Social influences

Social influences

The unskilled workers, once become consumers, began to be unsatisfied of the stressful work condition inside a a rigid synchronous line. The work done by elementary operations was evaluated as inhuman, alienating because disconnected from the finished product.

The initial satisfaction linked to increased life condition, if not even a welfare, made start a period of strikes, workers unions in conflict vs employers, breaking the Taylor dream to make grow simultaneously both parties creating the social peace.

To face the issues and find a new compromise the Manufacturing engineers together with other experts like Sociologist or Psychologist for the first time involved together in a problem-solving issue, investigated in two different directions:

1. Avoid the alienating conditions by putting together the workers in a **group in which they worked in parallel** instead of series on a bigger and more satisfying slice of work.

2. Introduce **Robots to complete the operations heavy, repetitive, dangerous** in order to leave the man to coordinate the machines and solve the jamming/maintain the machines.

Olivetti Company

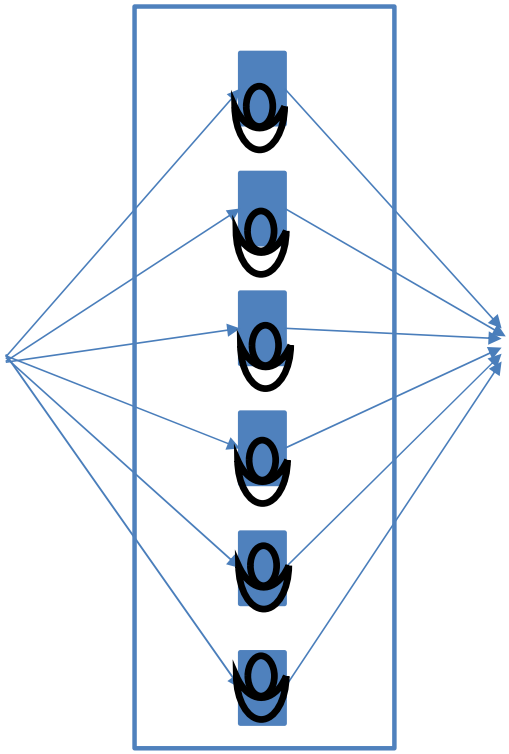
- Olivetti has been an Italian company based in Ivrea, a nice town 50 km north of Turin, founded by Camillo Olivetti a creative electrical engineer that began his career working in the team of Galileo Ferraris the great electrical engineer and scientist.
- Camillo Olivetti had the opportunity to follow Galileo Ferraris in a tour in United States supporting him because of his knowledge of English language. There he met T.A. Edison, he taught at American universities and spend six months to visit American companies when he realized the vision of a new industry approach.
- Come back to Italy, he started the manufacturing of electrical devices but just after the First World War he began to produce typewriters. His company grew in an incredible way due to the introduction of mechanical calculators in all offices, maintaining a high social profile in the meantime.
- Camillo left the place of CEO to his son, Adriano, in 1938. Adriano had also the opportunity to travel and do experiences in the US that were considered by his father as a democracy capable to introduce the most important innovation in technology.

