Harmonograph (1931 Instructional Article)

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Forward to the English edition:
Despite the prevalent use of Harmonographs in European factories by 1931, and their frequent mentions in scientific management articles and conferences, this piece is Adamiecki's first instructional article explicitly aimed at newcomers. The article also presages an early iteration of an "A3" report; advising users to photograph the board before erasing it, documenting progress and providing a tangible record "in the normal A3 format."

Substantial drafting difficulties can occur when creating scheduled work plans, particularly when numerous adjustments need to be made as work progresses. For instance, in the event of a change in one or several tasks, each time a significant part, or even the entire drawing, must be erased and recreated. This process is time-consuming, requiring a great deal of patience and attention. As a result, it can sometimes be challenging to keep up with the pace of the actual process through the drafting work. This usually ends with the charts being inadequately finished, entangled, or so unclear as to hinder the management of work. When frequent corrections are needed, less patient managers may become discouraged with the method itself.

Extended practice and experimentation have led us to construct a special board that eliminates these difficulties (Fig. 1). This board could be called a harmonograph.

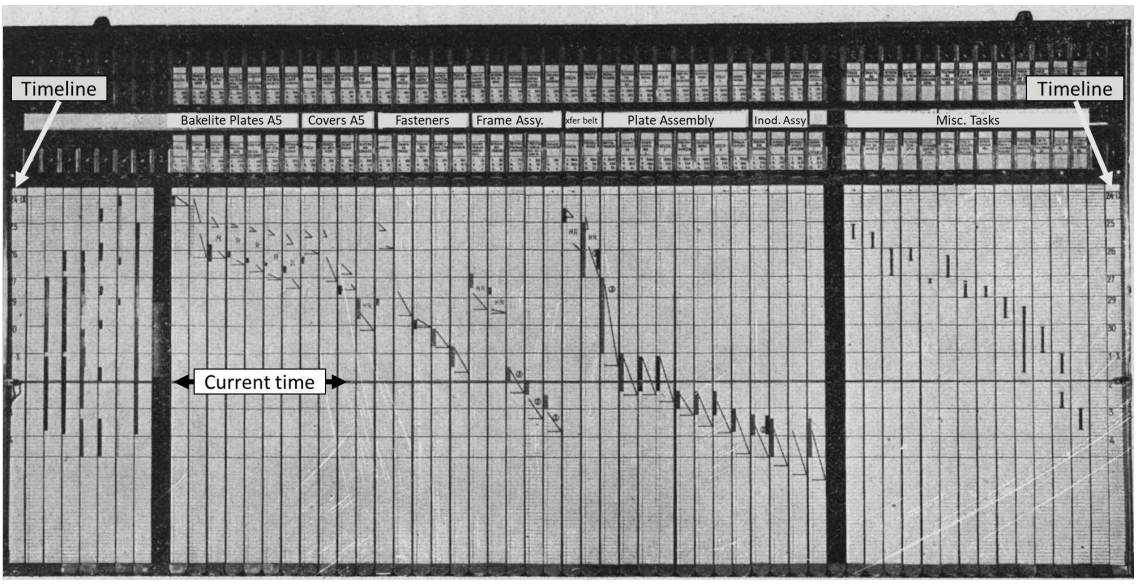

Fig. 1 [Additional labels added for clarity]

The main principle in the construction of the harmonograph is that the scheduling surface does not consist of a single indivisible sheet, but is composed of a series of paper strips arranged vertically next to each other. These strips are attached at both ends to a board using brackets so

that each can be installed or removed independently of the others. Clamped on the left edge of the strip are narrow sliders made of thin metal or colored celluloid, representing timeline markers. Figure 2 shows the slider in a perspective view. It is designed with groove is made in such a way that both sides spring towards each other and thus clamp the edge of the paper [*similar to a modern plastic bar for binding booklet covers*]. However, this compression is not too great, so that with slight pressure, it can be moved along the paper strip.

Time scales, marked by horizontal lines, are printed on each strip. One division can represent an hour, day, week, etc., depending upon the accuracy required.

Each strip is used to mark the duration of a specific operation along with data relevant to the execution of that operation. This information is unique to individual tasks or workstations, enabling a nuanced representation of the entire workflow.

From the above, it's clear that the process of creating a schedule with the harmonograph boils down to cutting a series of sliders to lengths that match the time designated for each operation, affixing them onto the appropriate paper strips, and adjusting their positions to reflect the sequence and progression of operations. This eliminates the need for drafting the schedule. Instead, the task is as simple as moving the sliders. This significantly accelerates the creation of schedules, and any adjustments to the timeline can be made quickly and easily during execution.

