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SDC

TM-1021/003/00

A Description of the Computer Program Implementation Process: A Process Flow

TM-10211/005/00

TECHNICAL MEMORANDUM

(TM Series)

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A Description of the Computer Program Implementation Process: A Process Flow

by

Robert E. Bleier

9 May 1963

SYSTEM DEVELOPMENT CORPORATION
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SANTA MONICA
CALIFORNIA

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FOREWORD

The Computer Program Implementation Process (CPIP) project, part of the Command Research Program, has as its objective the analysis and identification of management techniques for large computer-programming jobs in command-control system development. The purpose of these analyses has been to devise improvements that will permit shorter and less costly implementation for higher quality computer programs than has been possible previously. In the first phase of the project, members have been defining and describing the activities that constitute the implementation process, its phasing, and its products.

Results of the project are being documented as guidelines for managers in a Computer Programming Manager's Handbook. Initially, each chapter is being published as a separate paper. Later, these chapters will be bound together as one volume. Subjects of chapters presently planned include managerial coordination, planning for implementation, operational design, programmer training, program testing, program system installation and maintenance, computer facility management, and other relevant aspects of the development process.

Managers for whom these documents are intended may be civilians or members of the military services; they may be directly associated with a programming effort or a level removed, or responsible for an interface with the program. It has also been assumed that their experience with data processing is varied and, if limited, will increase. Therefore, materials have been graded to assist the uninstructed as well as to provide basic materials of importance to the most experienced.

The project wishes to acknowledge the contribution made by W. E. Willmorth of SDC's Research Directorate in the development of the flow diagram in this document.

THE PROCESS FLOW DIAGRAM

The diagram on the following pages illustrates one of several ways in which the computer program implementation process occurs.* The diagram is to be included in a projected Handbook as a basis for more detailed examination of the implementation process. The diagram is also expected to be of use to managers of the process in their overall planning and in discussions of these plans with members of their staffs, with contractors, with other managers, and with their superiors, who may be less sophisticated in the details of program systems. Also, use of the diagram in planning may provide consistency in the allocation of resources and in the development and application of schedules, and may thus, in time, introduce means for making effective cost comparisons among systems. The diagram may also prove useful in training programmers.

DIAGRAM ORGANIZATION

The diagram is divided into seven sequential phases.

System Analysis	Phase I
System Design	Phase II
Program Design	Phase III
Program Production	Phase IV
Program Test	Phase V
System Test	Phase VI
System Operation	Phase VII

The recursive nature of the computer program implementation process is not represented. The flow diagram emphasizes the time-dependent nature of the steps or activities within each phase and indicates the products that result from them. This flow diagram represents a partial answer to the question, "What activities and products constitute the computer program system implementation process and how should the activities be phased in time?"

DIAGRAM CONVENTIONS AND SYMBOLS

The symbols used in the diagram are few and straightforward. In each phase the steps or activities are contained in boxes. Products such as documents, card decks, and tapes are shown at the bottom of each page. Each is connected to the appropriate activity. There is a time-dependent relationship between connected activities; as shown on the diagram, activities must be

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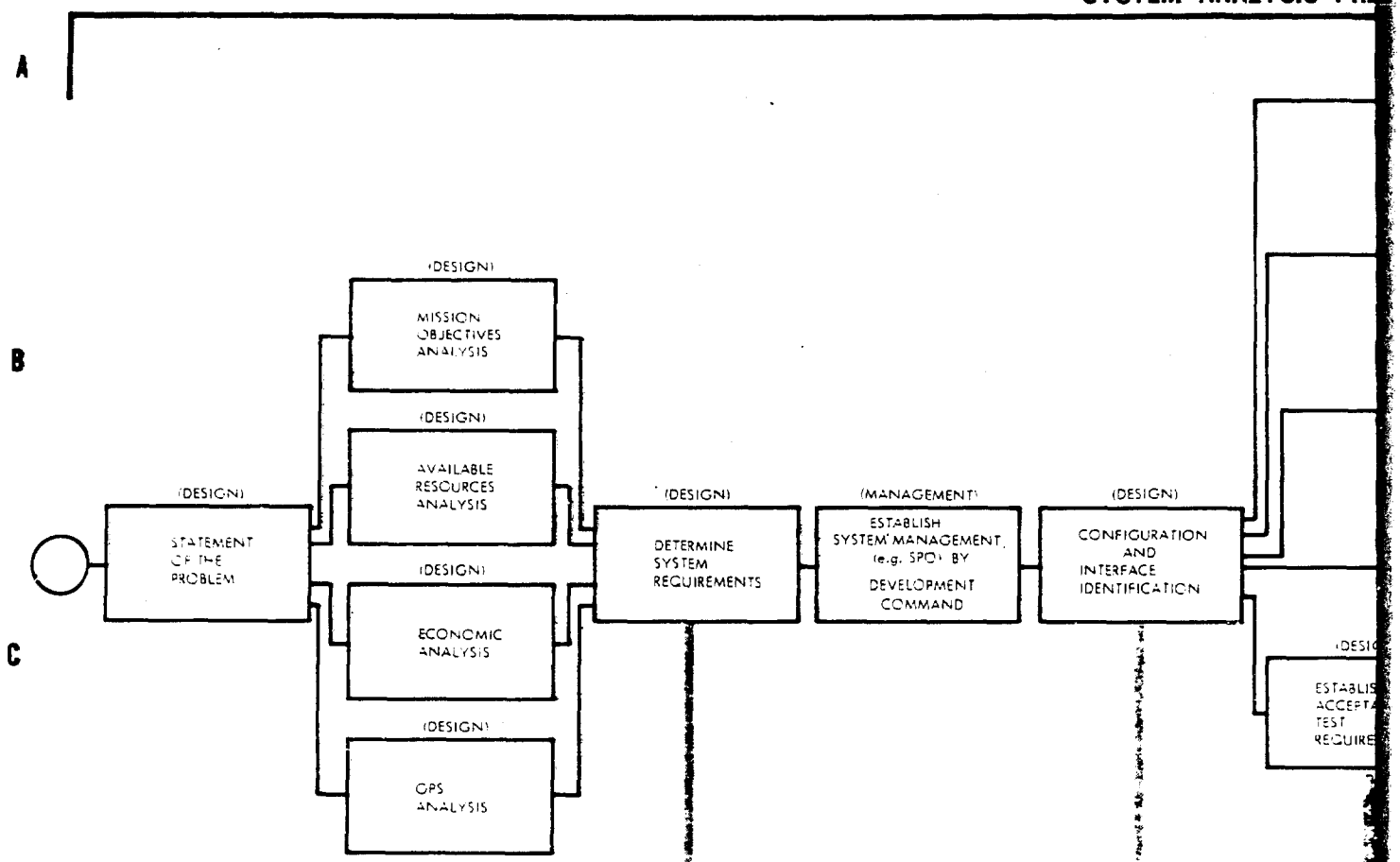
*This graphic description is discussed in TM-1021/002/00