Adriano Olivetti

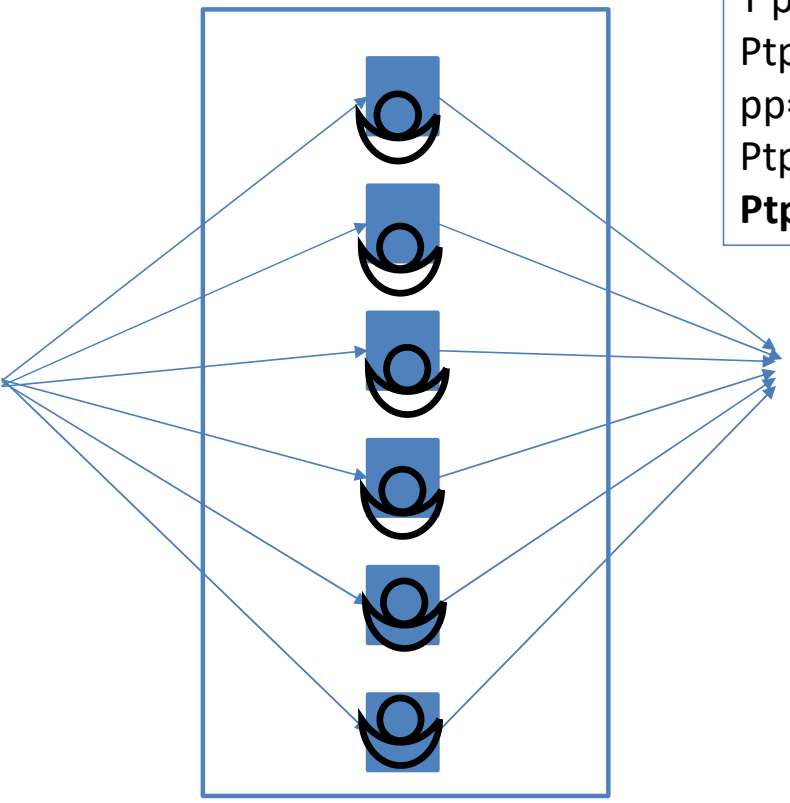
- The most important heritage of Adriano was implemented after the Second World War when the success of Olivetti was so important that in 1959 was able to buy the Underwood Company (most important American typewrites producer).
- The innovative thought of Adriano Olivetti was based on two important pillar: **the social vision of a factory integrated with the city life and the future of information technology.**
- The tool he used to pursue his objectives was the collection of free minds in any field of the culture and make them to work in a de-structured way to the creation of the Innovative company.
- Olivetti became in 1960 the first advanced technology computer company in Europe.
- At the same time this open and social view of the business helped also to improve the integration of the factory in the workers life creating “beauty” also in the workplace. Olivetti’s factory of Scarmagno for long time was considered the nicest of the world.
- Olivetti faced issues after the unexpected death of Adriano but was able to revamp and became the European leader of Electrical and Information product in 1985. After that there was a decline.

Asynchronous groups in Automotive

- It was in this environment, that was created in Olivetti a Center of Psicologic research. The leader of this center is F. Novara, the pupil of the greatest italian psicologist Cerare Musatti. Following to his view were introduced in Olivetti the concept of Work groups where the workers were responsible of the quantity and the quality of the product (UMI= Manufacturing Integrated Unit).
- In Automotive, due to the needs of finding better productive assets this concept was elaborated to define the "**Asynchronous group**" as assembly unit.
- In all the world there are cases of applications but mainly in Fiat Auto this solution become the standard for the powertrain manufacturing (the reason is linked to the limit in the dimension of the product).
- The workers **do they job in parallel**, obtaining two goals:
  1. **The men has not rigid constraints in his activity and is just forced to guarrantee an average cycle time.**
  2. **The cycle time is longer and if not transform an unskilled man in a craftsman, at least gives him more relation with the final product and a grather variety of movements**
- At the same time, the Automotive industry was aiming also to another model: high automation.

