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# Making Buildings Work
## Susanne Jany

In 1926, a giant parcel-processing machine opened in central Munich—or at least this was how the newly built Paketzustellamt München-Marsfeld looked to its contemporaries. f.1 The distribution center was the first automated post office in Germany, with an extensive transportation infrastructure in place to execute major portions of its workflows. Parcels were collected from the nearby Munich central station by a special tramway then loaded on arrival onto electrically driven trolleys that transferred them to the sorting facility inside the central rotunda. f.2 The ground-level sorting unit exhibited 24 openings: four times six slots for the six main Munich postal districts, arranged in such a way that up to 12 employees could work simultaneously. Once the parcels were dropped through the slots, spiral chutes forwarded them onto

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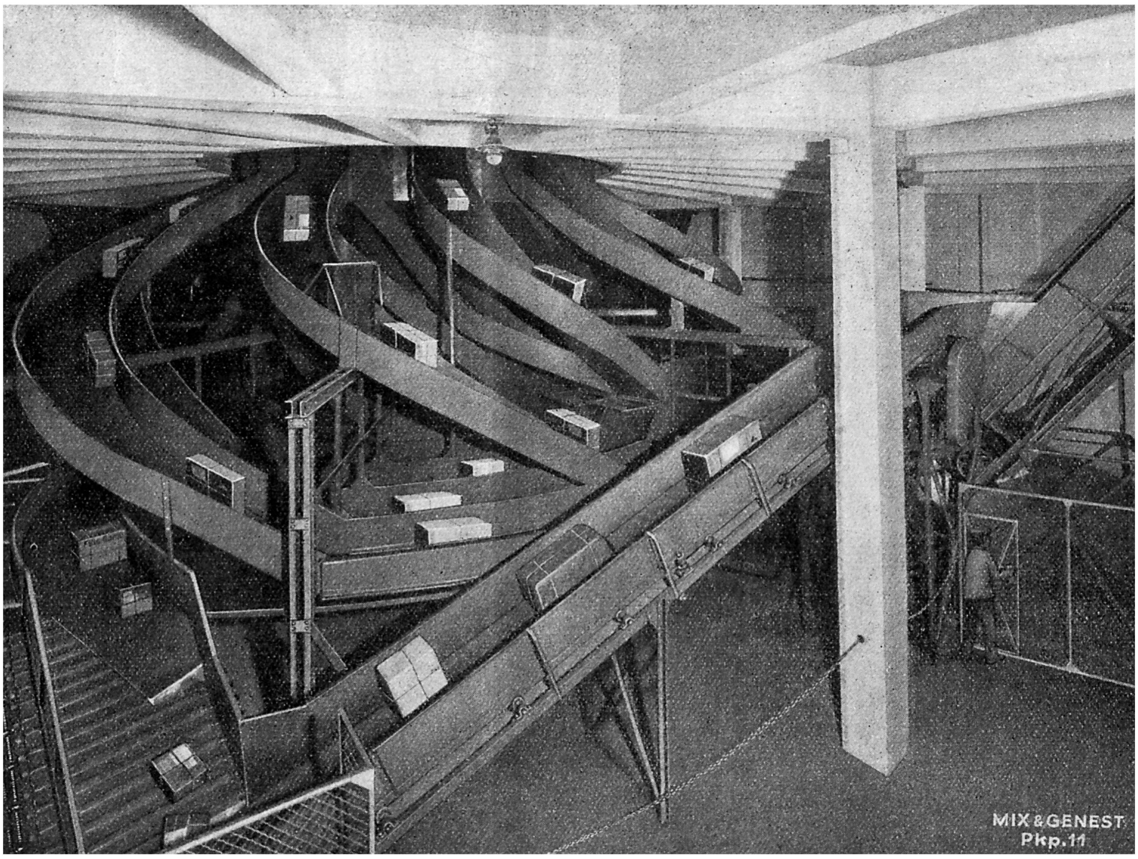
**f.1** Paketzustellamt München-Marsfeld (1925–1926), floor plan and front elevation. The central sorting facility is located in the middle of the rotunda while its expansive conveyors extend throughout the basement.


**f.2** Interior view of the central rotunda with electrically driven trolleys transporting parcels towards the "parcel distribution turbine."

an electrically driven turntable that propelled them individually onto one of six conveyors—one for each postal district. f.3 The conveyors led to distribution tables at which postal workers sorted the parcels according to apartment blocks, streets, and house numbers, before stacking them along the outer wall of the building in special storage spaces equipped each with a door and a ramp. Postmen then accessed these spaces from outside, loaded the parcels into vans, and drove off to deliver them.

