GILBRETH PROCESS CHART

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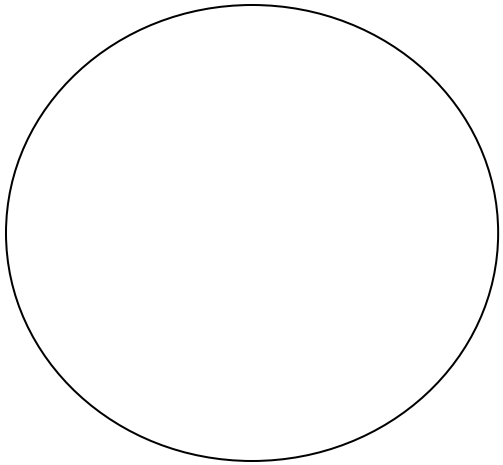
CHART:	
1. OPERATION PROCESS CHART (outline process chart)	Gives bird's-eye view of process and records principal operations and inspecting.
2. FLOW PROCESS CHART • Man type • Material type • Equipment type	Sequence of activities performed by worker. Sequence of activities performed on materials. Sequence of activities performed by equipment.
3. MULTIPLE ACTIVITY CHART	Charts activities of men and/or machines on a common time scale.
4. TWO HANDED PROCESS CHART	Activities performed by worker's two hands.
5. TRAVEL CHART	Movement of materials and/or men between departments.
6. SIMO CHART	Activities of worker's hands, legs and other body movements on common time scale.
DIAGRAM:	
7. FLOW AND STRING DIAGRAMS	Path of movement of men and materials.
8. MODELS AND TEMPLATES	Work place layout.
9. CYCLE GRAPH AND CHRONOCYCLE GRAPH	High speed, short cycle operation recording.

Operation

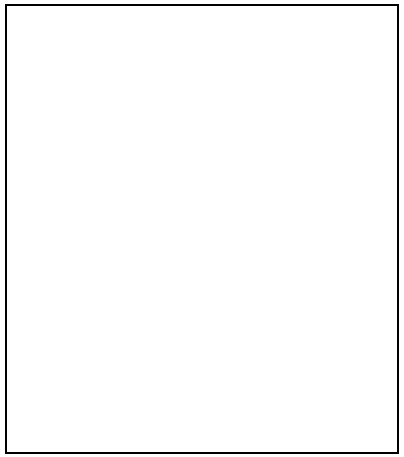
Represents an action – a step in the procedure – involves change in the location or condition of a product - takes object one stage ahead towards completion

Example : cutting a bar on a power hacksaw, driving a nail in wood, lathe operations, chemical reaction, welding, brazing, riveting etc.



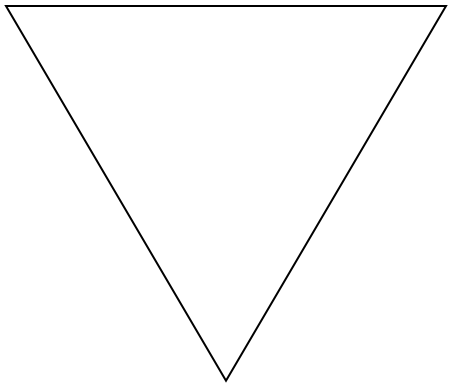
Inspection

- It represents verification of quantity or quality.
- **Example**: Checking of a draft document by a clerk, checking a product for its dimensions, visual inspection for finish.



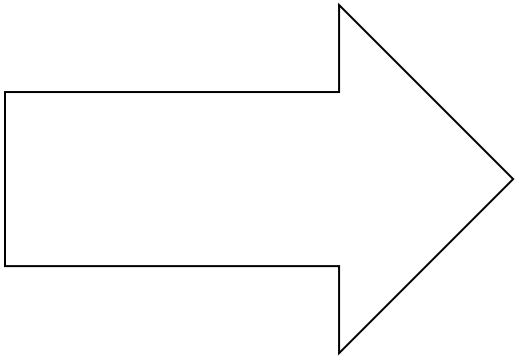
Storage

- It represents retention of materials, products or documents.
- **Example**: documents filed in a filing cabinet.



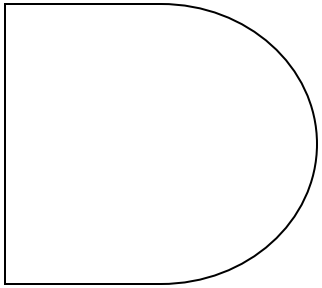
Transport

- Represents movement of workers, materials, products or documents from place to place, without affecting the process.
- **Example**: material flowing on a conveyer, a worker moving to and from the tool store.



