PROCESS ANALYSIS

IENG 301

FUNDAMENTALS OF WORK STUDY AND ERGONOMICS

PROCESS ANALYSIS

- The entire system or process of doing work should be studied before undertaking a thorough investigation of a specific operation in the process. Such an over-all study will ordinarily include an analysis of each step in the manufacturing process or system.

PROCESS CHARTS

- The process chart is a device for recording a process in a compact manner, as a means of better understanding it and improving it.
- The chart represents graphically the separate steps or events that occur during the performance of a task or during a series of actions.
- The chart usually begins with the raw material entering the factory and follows it through every step, such as transportation to storage, inspection, machining operations, and assembly, until it becomes either a finished unit itself or a part of a subassembly.
- The process chart might, of course, record the process through only one or a few departments.

PROCESS CHARTS

- A careful study of such a chart, **giving a graphic picture of every step in the process** through the factory, may suggest improvements.

- It is frequently found that
  - certain operations can be eliminated entirely or that a part of an operation can be eliminated,
  - that one operation can be combined with another,
  - that better routes for the parts can be found,
  - more economical machines used,
  - delays between operations eliminated, and
  - other improvements made,

  all of which serve to produce a better product at a lower cost.

PROCESS CHARTS

- The process chart assist in showing the effects that changes in one part of the process will have on other parts or elements.
- Moreover, the chart may aid in discovering particular operations, in the process, which should be subjected to more careful analysis.

PROCESS CHARTS

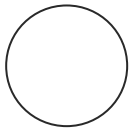
- The process chart, like other methods of graphic representation, should be modified to meet the particular situation. For example, it may show in sequence the activities of a person, or the steps that the material goes through. The chart should be either the man type or material type and the two types should not be combined.

PROCESS CHARTS

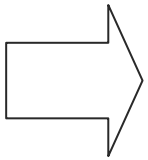
- Many years ago the Gilbreths devised a set of 40 symbols which they used in making process charts.

- The American Society of Mechanical Engineers has established as standard the five symbols listed below. This set of symbols is a modification of the four most widely used symbols of Gilbreths, in that the arrow replaces the small circle and a new symbol has been added to denote a delay.

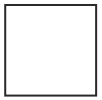
PROCESS CHARTS



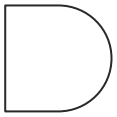
- Operation: An operation occurs when an object is intentionally changed in one or more of its characteristics. An operation represents a major step in the process and usually occurs at a machine or work station.



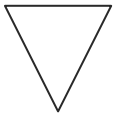
- Transportation: A transportation occurs when an object is moved from one place to another, except when the movement is an integral part of an operation or an inspection.



- Inspection. An inspection occurs when an object is examined for identification or is compared with a standard as to quantity or quality.



- Delay. A delay occurs when the immediate performance of the next planned action does not take place.



- Storage. A storage occurs when an object is kept under control such that its withdrawal requires authorization.