completed in sequence from left to right. The lengths of the lines between boxes in the flow diagram do not indicate the amount of time spent or degree of difficulty experienced in each of these activities. For example, the program- and system-test phases occupy about 20 percent of the total space in the flow diagram; but in practice the phases may use 25 to 50 percent of the total resources. Boxes on separate horizontal lines in the flow diagram represent concurrent activities. No time dependency between such activities is implied by the positions of the boxes on their separate lines, except when two or more lines meet at a box. The last box on each page is repeated as the first box on the next page. Each page of the flow diagram has a reference grid with letters at the left and numbers at the bottom to facilitate reference to particulars in the diagram. The activities that produce the operational program system are shown linked together by a heavy line. Organization responsibilities during the implementation effort vary in each phase from system to system; therefore, the flow diagram does not include this information.

COMMENTS AND CRITICISM

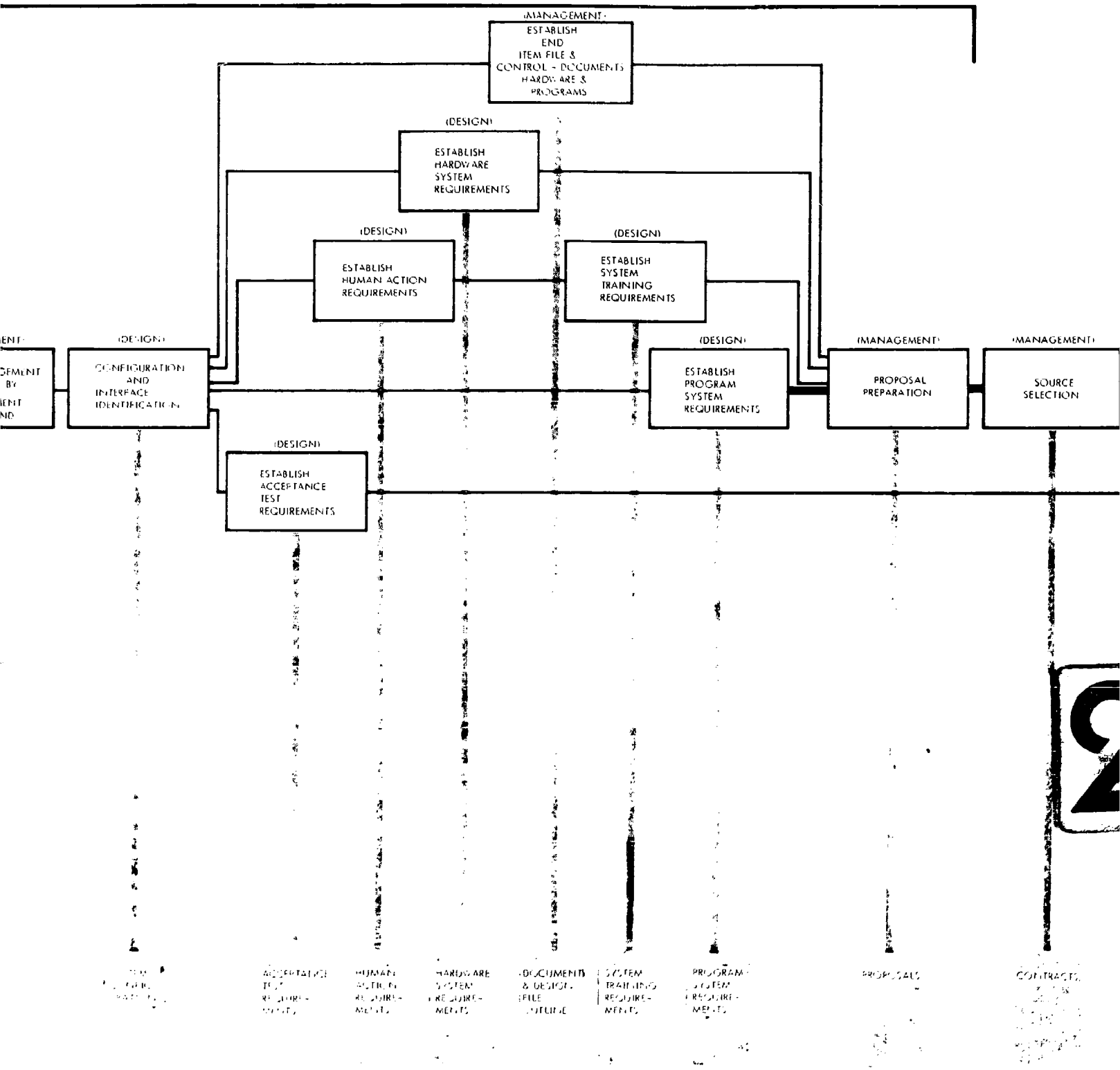
As a result of further data gathering and analysis, this flow diagram is to be further refined. Therefore, comments concerning the diagram and its projected utility will be welcomed by the author.