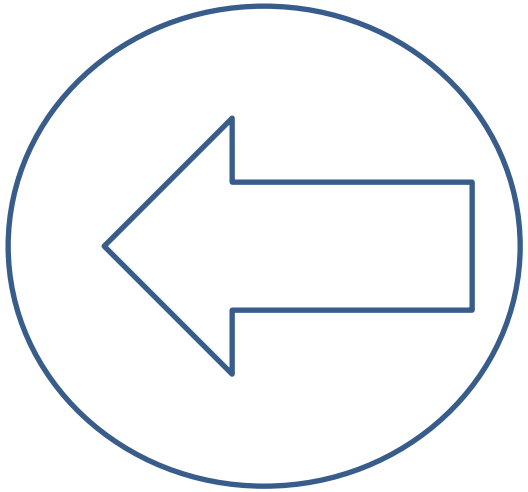
Delay or Temporary storage

- Delay occurs when the immediate performance of the next planned action cannot take place.
- **Example**: Worker waiting for a lift, a letter awaiting signatures, power failure



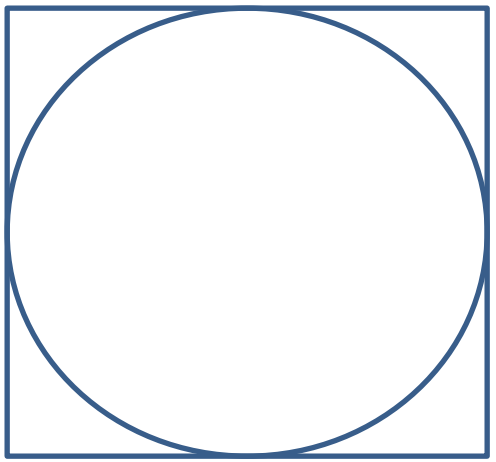
Operation cum transportation

- Articles being painted as they are transported by chain conveyor



Inspection cum operation

- Powder milk tin
  weighed as it is filled



OPERATION / OUTLINE PROCESS CHARTS

- Surveys and records an overall picture of the process and states only main events, sequence wise. Considers only main operations and inspections
- **Uses only two symbols – operation and inspection**
- Operation process chart helpful to,

  - Visualize the complete sequence of operations and inspections in the process - Know where the operation selected for detailed study fits into the entire process

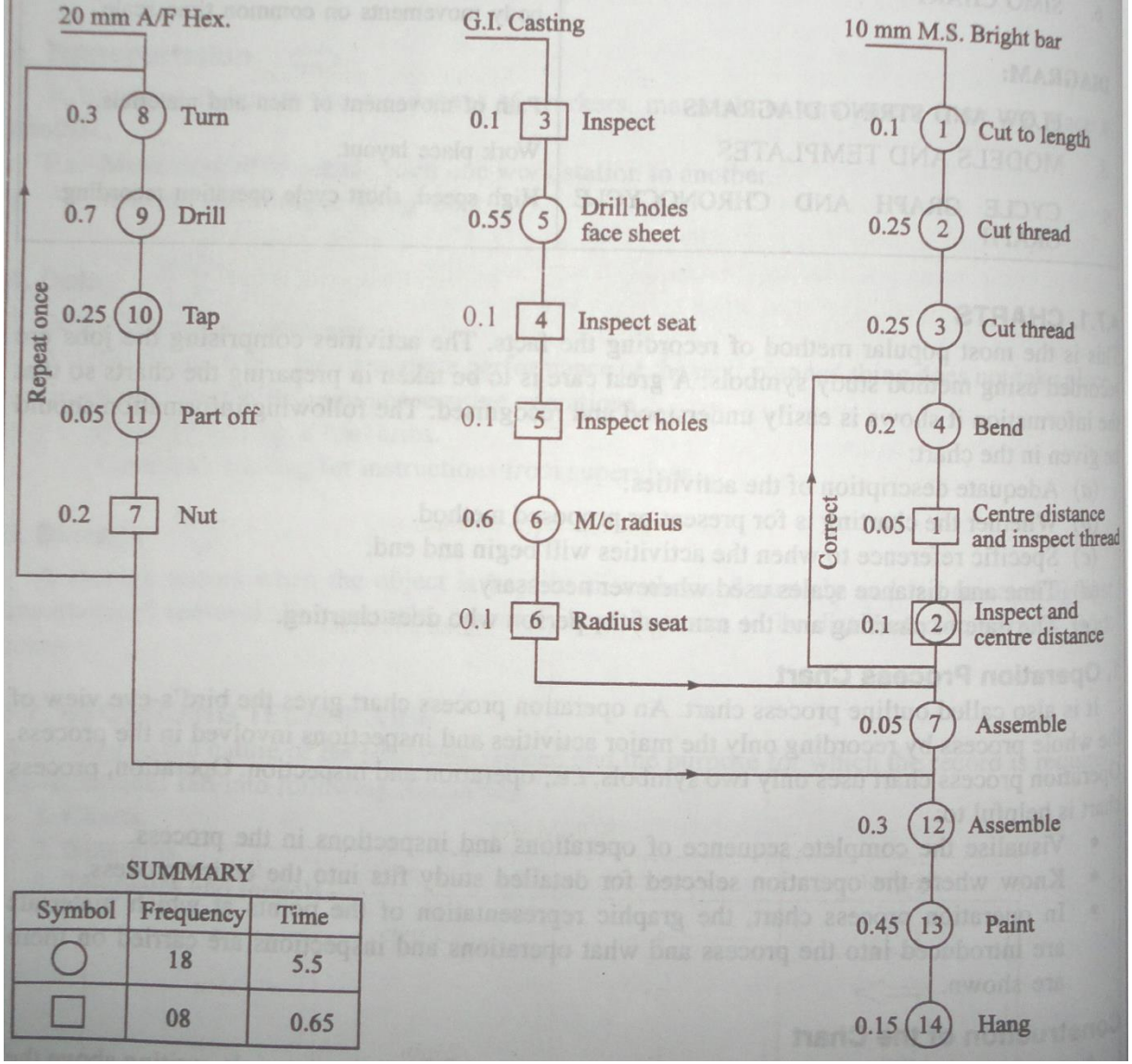
  - Graphic representation of the points at which materials are introduced into the process and what operations and inspections are carried out on them are shown.