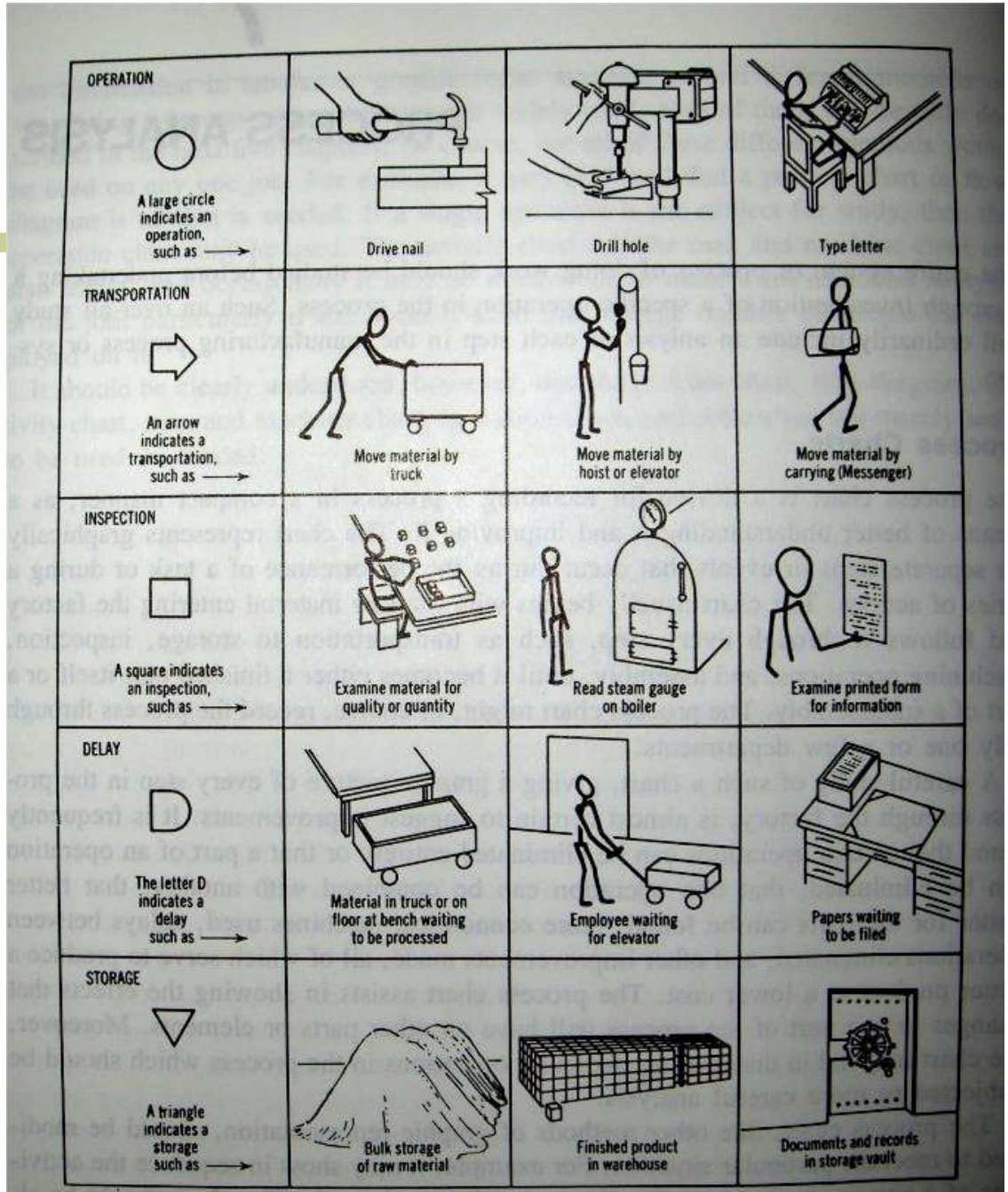
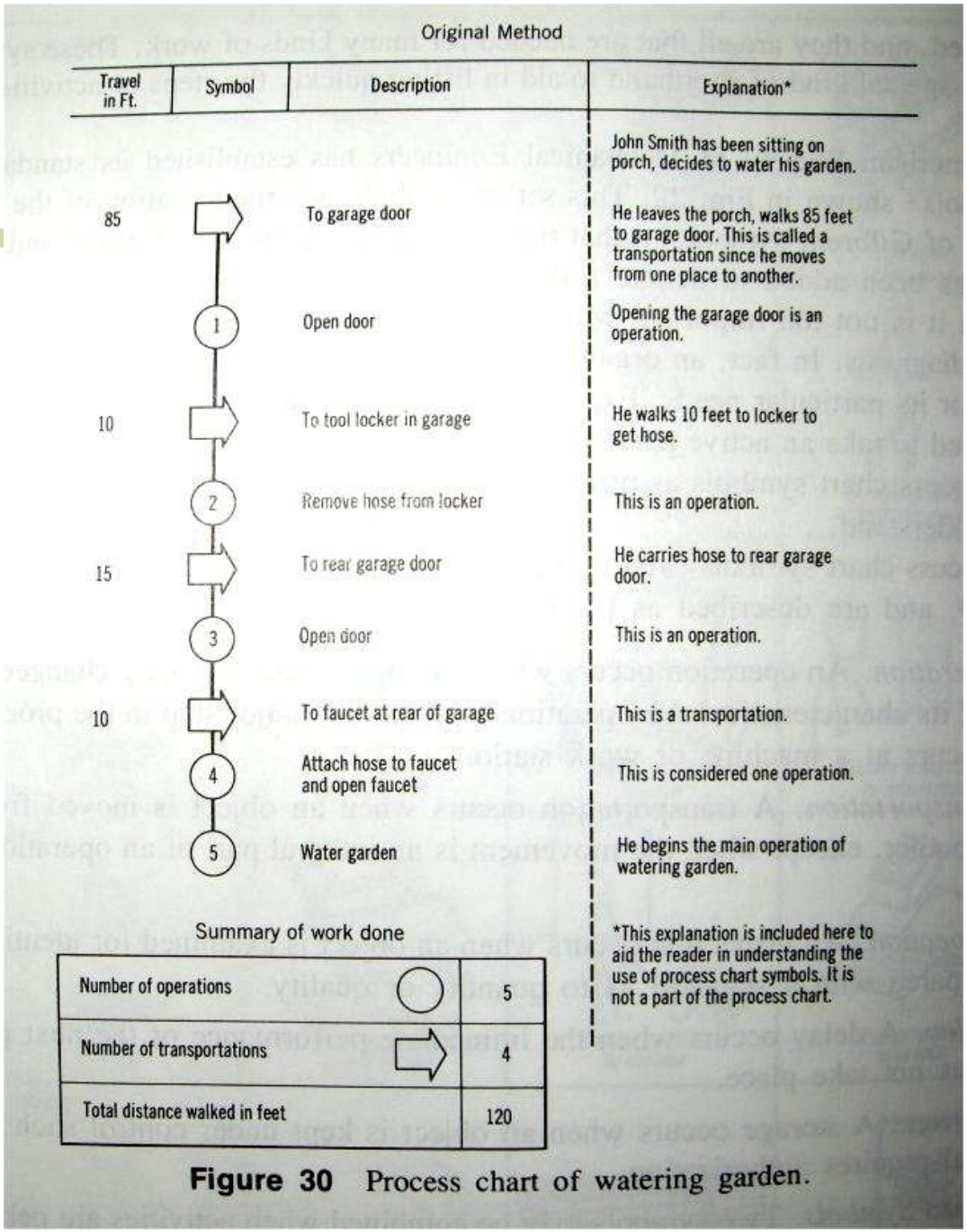