SYSTEM ANALYSIS PHA



1

SYSTEM ANALYSIS PHASE



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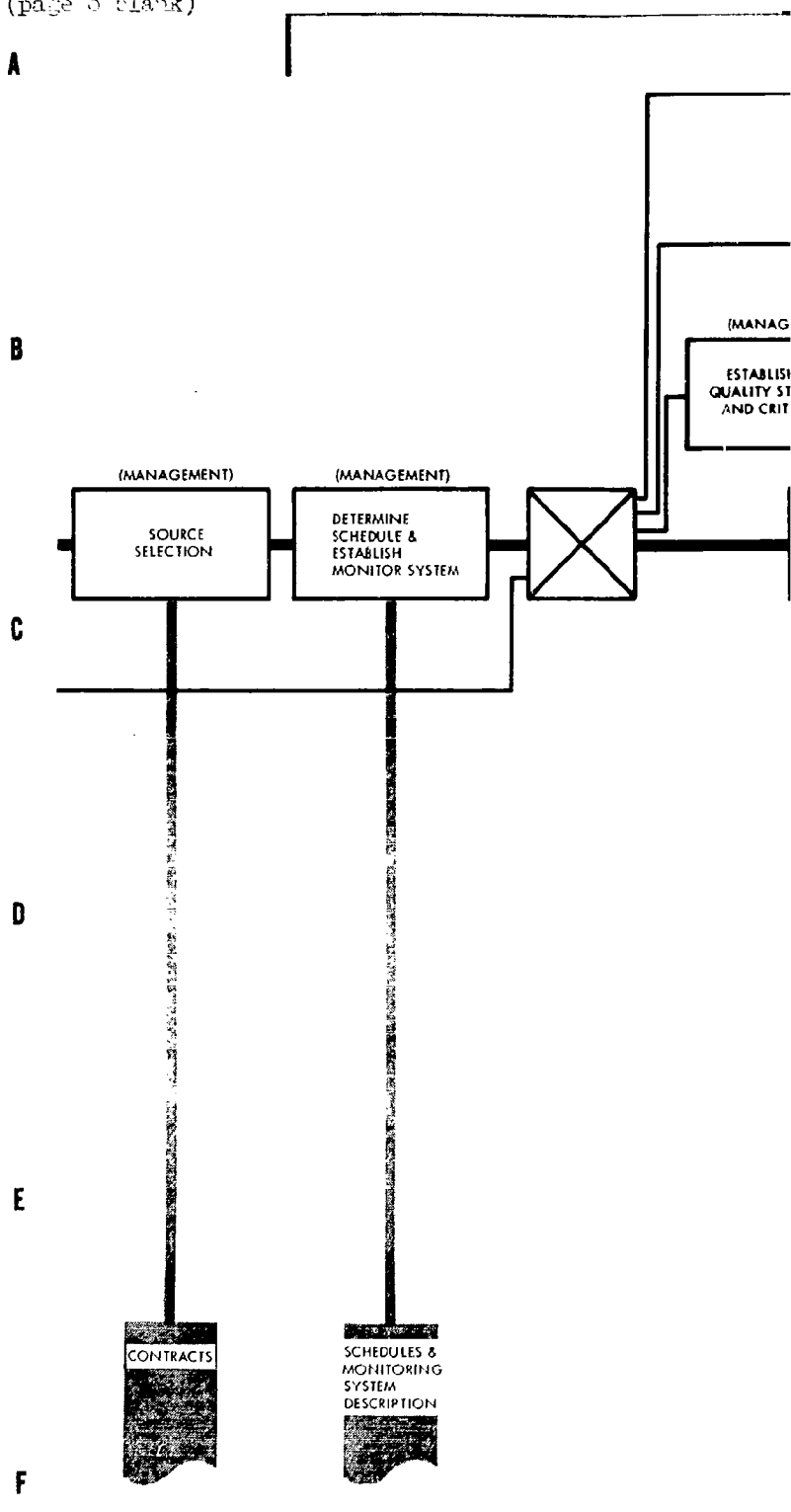
A
B
C