The distribution center specially designed and patented by a Berlin-based engineering firm, Mix & Genest, constituted a closed system that conformed to the contemporary definition of "full mechanization": [1] its successive conveyors were motorized and ran independently of manual procedures. They were rigorously aligned in order to guarantee unhindered parcel processing, and operated from a central control panel situated at the supervisor's workstation in the rotunda. In contemporary reviews, machine imagery prevailed. Architect Walter Schmidt, who along with his colleagues Franz Holzhammer and Robert Vorhoelzer of the Munich postal planning department was in charge of the distribution center, called it a "giant conveyance apparatus," in

1 Cf. Hans Schwaighofer, *Post-Betriebsmechanik: Das Förderwesen in neuzeitlichen Postbetrieben grösserer Städte*, vol. 1: *Grundlagen der Post-Fördertechnik* (Wittenberg: Ziemsen, 1927), p. 69.




**f.3** The sorting unit with its underground spiral chutes, turntable, and conveyors.

which "the operations, machine, and building are fused into a single entity." [2] Another member of the planning department, Oberpostrat Krinner, referred to the different elements of the complex as "construction components crucial to operations." [3] In particular the central sorting unit provoked machine references. It was repeatedly compared to technical gears and named a "parcel distribution turbine." [4] As Krinner explained, "like the guide vane that drives the water in a water turbine, it directs the parcels to their respective places." [5] Hans Schwaighofer, a leading expert in the mechanization of post offices, claimed that the "distribution turbine with its six conveyor systems constitutes a closed mechanism." [6]

Explaining a technical infrastructure in mechanical terms may well seem tautological and self-evident. However, I would like to argue that it was not only the electrically driven machinery

2 Walther Schmidt, *Amtsbauten: Aus Betriebsvorgängen gestaltet, dargestellt am Beispiel der bayerischen Postbauten* (Ravensburg: Otto Meier, 1949), p. 133. This and all further translations by Jill Denton.

3 "Das neue Münchener Paketzustellamt," *Archiv für Post und Telegraphie*, 55, no. 7 (1927), pp. 173–81; here p. 173.

4 Ibid., p. 179.

5 Ibid., p. 176.

6 Hans Schwaighofer, *Post-Betriebsmechanik*, vol. 2: *Mechanisierungsbeispiele aus der Postpraxis der Deutschen Reichspost-Verwaltung und des Auslandes* (Wittenberg: Ziemsen, 1927), p. 59.

of the Munich distribution center that prompted these various technical images. Around 1900, using machine metaphors to illustrate how certain buildings "work" was a means to explain not so much how to set things in motion mechanically but how to do so architecturally. The referential context was not merely the materiality of contemporary mechanized facilities—their transmissions, gears, rods, and so forth—but rather their disposition as operating entities. In light of this, the use of machine images is indicative of a new way of seeing architecture, one that emerged in the late nineteenth century and was characterized by a distinct awareness of the interrelation, in functional buildings, of work processes and their spatial prerequisites. Machine metaphors enabled building practitioners to envision architectural facilities as efficient operational systems and hence also to plan and build them as such.

**1** In fact, machine imagery had been used to describe certain buildings years before the advent of systematic mechanization—also in regard to architectures seemingly unconnected with the mechanical realm. In a periodical from 1903, the Swiss surgeon Rudolf Ulrich Krönlein described the architectural disposition of the newly built Surgical Clinic at the Kantonsspital in Zurich in regard to its purposes, namely treatment and teaching:

*"[I]t was to be hoped that the clinician would have an opportunity during the course of his training to experience the bustle and operations* [Getriebe und Mechanismus] *of the aseptic surgical ward at first-hand and thus to witness the meticulous care and pedantry with which the surgeon endeavors before, during, and after an operation to meet the strictest demands of asepsis."* [7]

In similar fashion, the director of the surgical hospital in Tübingen, Georg Perthes, outlined the ideal layout of a surgical ward and suggested that "[t]he waiting room for sick persons, if procurable, should be separated from the operating room by several other rooms so that the waiting patients are not disturbed by their view of operations [*Getriebe*] in the surgical room." [8] The semantics of the German word Perthes chose here, *Getriebe,* oscillate between its more technical sense of "mechanical gears" and its everyday sense of *Treiben* and *Betriebsamkeit,* meaning "hustle and bustle" or simply "activity." The use of the term *Getriebe* links operating machines with certain actions, accomplishments, and operations in a specially designed functional building. In this perspective, a patient's proper treatment is acknowledged to be an architectural task. For, according to Perthes, disturbing elements

**7** Rudolf Ulrich Krönlein, "Die aseptischen Operationsräume der Züricher chirurgischen Klinik und ihre Bedeutung für den chirurgisch-klinischen Unterricht," *Beiträge zur klinischen Chirurgie*, 37 (1903), pp. 660–75; here p. 672.