Figure 29 These process chart symbols save time in recording the steps used in doing wor

PROCESS CHARTS

- Combined Symbols. Two symbols may be combined when activities are performed at the same work place or when they are performed concurrently as one activity.

Process Chart



Original Method

Travel in Ft.	Symbol	Description	Explanation*
			John Smith has been sitting on porch, decides to water his garden.
85	⇨	To garage door	He leaves the porch, walks 85 feet to garage door. This is called a transportation since he moves from one place to another.
	1	Open door	Opening the garage door is an operation.
10	⇨	To tool locker in garage	He walks 10 feet to locker to get hose.
	2	Remove hose from locker	This is an operation.
15	⇨	To rear garage door	He carries hose to rear garage door.
	3	Open door	This is an operation.
10	⇨	To faucet at rear of garage	This is a transportation.
	4	Attach hose to faucet and open faucet	This is considered one operation.
	5	Water garden	He begins the main operation of watering garden.

Summary of work done

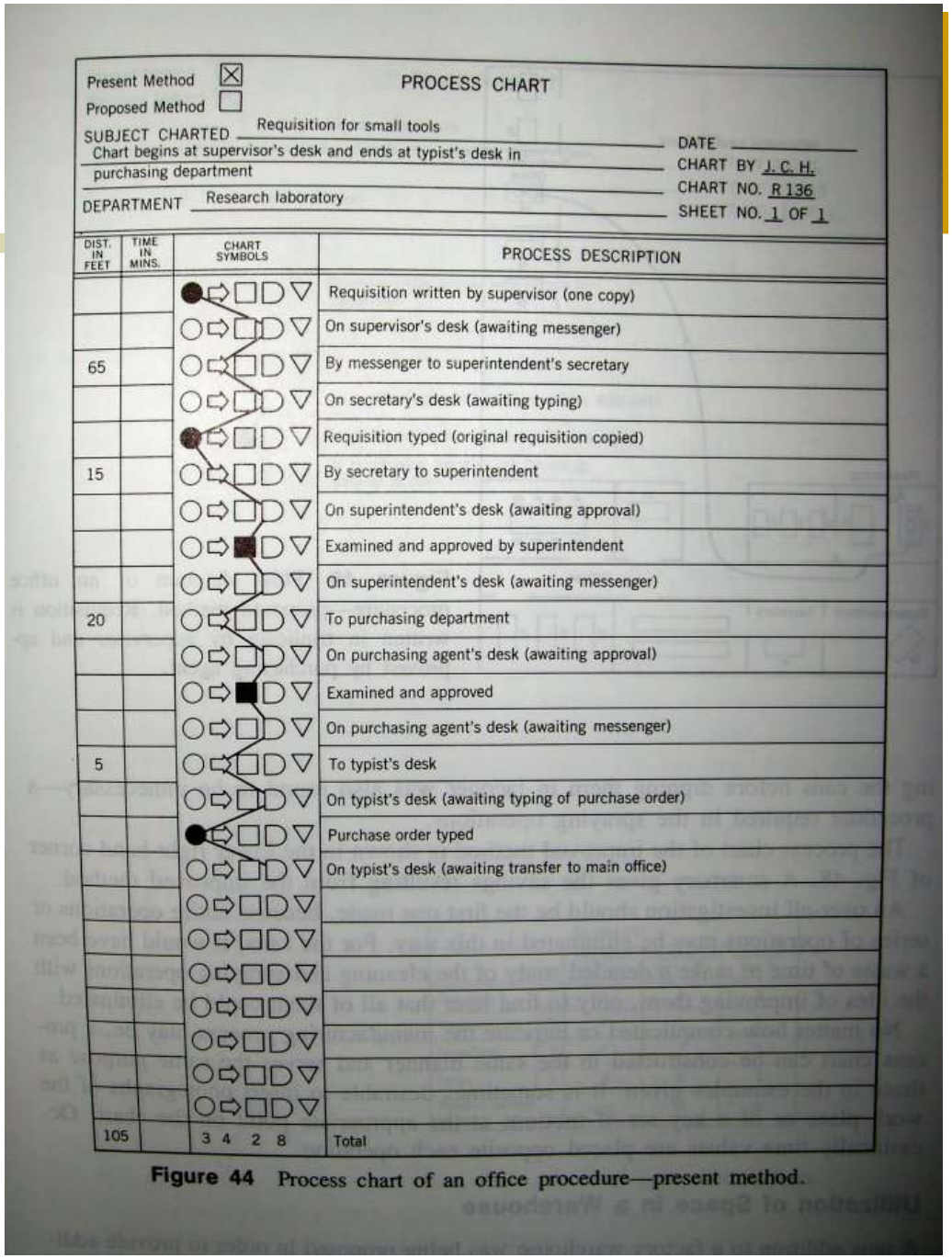
Number of operations ○	5
Number of transportations ⇨	4
Total distance walked in feet	120

*This explanation is included here to aid the reader in understanding the use of process chart symbols. It is not a part of the process chart.

Figure 30 Process chart of watering garden.

Process Chart

- In the office the process chart might show the flow of a time card, a material requisition, a purchase order, or any other form, through the various steps.
- The chart might begin with the first entry on the form and show all the steps until the form is permanently filed or destroyed.