OPERATION / OUTLINE PROCESS CHARTS - CONSTRUCTION

- A start is made by drawing an arrow to show the entry of the main materials, writing above descriptions of the components and below the line the description of the condition
- As each operation, inspection takes place, the symbol is entered and numbered in sequence with a brief description on the Right Hand Side (RHS) and time required for operation on the Left Hand Side (LHS)
- During assembly process, major process is charted towards RHS of the chart and the subsidiary process on its LHS
- These are joined to each other and to the main trunk at the place of entry of the material or subassembly
- Chart does not show where the work takes place or who performs it

OPERATION PROCESS CHART
(PRESENT METHOD)

Task : Manufacture of pipe clip assembly
Chart begins : Raw materials lying in the stores
Chart ends : Finished assembly of pipe clip on the rack
Charted by : .....
Date of charting : .....



SUMMARY

Symbol	Frequency	Time
○	18	5.5
□	08	0.65

FLOW PROCESS CHART

- A chart may be a diagram, a picture or a graph which gives overall view of the situation, say a process - A process chart records graphically or diagrammatically in sequence, the operations connected with a process
- Helps visualizing various possibilities of alteration or improvement
- Flow process chart gives sequence of flow of work of a product, or any part of it through the work centre or the department recording the events using appropriate symbols
- It is the amplification of operation process chart in which operations, inspection, storage, delay and transportation are represented
- Flow process charts are of three types – Material type showing events that occur to the materials – Man type showing activities performed by workman – Equipment type – showing how equipment is used

Flow process chart is useful,

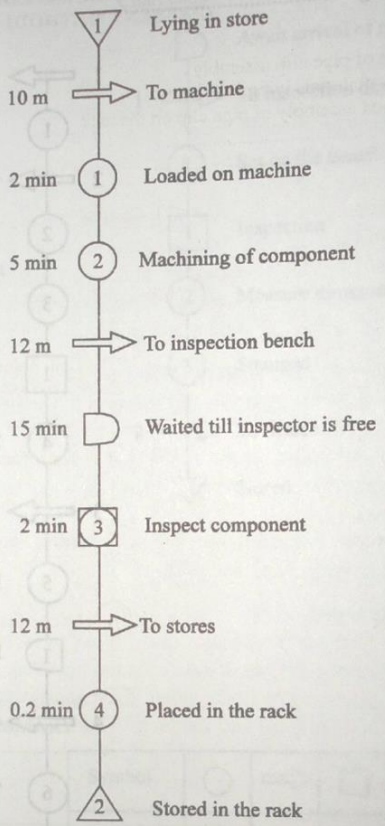
- To reduce the distance travelled by men or materials
- To avoid waiting time and unnecessary delays
- To reduce the cycle time by combining or eliminating operations
- To fix up the sequence of operations
- To relocate the inspection stages

❖ Like operation process chart, flow process chart constructed by placing symbols one below another as per the occurrence of the activities and are joined by a vertical line

❖ Brief description of the activity is written on the RHS of the activity symbol and time or distance given on the LHS

FLOW PROCESS CHART (Material type)
(PRESENT METHOD)

Task : Machining of the component
Chart begins : Component lying in the stores
Chart ends : The machined component lying in the stores
Charted by : .....
Date of charting : .....

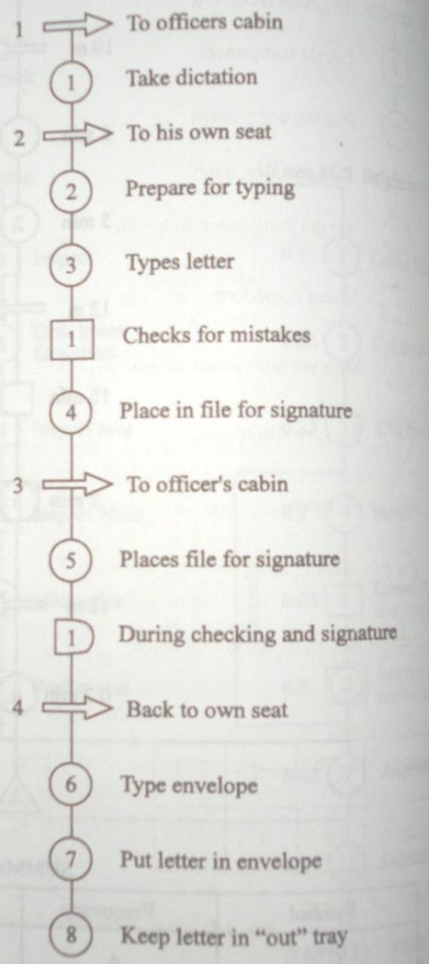


SUMMARY

Symbol	Frequency	Time	Distance
○	4	9.2 min	–
⇨	3	–	34 m
□	1	2 min	–
D	1	15 min	–
▽	2	–	–

FLOW PROCESS CHART (Man type)
(PRESENT METHOD)

Task : Writing a letter
Chart begins : Typist in his chiar at his office
Chart ends : Typist puts letter in "out tray"
Charted by : .....
Date of charting : .....