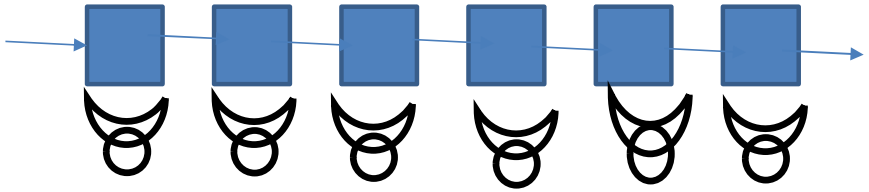


Asynchronous groups vs synchronous lines



T per unit=ctp
Ptp= N* pp
pp=1/ctp
Ptp=N/ctp
Ptp= N/T per unit

T/u= N* cts
Ps=1/cts
Ps=N/T per unit

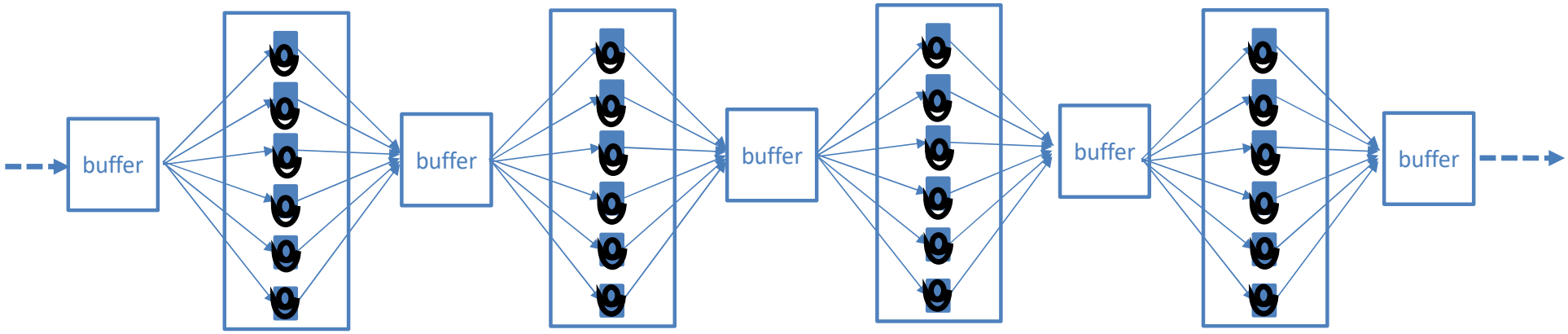


If we assume same T per unit

Ps=Ptp and:
ctp=N*cts

Series-parallel structures

In the practice, having a sole asynchronous group was impossible due to the extreme complexity of the automotive products.
The best solution has been a series of asynchronous groups able to avoid the “modern time” effect and optimize the ratio between complexity and cycle time.
In general, the groups consist of a number of workers varying from 6 to max 18.
Buffers are necessary to adapt the different speed that temporarily the groups may have.



Fanuc

- Around the same years of Adriano Olivetti, in Japan, **Dr. Seiuemon Inaba** has a similar vision about the product to develop and the manufacturing model.
- He also believes that the computer science will change the way to work in the world but **focuses his attention to the way in which the computer can support the manufacturing: CNC and robotics**.
- Also Dr. Inaba believes that the success in front of the society evolution must be based on an integration between the city and the factory.
- He starts, from the sixties, gradually building a factory/town around the mount Fuji.
- All worker live inside the factory having shops, supermarket, theaters, hospital. Everybody wears the same clothes. Visiting it is impressive: you feel to be inside a dream, a single man utopic and futuristic vision of the life.
- Important is to note that Dr. Inaba in his vision does not see unskilled workers or industrial craftsmen. He wants robotic specialist and in 1974 the robots are produced to be sold but also **to be implemented inside the Fanuc manufacturing processes to build other robots**.
- The model had success and some years ago Fanuc has overcome 50.000 robot sold plus CNC plus machine tool.