Present Method ☒
Proposed Method ☐

PROCESS CHART

SUBJECT CHARTED Requisition for small tools
Chart begins at supervisor's desk and ends at typist's desk in purchasing department

DEPARTMENT Research laboratory

DATE
CHART BY J. C. H.
CHART NO. R 136
SHEET NO. 1 OF 1

DIST. IN FEET	TIME IN MINS.	CHART SYMBOLS	PROCESS DESCRIPTION
		● ⇨ □ D ▽	Requisition written by supervisor (one copy)
		○ ⇨ □ D ▽	On supervisor's desk (awaiting messenger)
65		○ ⇨ □ D ▽	By messenger to superintendent's secretary
		○ ⇨ □ D ▽	On secretary's desk (awaiting typing)
		● ⇨ □ D ▽	Requisition typed (original requisition copied)
15		○ ⇨ □ D ▽	By secretary to superintendent
		○ ⇨ □ D ▽	On superintendent's desk (awaiting approval)
		○ ⇨ ■ D ▽	Examined and approved by superintendent
		○ ⇨ □ D ▽	On superintendent's desk (awaiting messenger)
20		○ ⇨ □ D ▽	To purchasing department
		○ ⇨ □ D ▽	On purchasing agent's desk (awaiting approval)
		○ ⇨ ■ D ▽	Examined and approved
		○ ⇨ □ D ▽	On purchasing agent's desk (awaiting messenger)
5		○ ⇨ □ D ▽	To typist's desk
		○ ⇨ □ D ▽	On typist's desk (awaiting typing of purchase order)
		● ⇨ □ D ▽	Purchase order typed
		○ ⇨ □ D ▽	On typist's desk (awaiting transfer to main office)
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
105		3 4 2 8	Total

Figure 44 Process chart of an office procedure—present method.

FLOW DIAGRAM

- Sometimes a better picture of the process can be obtained by putting **flow lines on a plan drawing of the building or area** in which the activity takes place. This is called a flow diagram.

- Sometimes, both a process chart and a flow diagram are needed to show the steps in a manufacturing process, office procedure, or other activity.