SUMMARY

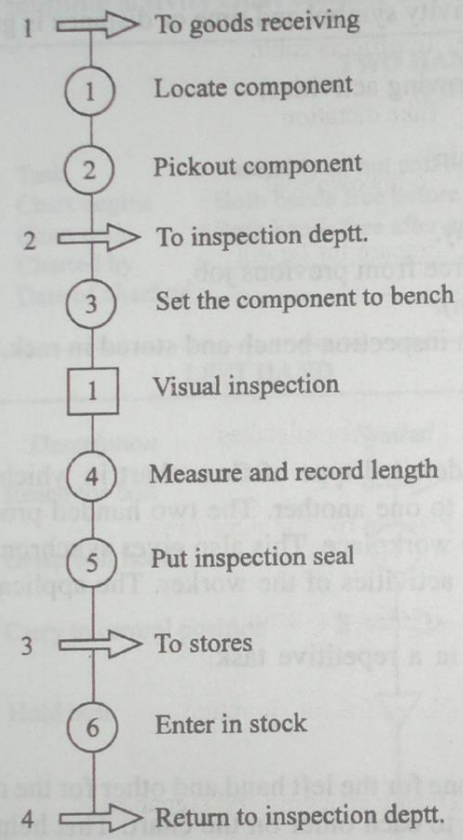
Symbol	○	⇨	□	▽	D
Frequency	08	04	01	–	01

FLOW PROCESS CHART (Man and Material type)
(PRESENT METHOD)

Task : Inspection of component

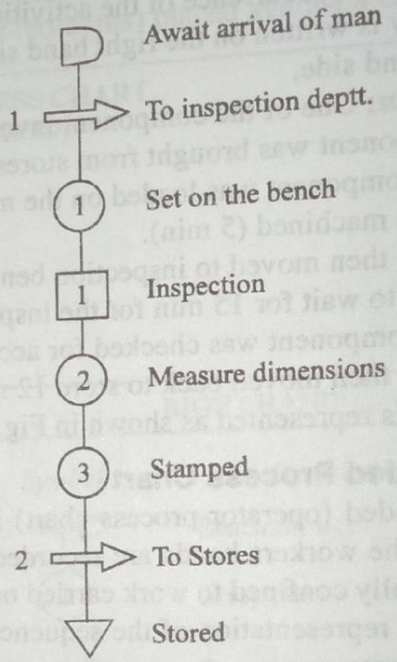
MAN TYPE

Chart begins : Man in inspection Deptt.
Chart ends : Man in inspection Deptt.



MATRERIAL TYPE

Chart begins : Material in goods receiving
Chart ends : Material in stores



SUMMARY

Symbol	○	⇨	□
Frequency	6	4	1

Symbol	○	⇨	□	D	▽
Frequency	3	2	1	1	1

TWO HANDED PROCESS CHART

- Most detailed type of flow chart in which activities of the workers hand are recorded in relation to one another
- Confined to work carried out at a single workplace
- Gives synchronized and graphical representation of the sequence of manual activities of the worker
- Applications – to visualize the complete sequence of activities in a repetitive task – to study the work station layout
- Consists of two charts – one for left hand and other for right hand
- Simultaneous activities are recorded opposite to each other
- Helps to analyze what left hand will be doing when right hand is working or vice versa at any point of time
- All symbols except that for inspection & storage are used

LAYOUT

BOLTS (B)

NUTS (N)

OPERATOR (O)

ASSEMBLY (A)

TWO HANDED PROCESS CHART (PRESENT METHOD)

Task : Assembly of nut and bolt
Chart begins : Both hands free before assembly
Chart ends : Both hands free after assembly
Charted by : .....
Date of charting : .....

LEFT HAND		RIGHT HAND	
Description	*Symbol*	*Symbol*	*Description*
Reach for bolt	1	1	Reach for nut
Grasp bolt head	1	1	Grasp nut
Carry to central position	2	2	Carry to central position
Hold bolt		2	Place nut on bolt
		3	Screw nut
Hold bolt		4	Grasp assembly
Transfer assembly to right hand	2	3	Carry to box
		4	Release assembly
		4	Return hand to central position

SUMMARY

Symbol	○	⇨	▽	D
Frequency (R.H.)	5	4	–	–
Frequency (L.H.)	2	2	2	2

TWO HANDED PROCESS CHART

- Inspection symbol used when touch or feel by hand is to be recorded
- Storage symbol used when the hand is used as a grip or vice to hold the object

MULTIPLE ACTIVITY CHART

- Chart where activities of more than one subject (worker or equipment) are each recorded on a common time scale to show their inter-relationship
- Helpful to study idle time of the man and machines – determine number of machines handled by one operator – determine number of operators

  required in teamwork to perform the given job
- Consists of a series of bars (columns) placed against a common time scale - Each subject allocated one bar and their activities are represented

MULTIPLE ACTIVITY CHART
(Present Method)

Task : Machining of a component
Chart begins : The part to be machined lying near machine
Chart ends : Machined part lying in the container
Charted by : .....
Charting date : .....