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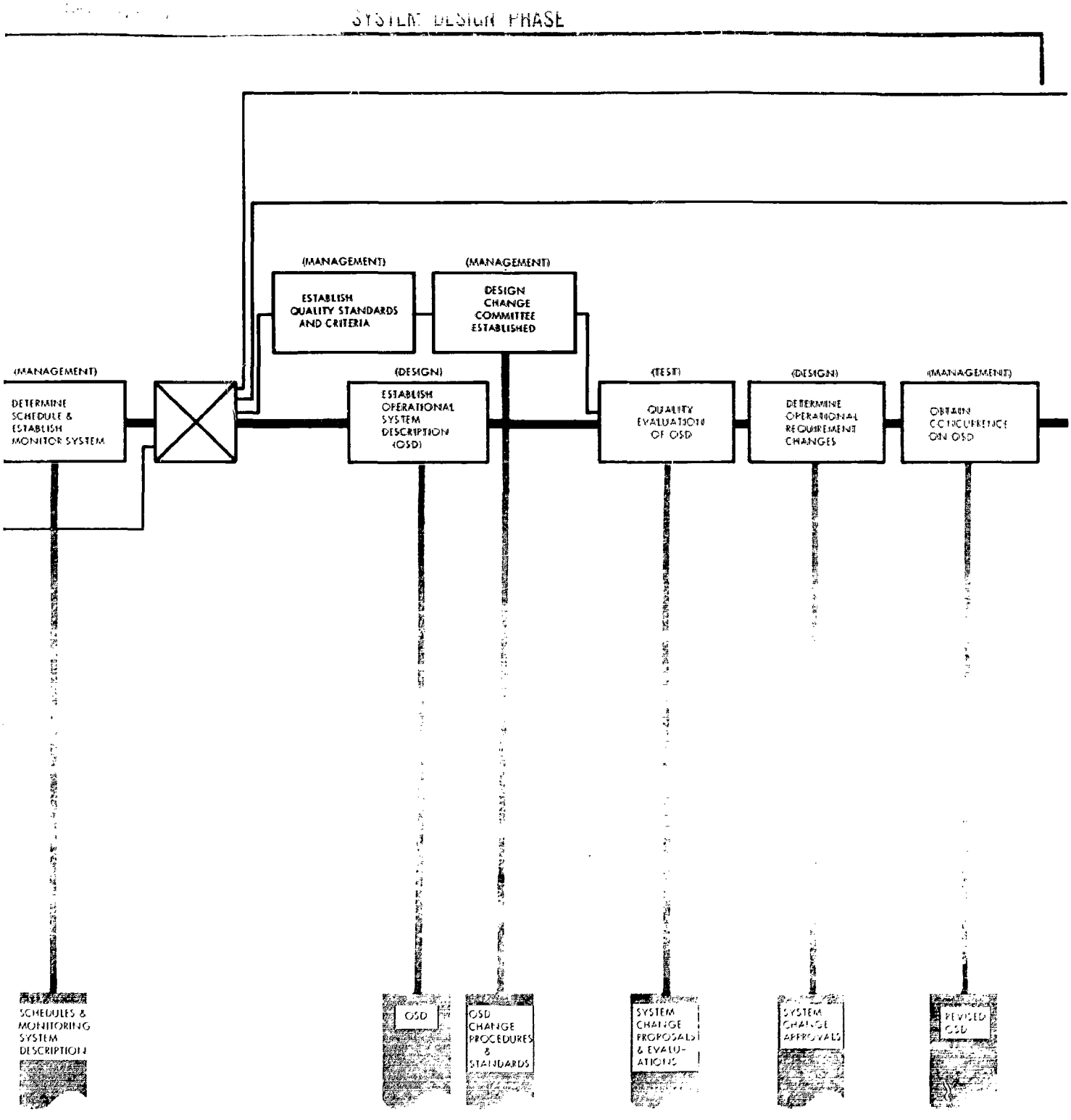
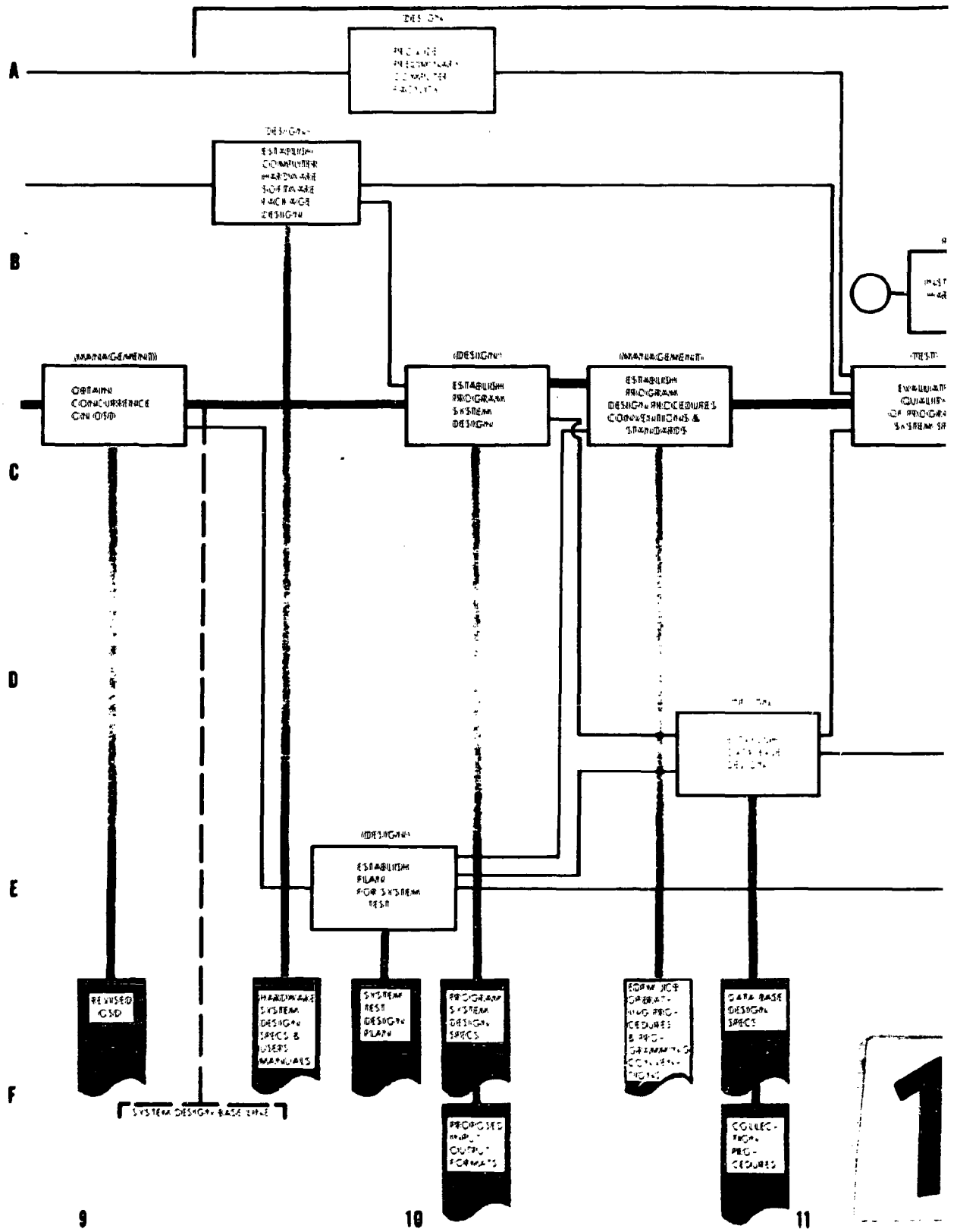
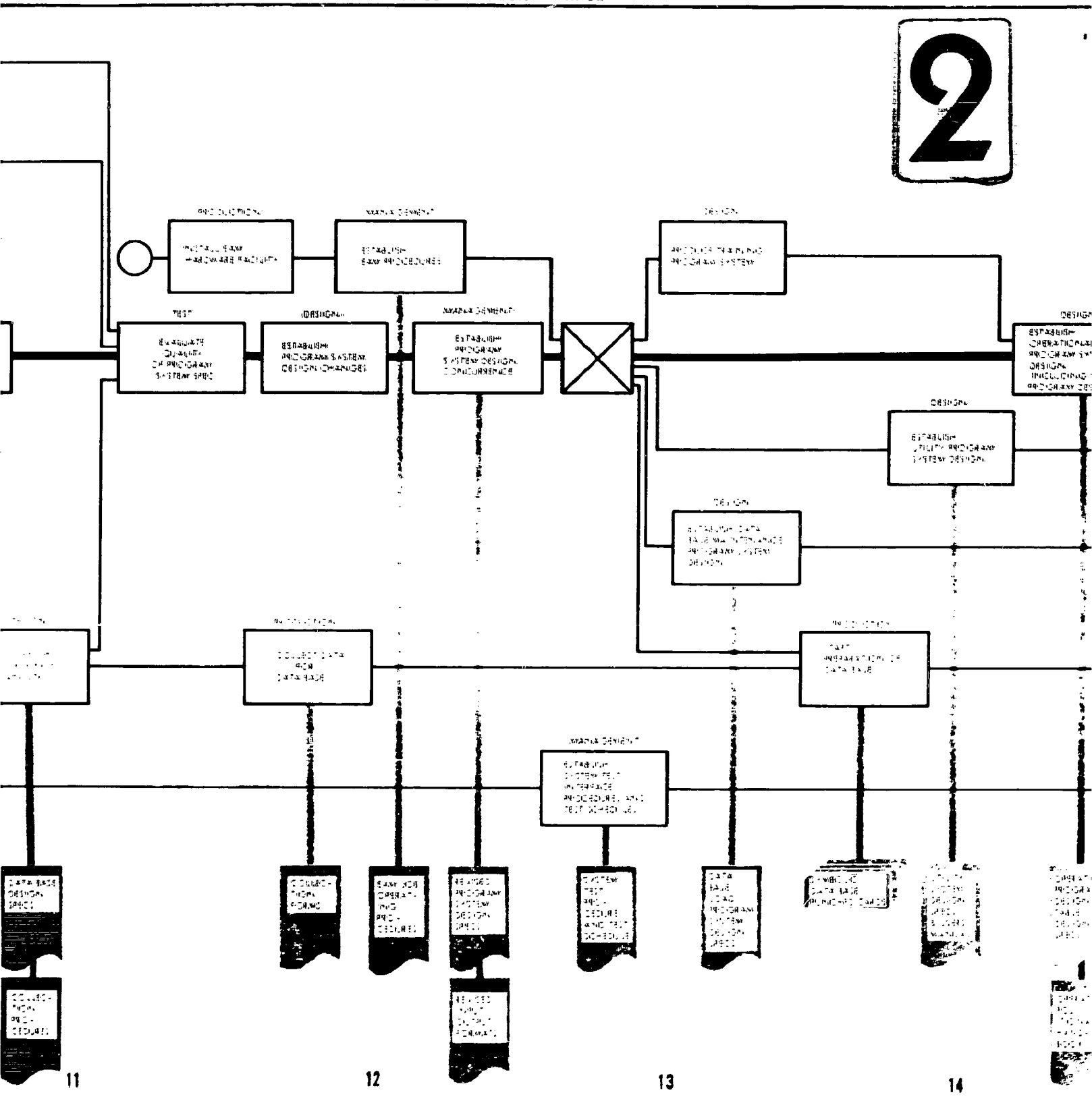
(MANAG
ESTABLISH
QUALITY ST
AND CRIT
(MANAGEMENT)
SOURCE SELECTION
(MANAGEMENT)
DETERMINE SCHEDULE & ESTABLISH MONITOR SYSTEM
CONTRACTS
SCHEDULES & MONITORING SYSTEM DESCRIPTION