High automation

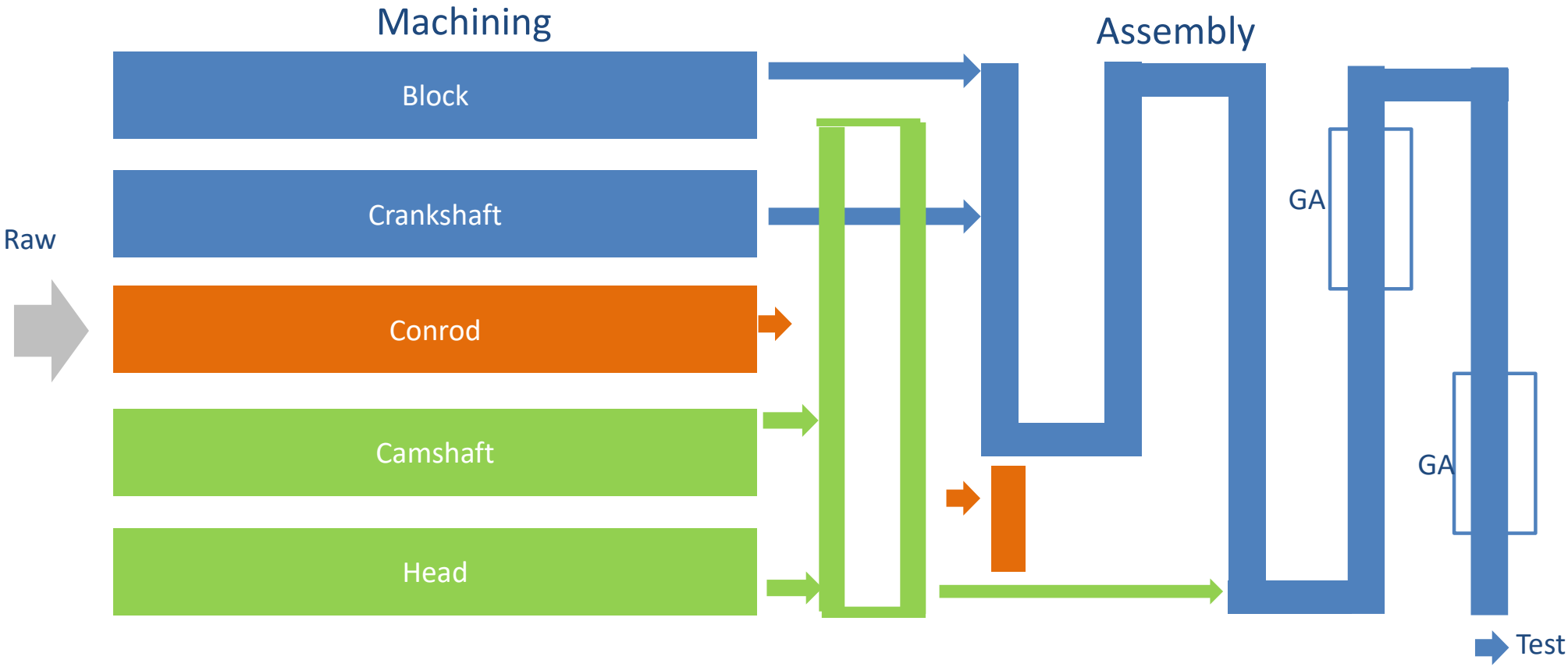
The high automation assembly model is based on:

- **Product conceived to be assembled by a robot**: simplified with clear mechanical references to be handled and moved with precision
- **Component selected to avoid jamming and breakdown**. This filter created bottom up by experience is one of the major contribution of automation to automotive quality increase.
- **To avoid set-up activities is a must** and the production plan can become the closest to the customer orders.
- Each product is assembled being sited on a pallet on which a magnetic tag (RFID) allows to write at the beginning all the product features and acquire the history of the product during the assembly.
- In that way the data about quality thresholds, batches of materials, possible rejections information, including the operator who repaired the product, are maintained all along the line and uploaded to a central computer to maintain it according to the customer rule requirements.

F.I.R.E.

- After the positive experience in Mirafiori, with the mid gasoline engine build for short/long block in 10 asynchronous groups linked by automatic tracks and a fully robotized cyl. Head subassembly, Fiat for the new greenfield engine is ready to the challenge of High Automation.
- The project of the small gasoline engine is developed in synergy with PSA group and the product is designed to be fully built by robots (apart form some final dressing).
- The line is installed in Termoli and the SOP is in 1985
- The daily production is 3000 engines/day with a cycle time of 18 seconds.
- All assembly is robotized. The few manual operations are arranged inside two asynchronous groups.
- The machining is fully automatic as well but based still on transfer lines.
- Direct and automatic connections between machining and assembly was conceived.
- The line has been stopped in 2021 after the production of 22 millions of engines.

FIRE layout



C 63X Verrone layout