	Operator			*Machine*		
0	Description	T	S		T	S
0.20	LOAD JOB	0.2		IDLE		
0.28	SWITCH 'ON'	0.08		IDLE		
0.36	SWITCH 'ON'	0.08		IDLE		
1.86	IDLE			MACHINING OF PART "Autocycle"	1.5	
1.91	PICKUP PART	0.05		IDLE		
1.96	KEEP IN TRAY	0.05		IDLE		

Subject	*Cycle time (min)*	*Time worked per cycle*	*Percentage utilisation*
OPERATOR	1.96	0.46	23.4
MACHINE	1.96	1.5	76.6

MULTIPLE ACTIVITY CHART

- Columns are placed against a common time scale which starts at zero and ends at cycle time of the job
- Task to be recorded broken into smaller elements and time for each element measured with the help of stop watch
- Activities then recorded in their respective columns
- Two symbols are used – one representing working (hatched column) and other idle (blank column)

DIAGRAMS

- Flow process chart shows only the sequence and nature of movement – does not clearly show the path of movement
- Undesirable features such as congestion, back tracking and unnecessary long movements associated with the paths of movement

DIAGRAMS

- To record these unnecessary features – representation of the working area in the form of flow diagrams, string diagrams can be made,
- To study different layout plans and thereby select the most optimal layout
- To study traffic and frequency over different routes of the plant
- Identification of back tracking and obstacles during movements

FLOW DIAGRAM

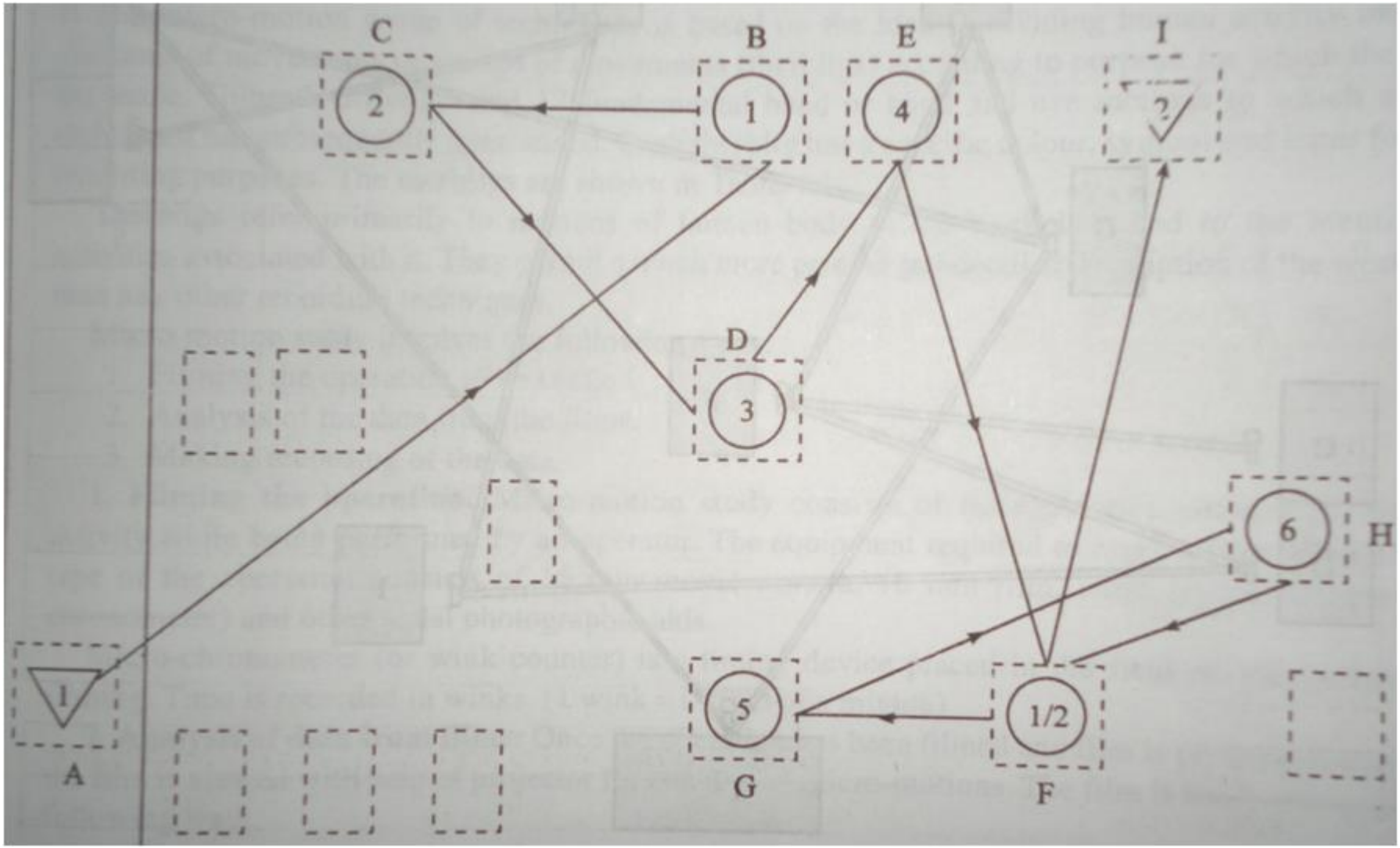
- A drawing substantially to scale of the working area, showing the location of various activities identified by their numbered symbols and are associated with particular flow process chart either man or material type
- Routes followed in transport are shown by joining the symbols in sequence

FLOW DIAGRAM

- Layout of workplace drawn to scale
- Relative positions of the m/c tools, work benches, storage, inspection benches are marked on scale
- Path followed by the subject under study traced by drawing lines
- Each movement serially numbered and indicated by arrow for direction
- Different colours used to denote different types of movements