**8** Georg Perthes, "Operationsräume," in Julius Grober (ed.), *Das deutsche Krankenhaus: Handbuch für Bau, Einrichtung und Betrieb der Krankenanstalten* (Jena: Fischer, 1911), pp. 526–56; here p. 527.

can easily be eliminated and the overall workflow improved by adding a few rooms and a couple of doors.

Thirty years before Krönlein and Perthes, the Swiss architect Eduard Guyer had published a book on hotel planning. Already in the first edition from 1874, his main concern was to emphasize the close relationship between the daily business of a hotel and its spatial disposition. [9] In the revised second edition from 1885, Guyer introduced the machine metaphor to clarify his point:

*"To intertwine all [the various hotel operations], to arrange everything according to the scope of the business and in a purposive and clear way, to separate it from the guests' circulation and still come up with effective connections: the construction of this hospitality machine constitutes the most difficult task facing the architect and hotelier when building and arranging a hotel."* [10]

In this perspective, the architectural layout appears to be the outcome of a careful spatial arrangement of different workflows—ranging from the delivery of food and supplies to the handling of luggage and the hotel administration. It is evident, therefore, that the notion of architecture as a machine is not contingent on specific technologies. A post office from as early as 1881 was able to be described as a machine-like structure without any need of motorized conveyors or mechanical turntables:

*"The disposition of the operations building [Betriebs-Gebäude] is determined by the mechanism of the brisk and complicated dispatch operation. The prerequisites of its purposive disposition are ... generally little known and nor can they be overseen and evaluated from the counters."* [11]

Since it was impossible to instantly assess this interrelation of work processes and their spatial requirements, considerable effort was put into investigating it: the German-speaking architectural community comprised of architects, engineers, building contractors, and operations experts published extensively on the matter in the late nineteenth century. The reference book *Handbuch der Architektur* and likewise architectural journals such as *Zeitschrift für Bauwesen*, *Deutsche Bauzeitung*, and *Zentralblatt der Bauverwaltung* were the central sites both for discussion of the "purposive disposition" (*zweckmässige Anlage*)—the prevailing discourse at the time—and proposed exemplary layouts of different building types. This also fostered a specific sensitivity to the interdependence of operations and spatial dispositions in functional buildings. In the decade 1870 to 1880, a nascent operative understanding of architecture was forged that I intend to address here as "process architectures," [12] my dual focus being how architectural structures are determined by workflows

**9** Cf. Eduard Guyer, *Das Hotelwesen der Gegenwart* (Zurich: Orell Füssli, 1874), pp. 48–117.

**10** Eduard Guyer, *Das Hotelwesen der Gegenwart*, 2nd, revised and expanded edition (Zurich: Orell Füssli, 1885), p. 86.

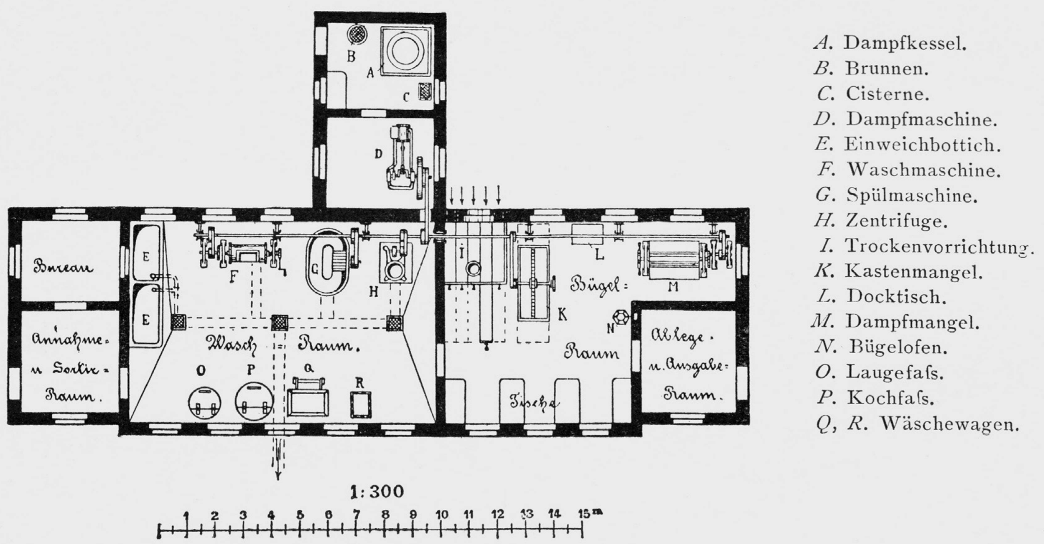
**11** "Das Bauwesen der deutschen Reichs-Post- und Telegraphen-Verwaltung," *Deutsche Bauzeitung*, 15, no. 27 (1881), pp. 169–70; here p. 170.