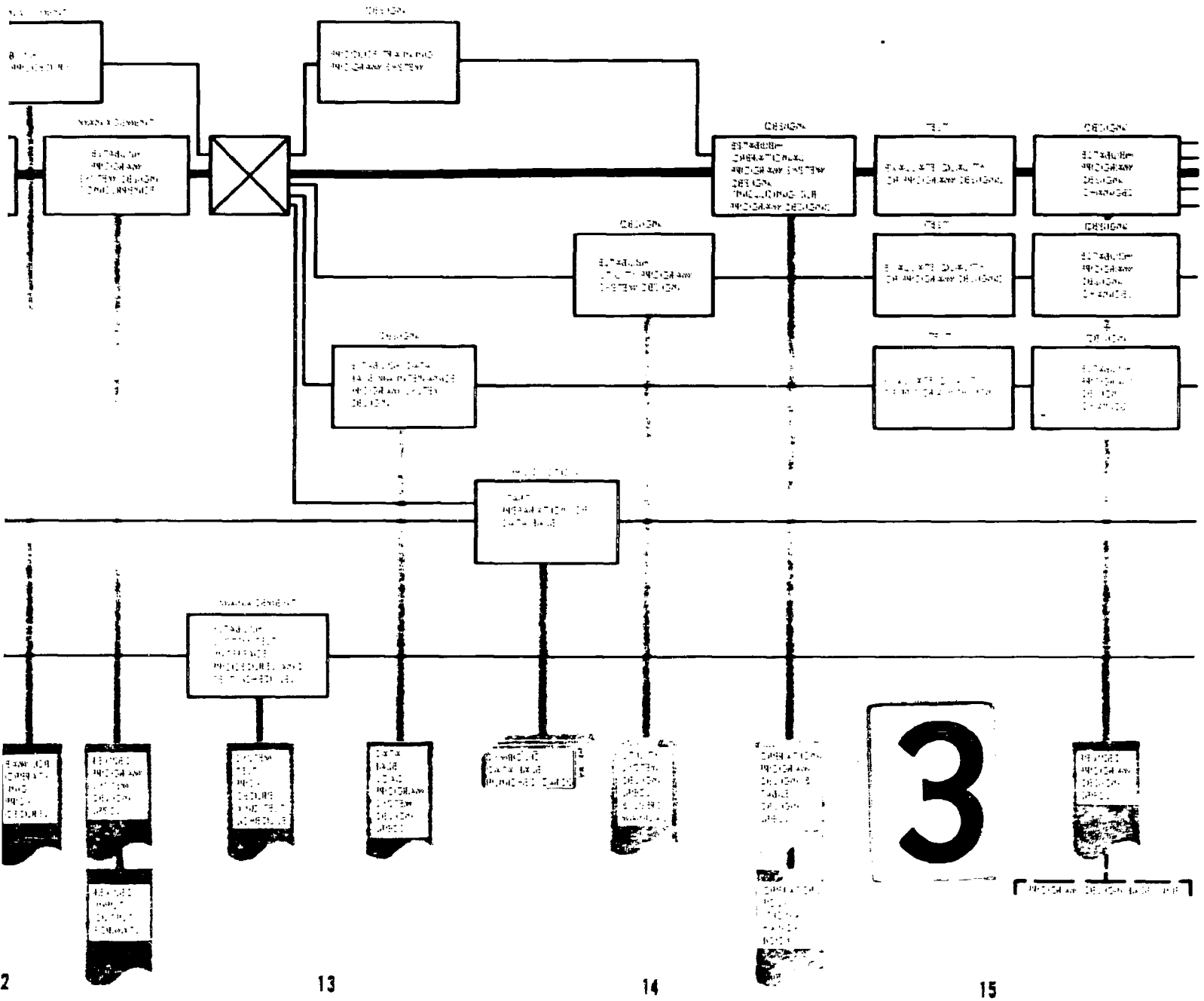

SYSTEM DESIGN PHASE
(MANAGEMENT)
ESTABLISH QUALITY STANDARDS AND CRITERIA
(MANAGEMENT)
DESIGN CHANGE COMMITTEE ESTABLISHED
(MANAGEMENT)
DETERMINE SCHEDULE & ESTABLISH MONITOR SYSTEM
(DESIGN)
ESTABLISH OPERATIONAL SYSTEM DESCRIPTION (OSD)
(TEST)
QUALITY EVALUATION OF OSD
(DESIGN)
DETERMINE OPERATIONAL REQUIREMENT CHANGES
(MANAGEMENT)
OBTAIN CONCURRENCE ON OSD
SCHEDULES & MONITORING SYSTEM DESCRIPTION
OSD
OSD CHANGE PROCEDURES & STANDARDS
SYSTEM CHANGE PROPOSALS & EVALU-ATIONS
SYSTEM CHANGE APPROVALS
REVISED OSD