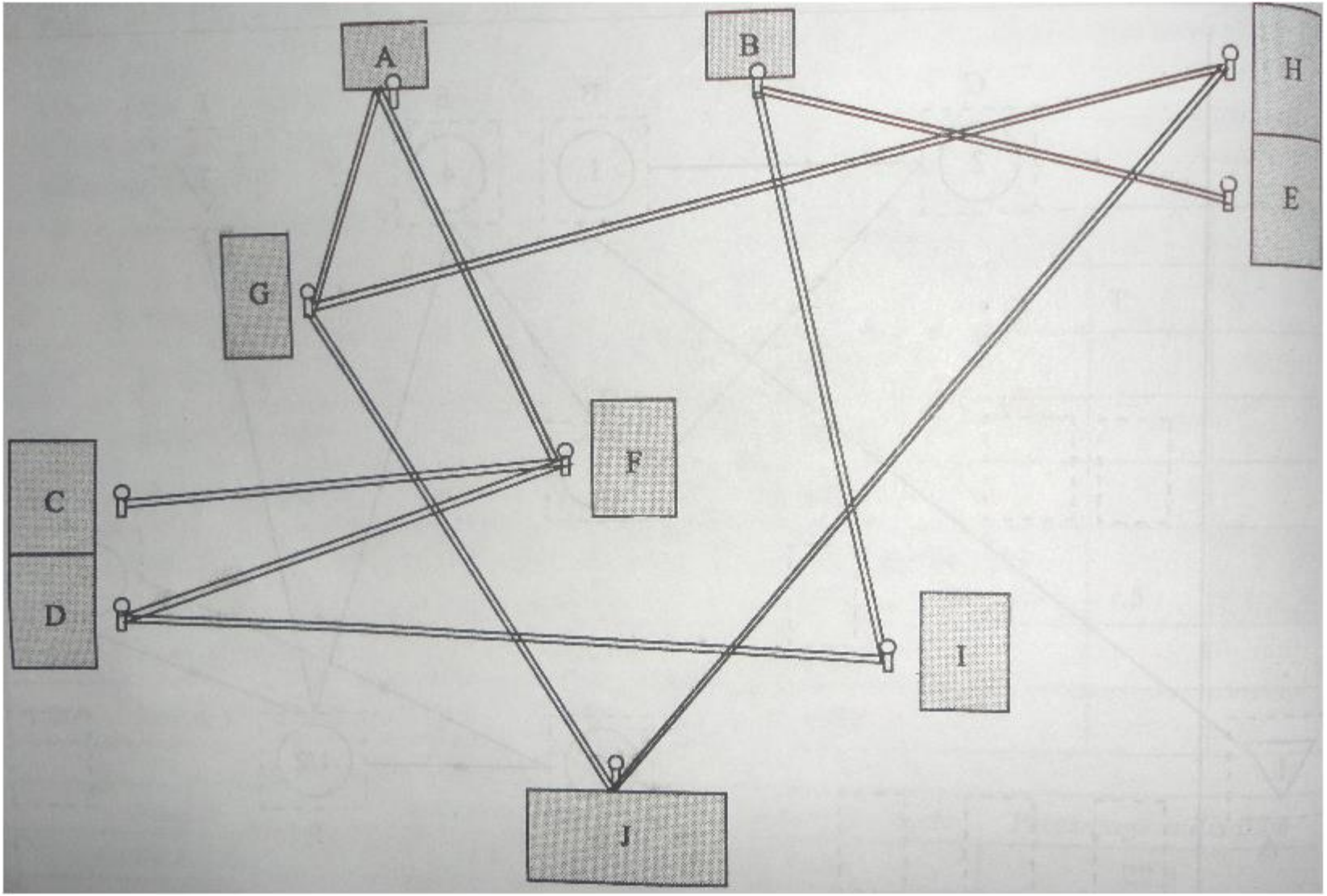
STRING DIAGRAM

- A scale layout drawing on which length of a string used to record the extent as well as the pattern of movement of a worker working within a limited area during a certain period of time.
- Valuable where journeys are so irregular in distance and frequency to see exactly what is happening.


C
2
B
1
E
4
I
2
D
3
6
H
1
A
5
G
1/2
F

STRING DIAGRAM (Contd…)

- Primary function – to produce a record of an existing set of conditions so that the job of seeing what is actually taking place is made as simple as possible.
- Valuable feature is the way it enables the actual distance travelled during the period of study to be calculated by relating the length of the thread used to the scale of the drawing
- Helps to make a very effective comparison between different layouts or methods of doing job in terms of the travelling involved
- Main advantage over flow diagram – repetitive movements between work stations can be conveniently shown
- Layout of the workplace drawn to scale on a soft board
- Pins are fixed to mark locations of work stations