**12** Susanne Jany, "Postalische Prozessarchitekturen: Die Organisation des Postdienstes im Medium der Architektur," *Archiv für Mediengeschichte*, 13 (2013), pp. 135–45. For a different historical concept of operative architectures, see Moritz Gleich, "Vom Speichern zum Übertragen: Architektur und die Kommunikation der Wärme," *Zeitschrift für Medienwissenschaft*, 12, no. 1 (2015), pp. 19–32.

and how workflows are determined architecturally. Discourse in the late nineteenth century about how to construct buildings as process architectures may be considered as the central historical site from which a logistic concept of functional architectures first emerged. Implicit in this concept, then broadly applied within the industrial, public, and private sectors, is an understanding of architecture as a means to organize and optimize workflows—as a *dispositif* (or apparatus) comprising architectural elements, circulating objects, technical infrastructures, discourses, operating procedures, and regulations, and designed with the criterion of purposive disposition in mind. 13 Whether the spatial organization of a factory, hotel, surgical clinic, or post office is concerned, the underlying assumption is that the production of commodities, the handling of clients, the treatment of patients, or the distribution of parcels can be structured and put into operation by architectural arrangements.

**2** One of the basic spatial strategies for implementing workflows architecturally is to arrange workstations within a building in a way that corresponds to the logic underpinning the overall work process. 14 The movement of objects through the plant then coincides with their processing, and vice versa. In industrial laundry facilities, for instance, it is recommended that the requisite rooms and machines be arranged in a sequence that reproduces the "cycle that clothes are meant to undergo during laundry," 15 as shown by this exemplary floor plan for a midsize laundry facility, which was first published in *Der Gesundheits-Ingenieur*, a German journal on applied hygiene. f.4 Dirty clothes are received and sorted in the reception and sorting room before embarking on the laundry process: first via the

Fig. 132.




Normale Anordnung einer gewerblichen Wasch-Anstalt nach *Eick*[41]).

**13** Over the last decade, a number of articles and anthologies have been published on logistic networks and infrastructures. The authors have investigated the material conditions of communication in terms of physical traffic, energy transmission, or social interaction. In exemplary case studies they have analyzed technical infrastructures embedded in domestic, industrial, or urban environments, such as automated production systems, container traffic, or the pneumatic post. But architecture too can adopt logistic qualities; especially when it is used as a technology to organize workflows. For examples from this infrastructure research, see Gabriele Schabacher, "Raum-Zeit-Regime: Logistikgeschichte als Wissenszirkulation zwischen Medien, Verkehr und Ökonomie," *Archiv für Mediengeschichte*, 8 (2008), pp. 135–48; Keller Easterling, "Disposition and Active Form," in Katrina Stoll and Scott Lloyd (eds.): *Infrastructure as Architecture: Designing Composite Networks* (Berlin: Jovis, 2010), pp. 96–9; Susanne Hauser, Christa Kamleithner, and Roland Meyer (eds.): *Architekturwissen: Grundlagentexte aus den Kulturwissenschaften*, vol. 2: *Zur Logistik des sozialen Raumes* (Bielefeld: transcript, 2013), pp. 14–21.

**14** For alternative spatial strategies to organize workflows in functional architectures around 1900, see Susanne Jany, "Operative Räume: Prozessarchitekturen im späten 19. Jahrhundert," *Zeitschrift für Medienwissenschaft*, 12, no. 1 (2015), pp. 33–43.

