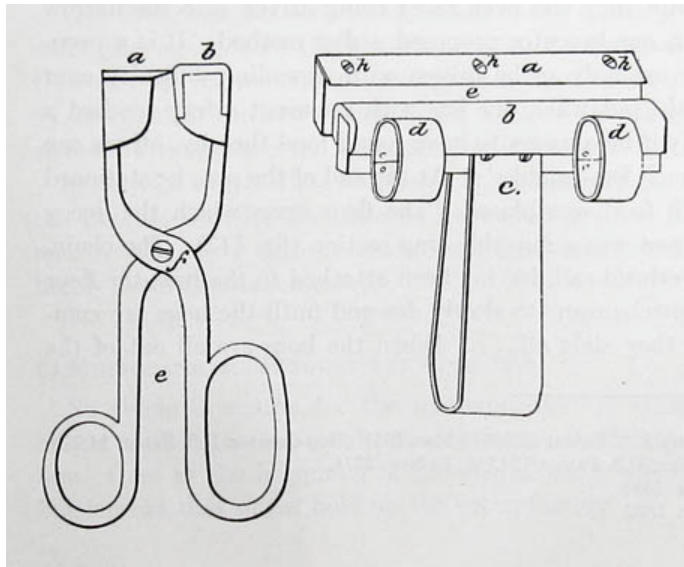


IMAGE: "Instrument for Extracting Hair from Skin. 1837. Imitation of the human hand. 'One of the jaws is designed to supply the place and office of the thumb as used in extracting hairs with the common knife, and is therefore covered or cushioned on the inside with leather, india rubber or other material...' (U.S. Patent 244, 30 June 1837)."

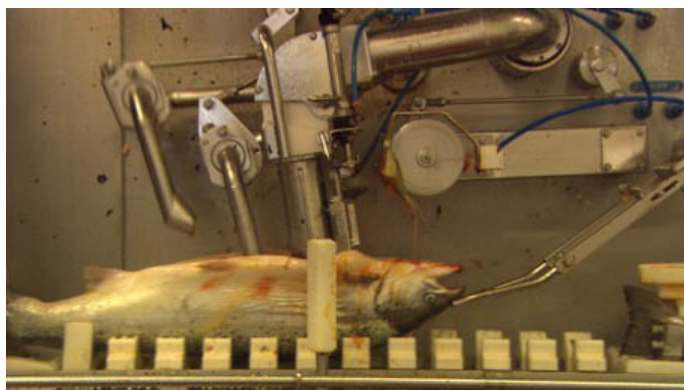


IMAGE: Still from [Our Daily Bread](#).

Yet neither Geyrhalter nor Giedion can help curating their investigation into a commentary. Giedion describes — and Geyrhalter shows — the impact of mechanisation on humanity:

In a Chicago packing house, hogs, hanging head downwards, moved uninterruptedly past a staunch Negro woman at the curve of the conveyor system. Her task was to stamp, with a rubber stamp, the carcasses examined by the inspectors. With a sweeping movement she smacked the rubber stamp on each skin.

Perhaps we start from false premises; but in an outside observer a strange feeling was aroused: a creature of the human race trained to do nothing else but, day after day, and eight hours each day, stamp thousand after thousand of carcasses in four places.



IMAGE: Still from [Our Daily Bread](#).



IMAGE: Still from [Our Daily Bread](#).

“Never has mankind possessed so many instruments for abolishing slavery,” concludes Giedion. “But the promises of a better life have not been kept. All we have to show so far is a rather disquieting inability to organize the world, or even to organize ourselves.”

Sixty years later, Geyrhalter’s documentary immerses us in the truth of Giedion’s assertion. The full mechanisation of food production, the goal of an earlier era’s entirely rational techno-optimism, is revealed in all its melancholy, depopulated, economically efficient, fluorescent-lit fascination and horror.

[NOTE: Thanks to [Geoff Manaugh](#) for showing me Sigfried Giedion’s book and bringing me into the [CCA](#) to consult it. For a moment, it seemed as though the excellent New York Review Books was [going to bring out a new edition](#): my fingers are crossed that might still happen!]