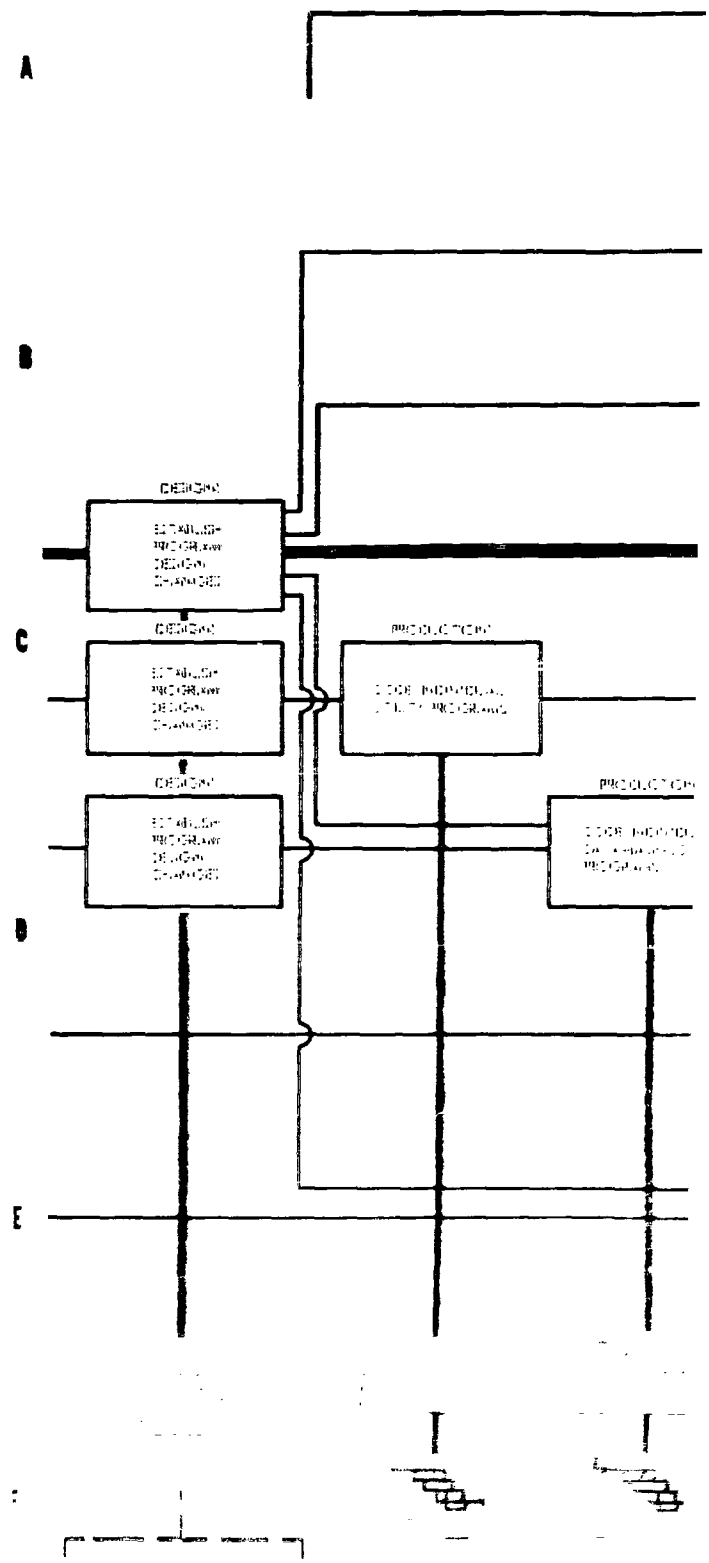

A
B
C
D
E
F
(MANAGEMENT)
OBTAIN CONCURRENCE ON OSD
(DESIGN)
ESTABLISH PROGRAM SYSTEM DESIGN
(MANAGEMENT)
ESTABLISH PROGRAM DESIGN PROCEDURES CONVENTIONS & STANDARDS
(DESIGN)
ESTABLISH PLANS FOR SYSTEM TEST
REVISED OSD
HARDWARE SYSTEM DESIGN SPECS & USERS MANUALS