**15** Felix Genzmer, *Wasch- und Desinfektionsanstalten, Handbuch der Architektur*, part 4, vol. 5, no. 4 (Stuttgart: Bergsträsser, 1900), p. 83.

**f.4** Exemplary floor plan of an industrial laundry.

washing room with its soaking tanks and washing machines, then via the pressing room with its drying ovens, mangles, and ironing boards. Once clean, the clothes are kept in the storage room until being returned to their owner in the reclaim room. The sequence of these four main rooms specifically reflects the order of their respective purposes and likewise the facilities and machines within them are conveniently set in close proximity to each other. This kind of spatio-logical arrangement was widely recommended at the time, inter alia for breweries, cotton mills, or slaughterhouses; [16] and equally, for hotels, railroad stations, post offices, or hospitals, which suggests that the architectural "handling" of people was to follow the same spatial rule. At railroad stations—due to the strict timeframe imposed by the train schedule—the traveler's route was supposed to lead directly from the ticket office to the baggage counter, then through the waiting room and barriers to the platform:

*"The route and rooms through which the departing traveler passes must be arranged in a way such that he is advised or indeed compelled to take a certain path in order to reach the waiting room resp. the platform and train. Any futile seesawing or turning back of the traveler must be precluded."* [17]

Unfavorable countercurrents in pedestrian traffic were also to be avoided: for instance, separate platforms for arriving and departing travelers were preferred in train stations, initially, because they were believed to prevent "countercurrents, which hinder the traveler's quick passage." [18] Under the primacy of workflows any architectural discrimination between circulating objects and subjects becomes obsolete. [19] The common spatial strategy is to accommodate short connections, a one-way direction, and a steady continuity while avoiding any form of collision, detour, crossway, or congestion.

In 1923, these spatial strategies were subsumed under the term *Gleichstrom* (co-current flow) in the volume on factories in the *Handbuch der Architektur*:

*"The most important principle for any kind of production is that the storage spaces and workstations must be arranged in such a way that as many operations as possible can be carried out in co-current flow and not be disrupted by countercurrents of activity. ... The effective floor area and spaces of a factory should be arranged in a sequence that allows the raw materials and necessary auxiliary materials to be transported from one point of production or use to the next by the shortest route and as cost-effectively as possible."* [20]

Thus, almost half a century after first being put into practice, the underlying spatial principles were conceptualized in

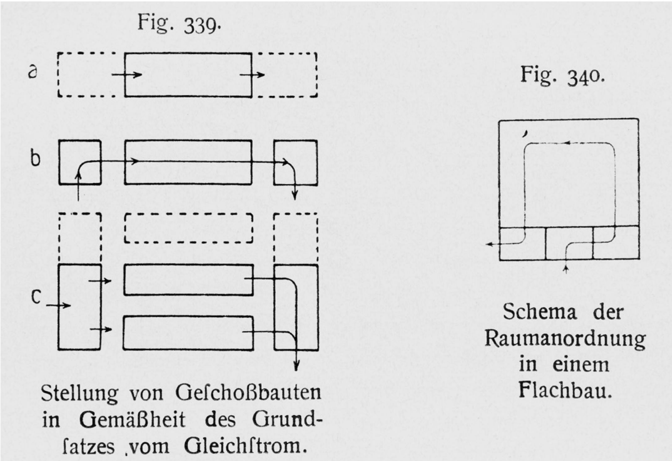
**16** For instance, for breweries, see Friedrich Engel, et. al., *Landwirthschaftliche Gebäude und verwandte Anlagen ..., Handbuch der Architektur*, part 4, vol. 3 (Darmstadt: Diehl, 1884), p. 418.

**17** Eduard Schmitt, *Empfangsgebäude der Bahnhöfe und Bahnsteigüberdachungen (Bahnsteighallen und -dächer), Handbuch der Architektur*, part 4, vol. 3, no. 4 (Leipzig: Gebhardt, 1911), p. 25.

**18** R. Paulus, *Handbuch des Eisenbahnwesens in ökonomischer, rechtlicher, administrativer und technischer Beziehung*, vol. 2: *Bau und Ausrüstung der Eisenbahnen* (Julius Mauer: Stuttgart, 1872), p. 241.

**19** This indifference had been characteristic of earlier conceptions of flows within buildings. Cf. Adrian Forty, "'Spatial Mechanics': Scientific Metaphors in Architecture," in Peter Galison and Emily Thompson (eds.), *The Architecture of Science* (Cambridge: MIT Press, 1999), pp. 213–31.