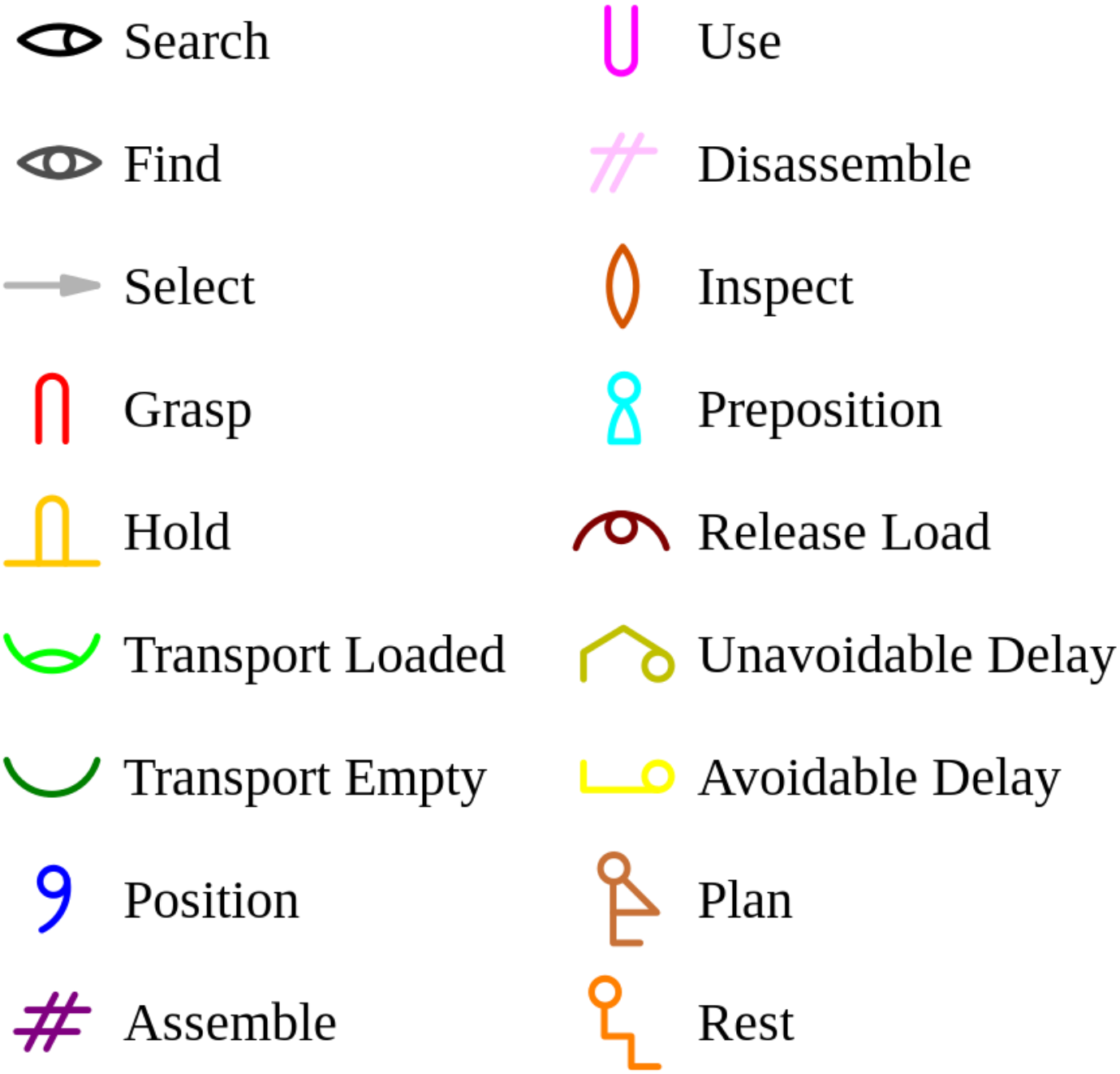

A
B
H
E
G
F
C
D
I
J

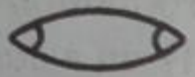
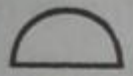
STRING DIAGRAM (Contd…)

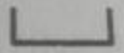
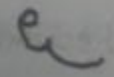
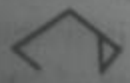
- Measured length of thread taken to trace the movement
- Distance covered by the object obtained by measuring the remaining part of the thread and subtracting it from the original length

MICRO MOTION STUDY

- Technique for recording and timing an activity
- Intended to divide human activities in a group of movements or micro-motions (**THERBLIGS**) – helps to find for an operator one best pattern of movement that consumes less time and requires less effort to accomplish the task
- Therbligs suggested by Frank B Gilbreth, founder of motion study – refer primarily to motions of human body at the workplace and to the mental activities associated with it – Each therblig has specific colour, symbol and letter for recording purpose


Search
Find
Select
Grasp
Hold
Transport Loaded
Transport Empty
Position
Assemble
Use
Disassemble
Inspect
Preposition
Release Load
Unavoidable Delay
Avoidable Delay
Plan
Rest

SYMBOL	CODE	NAME	DESCRIPTION	COLOUR
	SH	SEARCH	Locate an article	BLACK
	F	FIND	Mental reaction at end of search	GRAY
	ST	SELECT	Selection from a number	LIGHT GRAY
	G	GRASP	Taking hold	RED
	H	HOLD	Prolonged grasp	GOLD OCHRE
	TL	TRASPORT LOADED	Moving an article	GREEN
	P	POSITION	Placing in a definite location	BLUE

	A	ASSEMBLE	Putting parts together	VIOLET
	U	USE	Causing a device to perform its function	PURPLE
	DA	DISASSEMBLE	Separating parts	LIGHT VIOLET
	I	INSPECT	Examine or test	BURNT OCHRE
	PP	PREPOSITION	Placing an article ready for use	PALE BLUE
	RL	RELEASE LOAD	Release an article	CARMINE RED
	TE	TRASPORT EMPTY	Movement of a body member	OLIVE GREEN
	R	REST	Pause to overcome fatigue	ORANGE
	UD	UNVOIDABLE DELAY	Idle - outside person's control	YELLOW