Flow Diagram

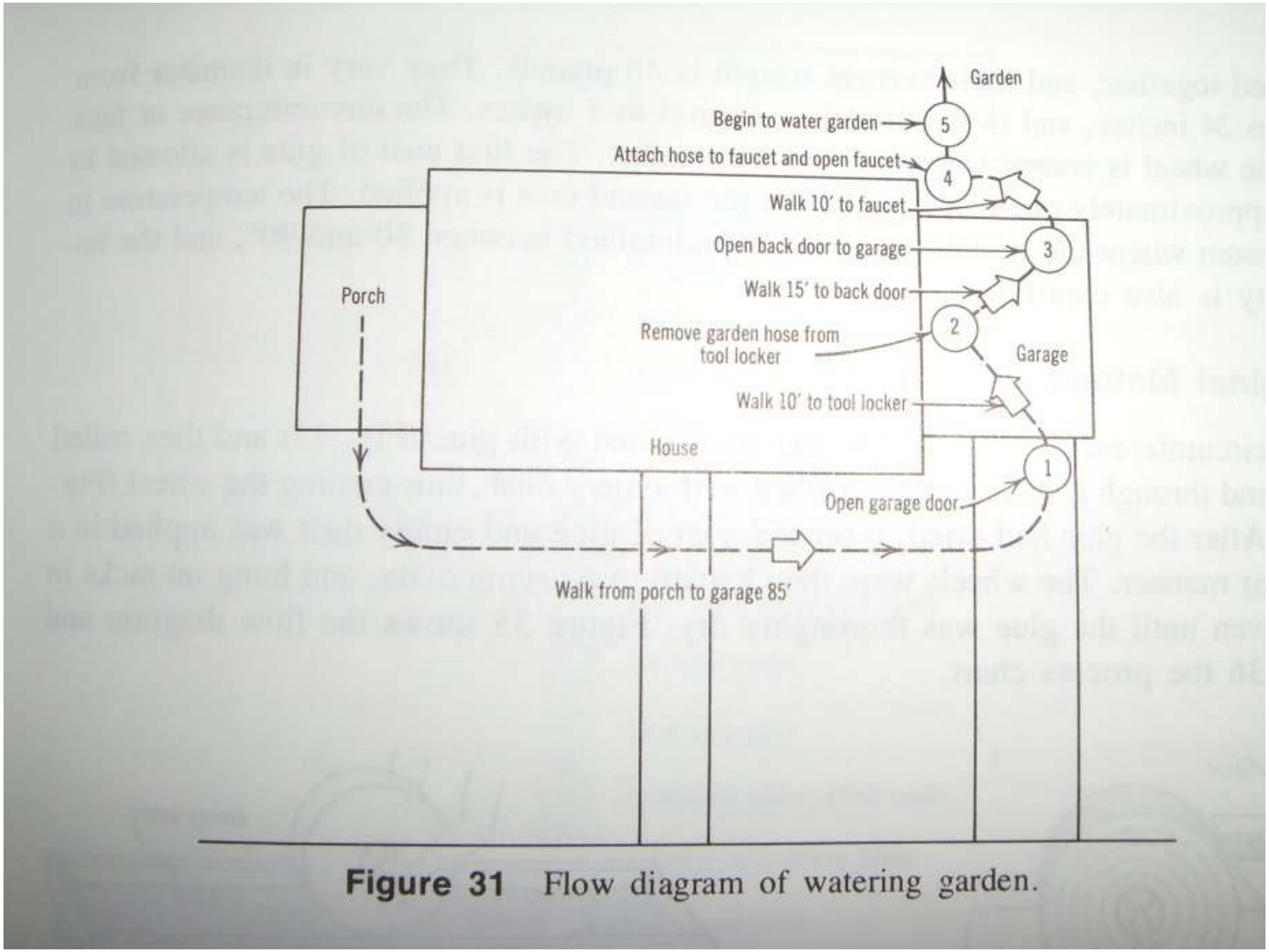


Figure 31 Flow diagram of watering garden.

ASSEMBLY PROCESS CHART

- A special type of process chart, sometimes called an assembly process chart, is useful for showing such situations as the following:
  - when several parts are processed separately and are then assembled and processed together;
  - when a product is disassembled and the component parts are further processed,
  - when it is necessary to show a division in the flow of work, such as separate action on different copies of an office form.