**20** Wilhelm Franz, *Fabrikbauten, Handbuch der Architektur*, part 4, vol. 2, no. 5 (Leipzig: Gebhardt, 1923), p. 188.




**f.5** Layouts of cotton mills with spatial dispositions according to the *Gleichstrom* principle.

the meanwhile prominent terms of the rationalization discourse: direct flow lines, brief procedures, and cost reduction. Yet it was still basically about creating a continuous and steady flow of objects through a facility, in keeping with the operative logic of the overall production process. As is apparent from the schemes featured in the same *Handbuch* volume, spaces organized in co-current flow do not necessarily have to be in a linear sequence, as long as the movement of products or people within them is linear. *f.5* In fact, in most functional buildings, several workflows at once must be taken into account and architecturally structured. Accordingly, the task of the architect is to develop a spatial scheme that facilitates all the individual work processes in what is perceived to be the most advantageous way. To refer to mobilized elements as "currents"—whether as "co-current flow" in the 1920s or the aforementioned "counter-currents" [21] in the 1870s—not only helps bring this design problem to mind in order to be able to solve it, but also introduces a specific form of activity into the architectures concerned by featuring them as operative systems that initiate, direct, and regulate physical flows. Images of the fluid suspend the alleged contradiction between "static buildings" and "temporal processes," thereby opening up a specific concept of architecture that implies temporality, timing, and continuity while holding on to spatial matters of orientation, formation, and direction.

**21** "Gegenströmungen," Paulus, *Handbuch des Eisenbahnwesens* (see note 18), p. 241.

**3** What is the predominant concept of "machine" adapted within this specific field of architecture in the latter half of the nineteenth century? In particular, how is an operative (architecture) machine conceived? In 1875, the prominent German engineer and scientist Franz Reuleaux published a widely noted textbook on kinematics in which he systematically investigated machine motion. According to Reuleaux, a machine is "a combination of resistant bodies so arranged that by their means the mechanical forces of nature can be compelled to do work accompanied by certain determinate motions." [22] Machines can be put in operation because they consist of one or more mechanisms that are implemented as kinematic chains and transfer mechanical forces. These kinematic chains are made up of force-closed

**22** Franz Reuleaux, *Kinematics of Machinery: Outlines of a Theory of Machines*. Trans. Alex B. W. Kennedy (London: Macmillan, 1876), p. 35.

element pairs, one part being static and one part being able to move. The main function of the static element is to limit the range of the actively moving element to the only motion requested. [23] Reuleaux gives the example of screw and nut. If the screw is fixed in position, the only possible motion of the nut is a helix of determined magnitude resulting in a tightening or loosening operation. What is significant about this concept is that the fixed element is as important to any operation as is the moveable element. Spatial limitation is the necessary condition for any form of machine motion; it is from this constraint that any mechanism originates. Thus, an utterly passive structure gains operative potential by enabling and directing the motion of an active element.

**23** Cf. ibid.

This concept of mechanical operativity corresponds to how architects and building engineers conceived functional architectures around 1880. When they utilized spatial elements to accommodate workflows, guide movements, or trigger operations, "passive" structures such as walls, barriers, or ramps were understood to be parts of an operative system to the same degree that "active" elements such as circulations and workflows were incorporated as crucial parts of the architectural disposition. It was this alone that made operative elements of architectural elements: not because the latter needed to be moveable themselves but because they enforced and guided the motions of their complementary systemic elements. For instance, it is by constraining the streams of people or objects passing through that threshold elements gain the central control function ascribed to them in contemporary architectural media theory: "Openings like passages, entries, elevators, bridges, doors and windows are architectural elements with eminently operative character. They ... control the transport and transmission of persons, objects and information." [24] Accordingly, process architectures can be understood adequately only when workflows (or any other kind of flow) are taken into account as integral parts of the operative system. This is why architectural manuals such as the *Handbuch der Architektur* draw the architect's attention not solely to spatial arrangements but also to the logic of workflows, to architectural elements and technical equipment, to the streams of subjects or objects through and within a building, as well as to possible instances of interference or dysfunction.

**24** Wolfgang Schäffner, "Architecture of the Openings: Windows, Doors and Switches," in Joachim Krausse and Stephan Pinkau (eds.), *Architecture of the Medial Spaces* (Dessau: Stiftung Bauhaus, 2006), pp. 74–9; here p. 78.