MICRO MOTION STUDY (Contd…)

- **Applications include** – an aid in studying activities of two or more persons on a group work
  - Aid in studying the relationship of the activities of the operator and the machine as a means of timing operations
  - Aid in obtaining motion time data for time standards
  - Acts as permanent record of the method and time of activities of the operator and the machine
- Study involves – filming operation to be studied – analysis of the data from the films – making recording of the data
- **Filming the operation** – consists of taking motion pictures of the activity while being performed by an operator – Equipment needed movie camera, wink counter (micro-chronometer) a timing device placed in the field of view, **1 wink = (1/2000) of a minute**

MICRO MOTION STUDY (Contd…)

- **Analysis of data from films –** film is viewed with the help of projector for analysis of micro-motions
- Film is run at normal speed so as to get familiar with the pattern of movement involved
- A typical work cycle selected from amongst the filmed cycle
- Film run at a very low speed and is usually stopped or reversed frequently to identify the motions (therbligs)
- Therbligs after identification entered in analysis sheet
- **Recording of data done using SIMO chart**
- Simultaneous Motion Cycle Chart – a chart based on film analysis, used to record simultaneously on a common time scale - the therbligs or a group of therbligs performed by different parts of the body of one or more operators.

- SIMO Chart – used for micro-motion analysis of short cycle repetitive jobs, high order skill jobs - component assembly, packaging, inspection
- To prepare - an elaborate procedure and use of expensive equipments are required - Savings resulting from the study will be very high

SIMO CHART

Operation : .....
Part drawing No. : .....
Method : ..... Present/Proposed
Operation No. : .....

Film No. : .....
Chart No. : .....
Date : .....
Charted by: .....

Wink counter Reading	*Left hand description*	*Therbligs*	*Time*	*Time in 200/m*	*Time*	*Therbligs*	*Right hand description*

MEMO MOTION STUDY

- A form of time-lapse photography which records activity by use of cine camera adapted to take picture at longer intervals than normal
- Jobs that have activities which does not need to be examined in fine detail
- Filming of such work can be performed efficiently and economically by method of time lapse cine photography known as memo motion
- Carried out by attaching electric time lapse unit to the cine camera so that a picture taken at an interval of time set at any convenient unit between ½ to 4 seconds in frequency
- Camera placed with a view over the whole working area to take pictures at the rate of one or two per second instead of 24 frames per second

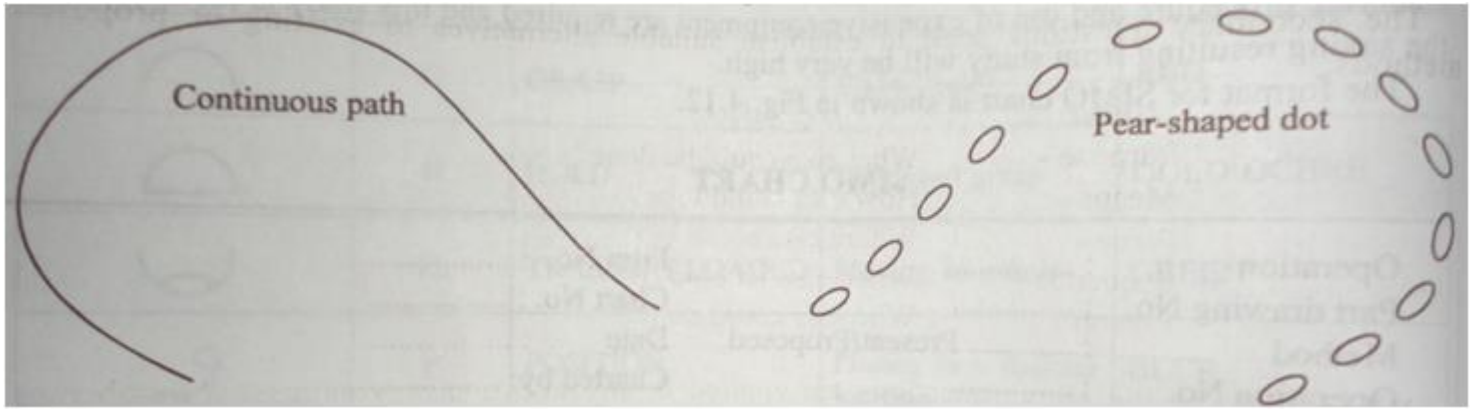
- Result is that activities of 10 or 20 minutes may be compressed into one minute and a very rapid survey of the large movements giving rise to wasted efforts can be detected and steps taken to eliminate them

CYCLE GRAPH AND CHRONOCYCLE GRAPH

- These are photographic techniques for the study of path of movements of an operators hands, fingers etc.
- Used for those movements which are too fast to be traced by human eye
- Cycle Graph – a record of path of movement usually traced by continuous source of light on a photograph
- A small electric bulb attached to hand, finger or other part of the body of the operator performing the operation
- Photograph taken by still camera and the light source shows path of the motion and the path of the photograph is called cycle graph

CHRONOCYCLE GRAPH

- Cycle graph has a limitation that it will not give the direction or the speed of movements
- A special form of cycle graph in which light source is suitably interrupted so that the path appears as series of dots, the pointed end indicating the direction of movement and the spacing indicating the speed of movement
- Time taken for the movement determined by knowing the rate at which the light source is being interrupted and by counting the number of dots.



Thank you