APPLICATION OF STATISTICS

IN

MASS PRODUCTION

by

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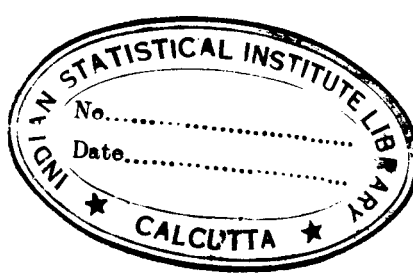


Outline of paper to be presented by invitation before Canton-Akron Section of the ASME in Akron, Ohio, March 20th.

Historical Background

Slide #16062 - Mass production in its infancy.

S

Interchangeability

Slide #17802 - March of technique of control in step with march of ideas.

S

1. Statistical law - 1900.
2. Operation of control - 1924.
3. Operational meaning - 1928
4. Need for operationally verifiable specifications - 1934.
5. Operationally verifiable meanings - 1939.

WHY Should YOU Be Interested?

S3 (21624) - Tolerance range

Concept of mass production as an operation such that, if repeated again and again, it will give a result X within previously specified tolerance limits.

Problem

1. Minimize rejections.
2. Minimize cost of inspection.
3. Minimum tolerances.
   - 3.1 To save material
   - 3.2 To maximize lifting power.
4. Maximize assurance.
   - 4.1 Blowing time of fuses in shells.
   - 4.2 Drugs and hospital supplies.
   - 4.3 Strength of materials.

S4(8836) - Evidence of reduction in rejections

1.4 - .8 = .6.

S5 (18845) - Fuses - minimize tolerances.

S6 (16047) - Fuses - sequence of samples - Maximize assurance, minimize cost of inspection.

S7 (17798) - Velocity of light: not as good state of control as S6.

Statistics in Scientific Control

S8 (23040) - Act of control (scientific)

Statistics enters each of 3 steps

Hypothesis I

S9 (8889) - State of Statistical Control

Drawings from a bowl - normal.

1. Maximum control.
2. Maximum assurance.

S10 (15437) - Control chart for averages of numbers drawn from bowl.

S11 (21617) - Runs.

Hypothesis II

S12 (21879) - Operation of control: Steps

S13 (7809) - 204 observations: table

S14 (8837) - Control charts: 51 and 16 samples

S14 E.B. Ferrell's data, table
S16 " " " " (plotted)
S15 " " " " (runs)
S16 S17 " " " " control chart.
S18 Contact resistance.

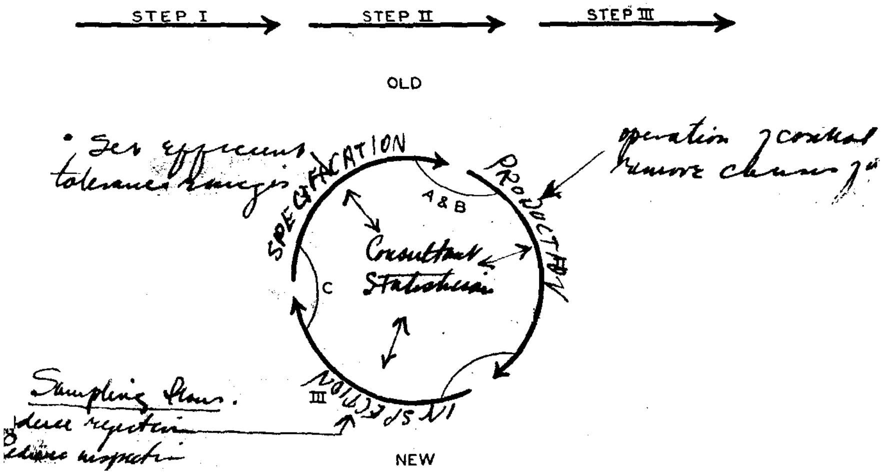
SPECIFICATION

OLD	NEW
1. Specification sets tolerance range as screen.	1. Specification is of the nature of an hypothesis.
2. Mass production b based upon scientific knowledge.	2. Mass production is a means of acquiring knowledge.
3. Only tolerance range specified.	3. Tolerance range plus two action limits A and B and aimed-at value C S1 4 (16061)
4.	4. When control is attained set minimum tolerance range.
5. Inefficient overall tolerances.	5. Efficient overall tolerances.

INSPECTION

OLD	NEW
1. Routine job.	1. Important step in scientific method.
2. Separate good from bad as screening process.	2. Detect assignable causes to be removed.
3. Keep eye on the product.	3. Keep eye on process.
4. Inspect in accord with a standard.	4. Help shape standard in much the same way that a judge must help shape law.
5. Data used primarily to screen product.	5. Data fed back into specification to set aimed-at values, etc. Keep running quality report.
6. How large a sample?	6. How minimize sample size through control.
7. Emphasis on size of sample.	7. Emphasis not only on size of sample but also on how sample is obtained and quantity of prior information.

"Single Sampling and Double Sampling Inspection Tables", by H. F. Dodge and H. G. Romig, Bell System Technical Journal, January 1941.



Now we are in a place to consider a very important poten-
tial contribution of mass production to scientific industrial
progress. You have [illegible] seen how in order to re[illegible] the assign-
able causes of variation [illegible] quality of product, it is possible to
apply the quality cont[illegible] seen how es-
sential it is to have a [illegible] to give the
highest quality [illegible] that this
potential [illegible] the
s[illegible] as a statistical [illegible]
re[illegible]d in a day. It cannot [illegible] of a
product in which only a few p[illegible] manufactured. [illegible]
however. be approached [illegible]cally in continu[illegible]
production.

Thus you see how statistical theory has helped the ~~William Fell of our story~~, the manufacturer, to hit his mark—the highest standard of quality and the greatest quality a[illegible]ance at a given cost.

CONCLUSION

S17 (20472) - Three correlated steps.

Statistical Scientific Method + Mass Production

= New Tool of Research