Assembly Process Chart

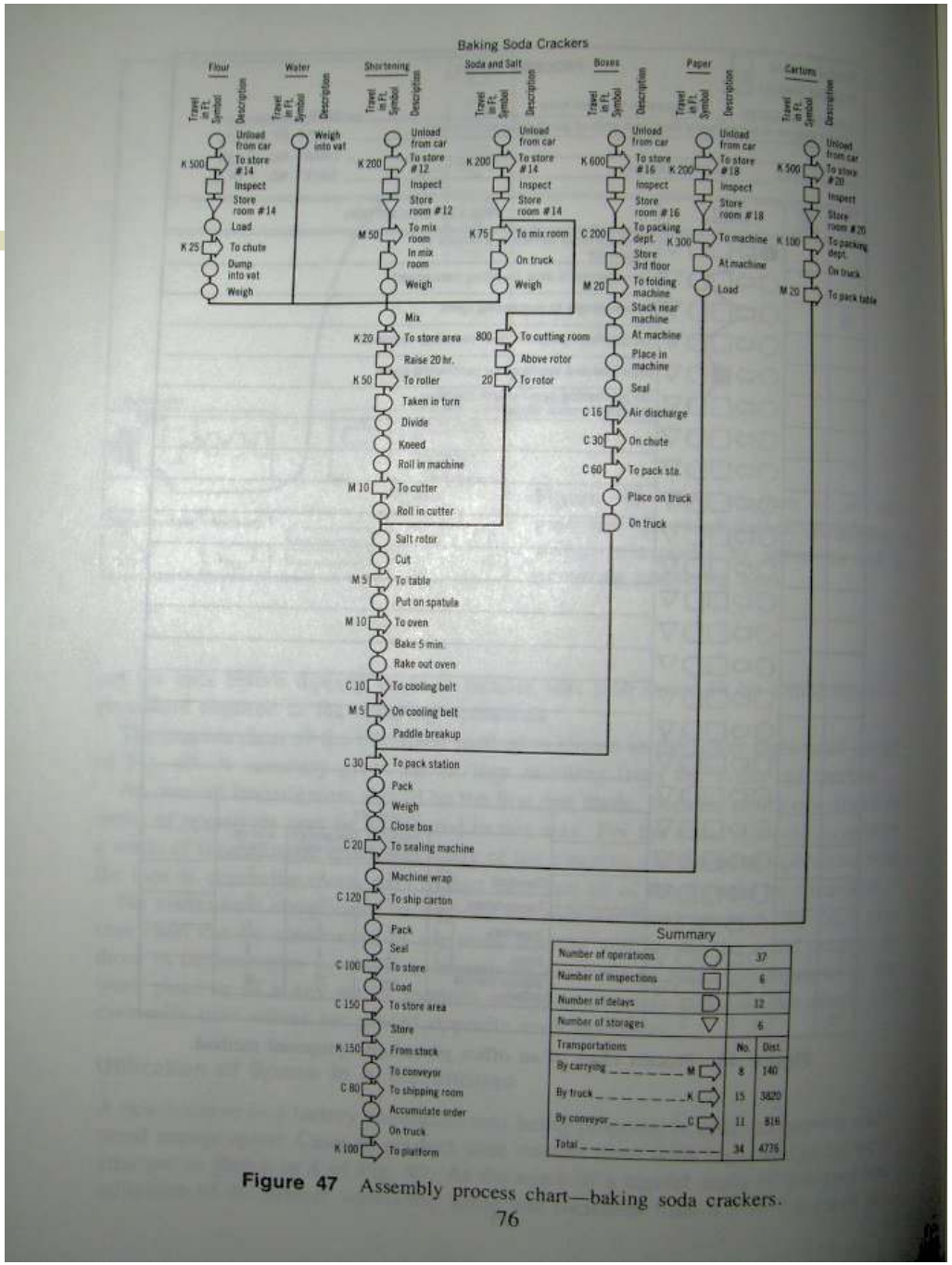