Reuleaux's ideas on the operating machine were not just descriptive in character. Rather, they investigated functional compositions in order to be able to optimize them: "[T]he technological part of the study of special machines," Reuleaux wrote in the 1870s, "examines ... by what special arrangement of the parts of the machine the required action can best be obtained." [25] The technologist tradition to which Reuleaux referred dates back to Johann Beckmann's *Anleitung zur Technologie* from 1777. In his treatise, Beckmann proposes the analytical description of handicrafts: classification of their elementary means and operations fosters an understanding of the manual production of objects, and is simultaneously the foundation for achieving technical and procedural innovation. Similar practices appear at the core of machine theory, for example in Jean Nicolas Pierre Hachette's *Traité élementaire des machines* (1811) or later in Robert Willis's *Principles of Mechanism* (1841). [26] Here, the analysis and construction of machines is based on the division, formalization, and optimized recombination of basic machine motions. In a general perspective seeking similarities in elementary motions and procedures, operating machines emerge as structural arrangements of technical elements that follow a certain functional logic and can be composed accordingly. Nineteenth-century engineering has been described as the practice of organizing and reorganizing (spatial) structures. [27] It was within the construction sector that the analytical approach to production and industrial labor was narrowed down to inquiries into the architectural means of ideally organizing workflows and circulations. Articles in architectural encyclopedias of the late nineteenth century need to be seen within this technologist tradition. Similar to Reuleaux's *Kinematics of Machinery* and other textbooks on machine theory, the *Handbuch der Architektur* appears as a medium for the analytical description both of buildings and the work processes executed within them, which is a prerequisite of their effective operation under optimal conditions.

In contrast to earlier conceptions, nineteenth-century "machines" are characterized in terms of their functionality, which is seen to derive from the distinct disposition of their elements—and this approach allows the machine label to be applied to operative entities on a variety of scales. As examples of kinematic machines, Reuleaux mentions water mills, high-pressure steam machines, and the railroad. Nineteenth-century notions of the machine are not limited to apparatuses but include mechanical systems of architectural or even larger dimensions. Hence, the analogy works in both ways: architectures adapt machine-like features and machines adapt architectural features—both thereby blur their respective boundaries. To draw an analogy between the machine and the factory is a common topos during the nineteenth century. The central criteria for machines are not, as in previous centuries, intrinsic values such as perfection and utility, but economic ones: machines must be productive and efficient;

**25** Reuleaux, *Kinematics of Machinery* (see note 22), pp. 38–9.

**26** Cf. Wolfgang Schäffner, "Erfindungskunst: Johann Beckmann und die Technologie der Künste im 18. Jahrhundert," in Inge Baxmann, Michael Franz, and Wolfgang Schäffner (eds.), *Das Laokoon-Paradigma: Zeichenregime im 18. Jahrhundert* (Berlin: Akademie Verlag, 2000), pp. 418–38; here pp. 429–38.

**27** Historically: cf. Antoine Picon, *French Architects and Engineers in the Age of Enlightenment* (Cambridge: Cambridge University Press, 1992), p. 105. Theoretically: cf. Gilbert Simondon, *Du mode d'existence des objets techniques* (Paris: Aubier Montaigne, 1969), p. 117.

they are crucial elements within the national system of production. [28] Not surprisingly, behind the notion of the "purposive disposition" of functional buildings lay an economic imperative. The term *Zweckmässigkeit* (purposiveness) was broadly used by the national building authority, which administered the construction of public buildings and was bound to *Wirtschaftlichkeit*, the responsible handling of public funds. [29] Adopted likewise for industrial and private building projects, purposiveness and efficiency became the benchmark for all kinds of architecturally regulated workflows and circulations. [30] Describing functional buildings in terms of the machine around 1880 had a specific economical ring to it, namely to design them to run as effectively and profitably as possible. At the same time the machine reference proved to be the genuine tool to achieve just that: to analyze and optimize the architectures concerned with respect to their purposive disposition.