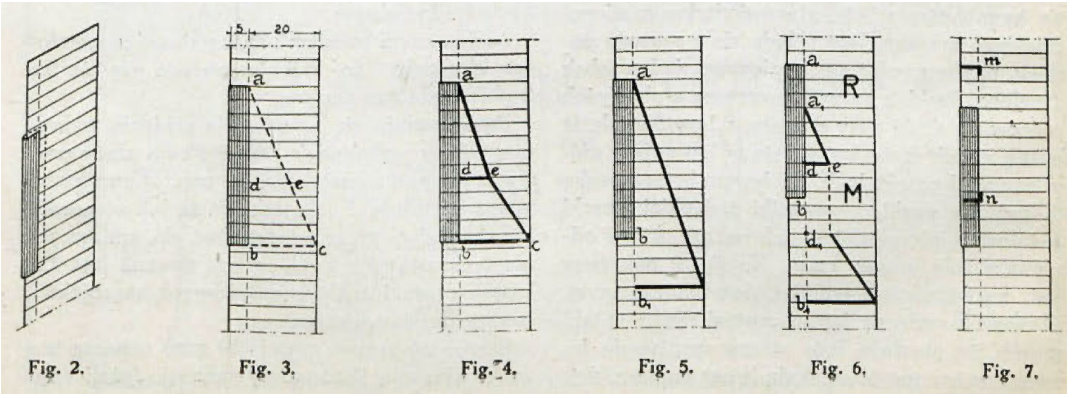

Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.

Above each strip, on the board, there is a metal pocket for inserting a piece of paper with a descriptive label.

The strips are also designed for creating charts of completed work. For this purpose, the right-hand side of the strip with a width of 20 mm is used. The left-hand side of the strip, with a width of 5 mm, matches the width of the sliders and reserved for their placement, that is, this column is designated for timelines and symbols corresponding to the planned schedule.

The width of the right side of the strip (20 mm) represents the total amount of work assigned. Therefore, if we have a given time, "*ab*" (fig. 3), it means that during this time 100% of the assigned work, "*bc*," should be completed. Assuming a steady pace of work, the horizontal

coordinates "*de*" of the line "*ac*" will represent the percentage of work completed while the task is in still in process. For example, during "*ad*," the amount of assigned work will be equal to the percentage "*de*". To avoid confusion and to limit the amount of drawing corrections needed, the lines "*ac*" and "*bc*" are not drawn, and the assigned amount is not written on the strip, but should be included on the description label above.

As the reports of the progress come in, the percentage of work completed, expressed in relation to the assigned amount, is marked on the corresponding horizontal time divisions and a thick diagonal line is drawn in pencil to indicate the actual progress made. This way, we obtain a progress chart next to the slider indicating the assigned time. For example, the chart in fig. 4 will indicate that the work started and ended exactly at the designated time, then, up to the moment "*d*", "*de*" percent of the assigned amount was completed, and up to the moment "*b*," the entire assigned amount of work "*bc*" was completed.

The second example (fig. 5) shows that the start of the work was in accordance with the plan, but the total completion was delayed by the time of "*bb*".

In fig. 6, another case is shown. The start of the work was delayed by "aa_1," then, at the moment "*d*", after completing the amount of "*de*" work, the task was interrupted and started again at the moment "*d*," and finally completed at the moment "b_1", which means that the overall delay in completion is the length of time represented by the dashed vertical line "bb_1."

The examples provided above are sufficient to illustrate the method for creating progress charts. If the actual execution deviates from the planned schedule, different symbols or letters can be used next to the sliders to indicate the reasons for these deviations. For instance, “R” could signify a repair, while “M” might denote a material shortage, et cetera.

If it is necessary to shift the timelines below due to these deviations, for clarity, the previous position of the slider can be marked on the strip with a pencil as with marks "*m*" and "*n*" in figure 7.

For easier visualization, different colored sliders can be selected for each type of activity and the corresponding execution lines can likewise be drawn in the same color.

After all scheduled activities are completed, the strips are removed from the board and new ones are used to prepare the plan for the next series of work. However, before that, the entire board should be photographed. Such photographs serve as visual aids for drawing various conclusions, both regarding the work already completed as well as for the preparation of the next plan. With today's improvements in photography, photographic images are easy and available to even the smallest enterprise. It is best to photograph the boards using small film, e.g., 6 cm X 9 cm, and make enlarged prints in the normal A3 format, which is 420 mm X 594 mm.

Beyond featuring a row of pockets for cards describing current scheduled activities, the board displayed in Fig. 1 also includes two supplementary rows above for cards detailing subsequent

tasks in the series. Constructed in this way, the harmonograph simultaneously serves as a distribution board, similar to the [*Gantt Chart*] boards used in workshops following the Taylor system. However, the harmonograph has an advantage in that it provides a visual representation of the entire process, significantly facilitating the manager's navigation through all the intricate aspects of job control and distribution.

The board itself is constructed using a of a series of identical sections, which can be joined together with two metal bars to form a single unit, with each section containing 10 strips. This type of construction allows the board to be freely expanded or contracted, depending on the number of workstations or activities involved. If there are many positions, two or more boards can be arranged side by side. To facilitate orientation along the board, a string or wire is stretched across it, which is continuously moved throughout the shift vertically along the timeline to the current date and time.

Charts and symbols related to execution should be made in pencil, allowing them to be erased once a particular series of tasks is complete, and the same strips can then be reused. The consumption of strips is generally minimal, as they are made of thick and very durable drawing paper, and time scales are printed on both sides, enabling the same strips to be used multiple times.

To prevent the need to cut new sliders each time, it's useful to keep a box within reach, containing a range of sliders of different colors and pre-cut to various lengths.