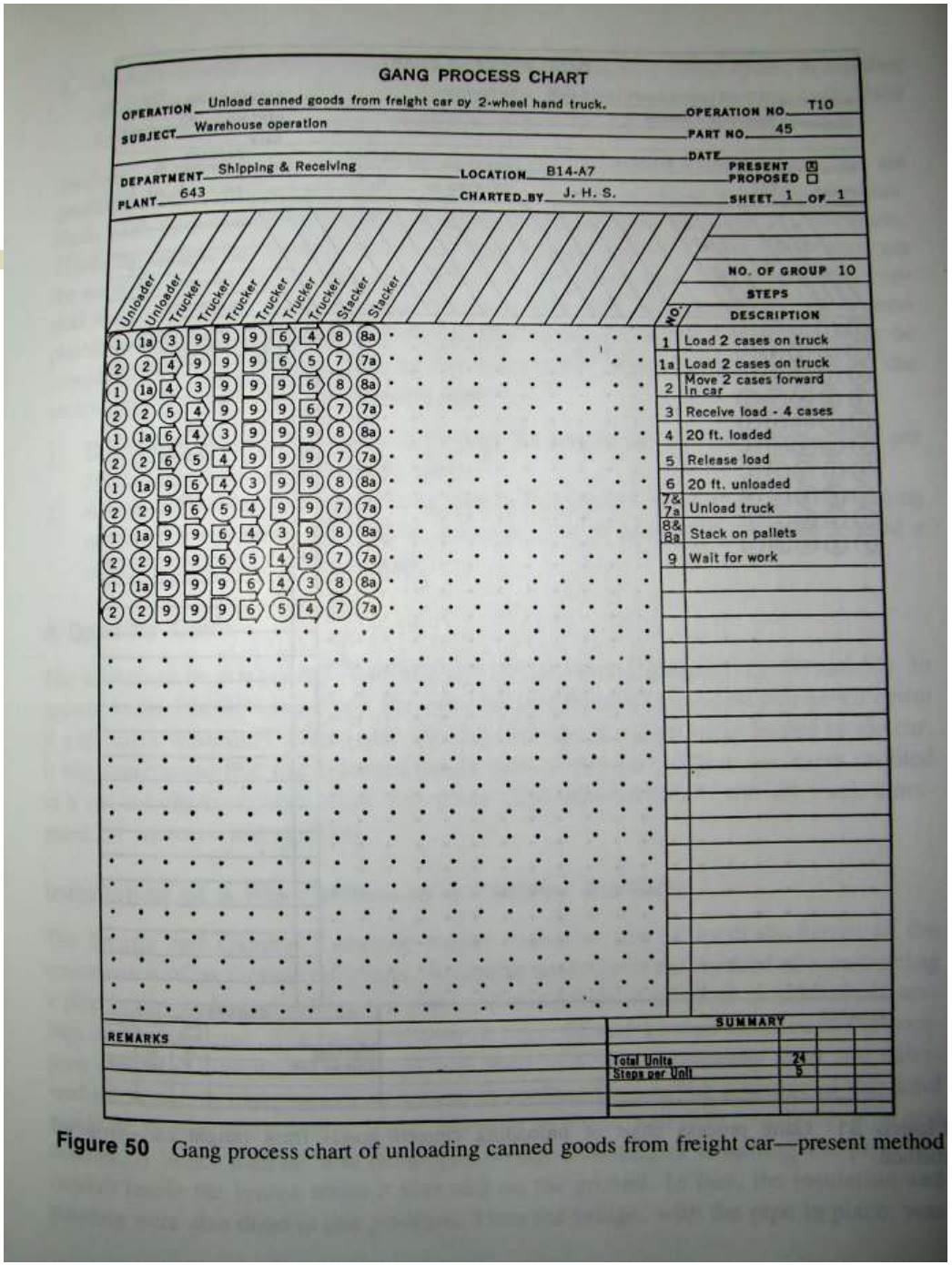