**4** Imagining functional buildings such as banks, disinfection plants, or dairies as operating machines made up of intermeshing elements aids the understanding and implementation of workflows in relation to their spatial requirements and functional logic. Whereas the machine metaphor used in late-nineteenth-century architectural discourse only implicitly referred to matters of spatial organization, this aspect was increasingly explicated in the early twentieth century. In 1930, the engineer Rudolf Wolters wrote about railway stations:

> *"The most important elements of the layout occur for the same purpose* [Zweckbestimmung] *and in the same order in each facility, just as every steam engine needs a boiler, cylinder, piston, and flywheel in this particular succession. Changing the sequence of the single components or omitting any one of them would render the machine impracticable. The station building can be compared to such a machine."* [31]

Being alert to the spatial interdependency of architectural and technical elements seems to have proven useful for avoiding scenarios such as that painted in vivid colors by Walther Schmidt, one of the architects of the Munich parcel distribution center:

> *"If from the very start the architect building a house pays no attention to the complex 'organism of the mechanical' then the technology thus ousted from the … overall architectural organization of the project runs riot within the building. Then, there is no taming it. Then, spaces are blocked and windows obstructed. In every corner something judders, something shifts, and people are obliged to find their way around an ugly mess of a structure."* [32]

28 Cf. Thomas Brandstetter, *Kräfte messen: Die Maschine von Marly und die Kultur der Technik 1680–1840* (Berlin: Kadmos, 2008), pp. 13–4, 227, 255–6.

29 For the novelty of this economic concept and its ties to architectural practice, see Reinhart Strecke, "Prediger, Mathematiker und Architekten: Die Anfänge der preußischen Bauverwaltung und die Verwissenschaftlichung des Bauwesens," in Strecke (ed.), *Mathematisches Calcul und Sinn für Ästhetik: Die preußische Bauverwaltung 1770–1848* (Berlin: Duncker & Humblot, 2000), pp. 25–7.

30 To give just one example: "In many cases the successful prospering of an industrial company depends on the purposeful arrangement [of its workspaces]." Julius Koch, "Mittheilungen über Fabriks-Anlagen," *Zeitschrift des österreichischen Ingenieur- und Architekten-Vereins*, 34, no. 4 (1882), pp. 74–81; here p. 74.

31 Rudolf Wolters, *Vom Grundriss der Empfangsgebäude großer Fernbahnhöfe* (Berlin: Germania, 1930), p. 41.

32 Schmidt, *Amtsbauten* (see note 2), p. 133.

In 1927, Krinner wrote of the Munich parcel center:

*"[T]he design of the facility derives from operational requirements that were constantly borne in mind in their entirety. In consentaneous cooperation, the management, building constructors, and engineers have sought to find a solution that is strictly related to the facility's work processes."* [33]

Evidently, not merely the parcel center's mechanical equipment was essential to its design but also the organization of its workflows. In fact, any mechanization or automation is based in the first place on the question of how to spatially accommodate the underlying work processes. The spatial organization of workflows precedes their mechanization. [34] The *Gleichstrom* principle is the *sine qua non* of what has come to be known as "assembly line production" or "flow production": [35] a successive order of workstations that reproduces the logic of the overall workflow and features short transportation distances and a preferably uninterrupted one-way flow of objects. The basic design principles of the Munich parcel distribution center thus date back to the way functional buildings were conceived and architecturally organized during the last third of the nineteenth century, namely as a means to make operational sense of their spatial arrangements. One of the most extensive descriptions of the parcel center can be found in a book written for architects and construction engineers under the telling title *Post-Betriebsmechanik*—"the mechanics of postal operations." [36] The title refers to the architectural implementation of technical infrastructures in post offices, which is outlined in the book. But at the same time, it suggests that there are certain mechanisms to postal operations themselves that need only be transferred to the architectural realm.

**33** Krinner, "Münchener Paketzustellamt" (see note 3), p. 173.

**34** See Gilbert Simondon's argument: "[C]e n'est pas le travail à la chaîne qui produit la standardisation, mais la standardisation intrinsèque qui permet au travail à la chaîne d'exister." Simondon, *Du mode d'existence* (see note 27), p. 24.

**35** That is probably why the principle is referred to in 1923 as "co-current flow" and not as "assembly line production." In the *Handbuch der Architektur* it is presented as a spatial principle for the organization of workstations, machines, and transportation infrastructures that could be mechanized whenever possible but did not have to be: "Insistence on co-current flow is all the more important the larger the weight and amount of the raw materials and products. If the co-current flow cannot be implemented down to the last detail, fail-safe and cost-effective conveyor systems or means of transportation can offset the subsequent drawbacks." Franz, *Fabrikbauten* (see note 20), p. 188.

**36** Schwaighofer, *Post-Betriebsmechanik* (see note 6), pp. 53–81.