Figure 47 Assembly process chart—baking soda crackers.

GANG PROCESS CHART

- The gang process chart is an aid in studying the activities of a group of people working together. This chart is a composite of individual member process charts, arranged to permit thorough analysis.
- Those operations which are performed simultaneously by gang members are indicated side by side.
- The basic purpose of the chart is to analyze the activities of the group and then compose the group so as to reduce to a minimum all waiting time and delays.

Gang Process Chart



GANG PROCESS CHART

OPERATION Unload canned goods from freight car by 2-wheel hand truck. OPERATION NO. T10

SUBJECT Warehouse operation PART NO. 45

DEPARTMENT Shipping & Receiving LOCATION B14-A7 DATE

PLANT 643 CHARTED BY J. H. S. PRESENT ☒ PROPOSED ☐ SHEET 1 OF 1

Unloader | Unloader | Trucker | Trucker | Trucker | Trucker | Trucker | Trucker | Stacker | Stacker

NO. OF GROUP 10

NO.	STEPS DESCRIPTION
1	Load 2 cases on truck
1a	Load 2 cases on truck
2	Move 2 cases forward in car
3	Receive load - 4 cases
4	20 ft. loaded
5	Release load
6	20 ft. unloaded
7& 7a	Unload truck
8& 8a	Stack on pallets
9	Wait for work

REMARKS

SUMMARY

Total Units	24
Steps per Unit	5

Figure 50 Gang process chart of unloading canned goods from freight car—present method

Analysis of Gang Process Chart

- Four steps are followed in analyzing a gang process chart.
  - First, the six questions what, who, where, when, how, and why are asked of the entire process.
  - Second, each operation and inspection is analyzed by utilizing the same six questions.
  - Third, the remaining transportations and storage are studied.
  - Fourth, the how question should be applied in a new way after refinements have been completed under step1, 2, and 3.

Analysis of Gang Process Chart

- This question is asked: “How should the gang be composed to reduce waiting time to minimum?” The following will assist the analyst to “balance” the gang under step 4:
  - Determine the class of operator having the largest amount of waiting time per cycle, and the class having the least.
  - Adjust the gang by decreasing number of operators least busy and increasing number of operators most busy. Generally, it is preferable to work toward a smaller rather than a larger gang.