SYSTEM TEST DESIGN PLAN
PROGRAM SYSTEM DESIGN SPECS
PROPOSED INPUT-OUTPUT FORMATS
FORM OF OPERATING PROCEDURES & PROGRAMMING CONVENTIONS
DATA BASE DESIGN SPECS
COLLECTION PROCEDURES
SYSTEM DESIGN BASELINE
9
10
11

PROGRAM DESIGN PHASE



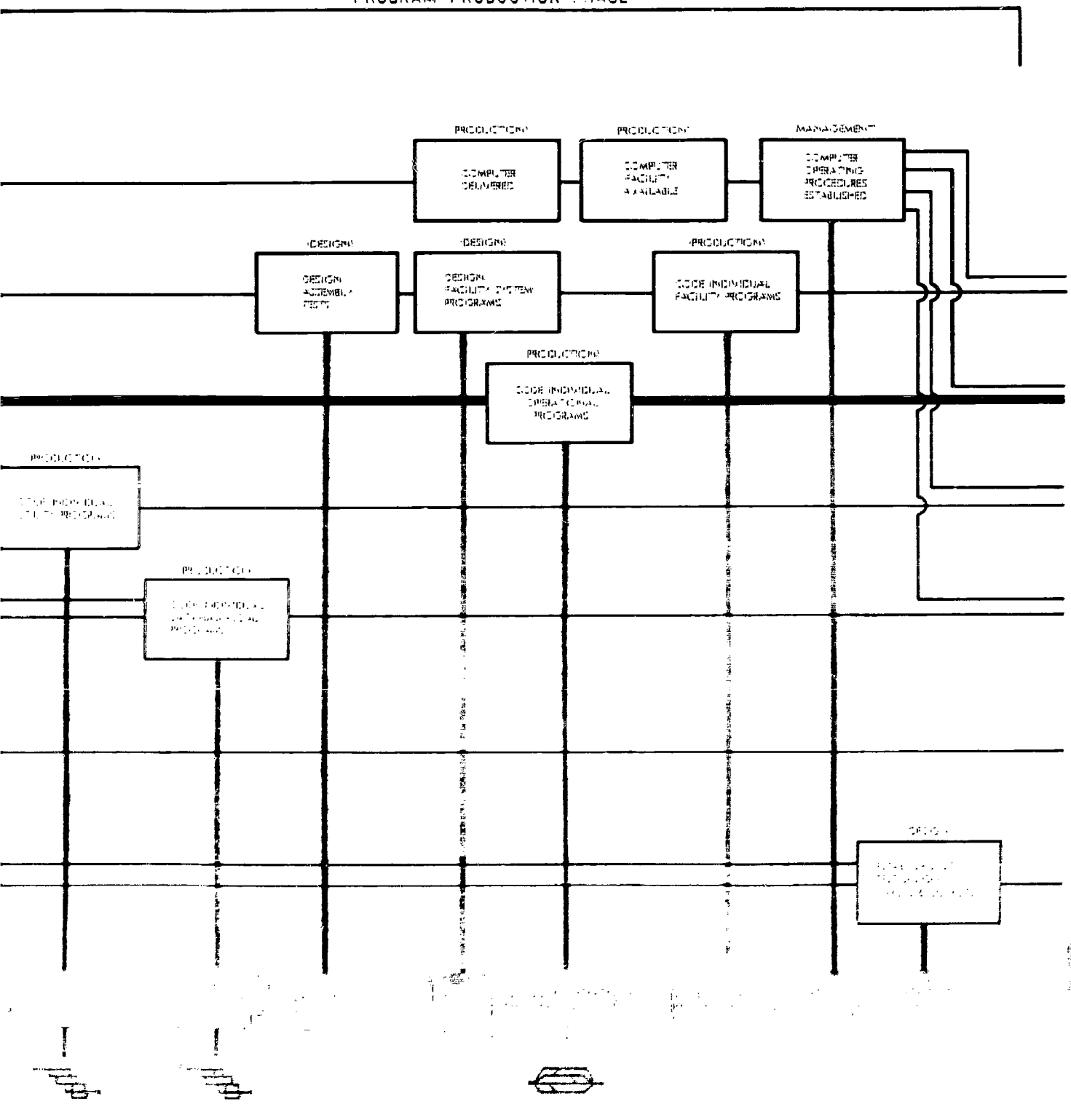
PROGRAM DESIGN PHASE





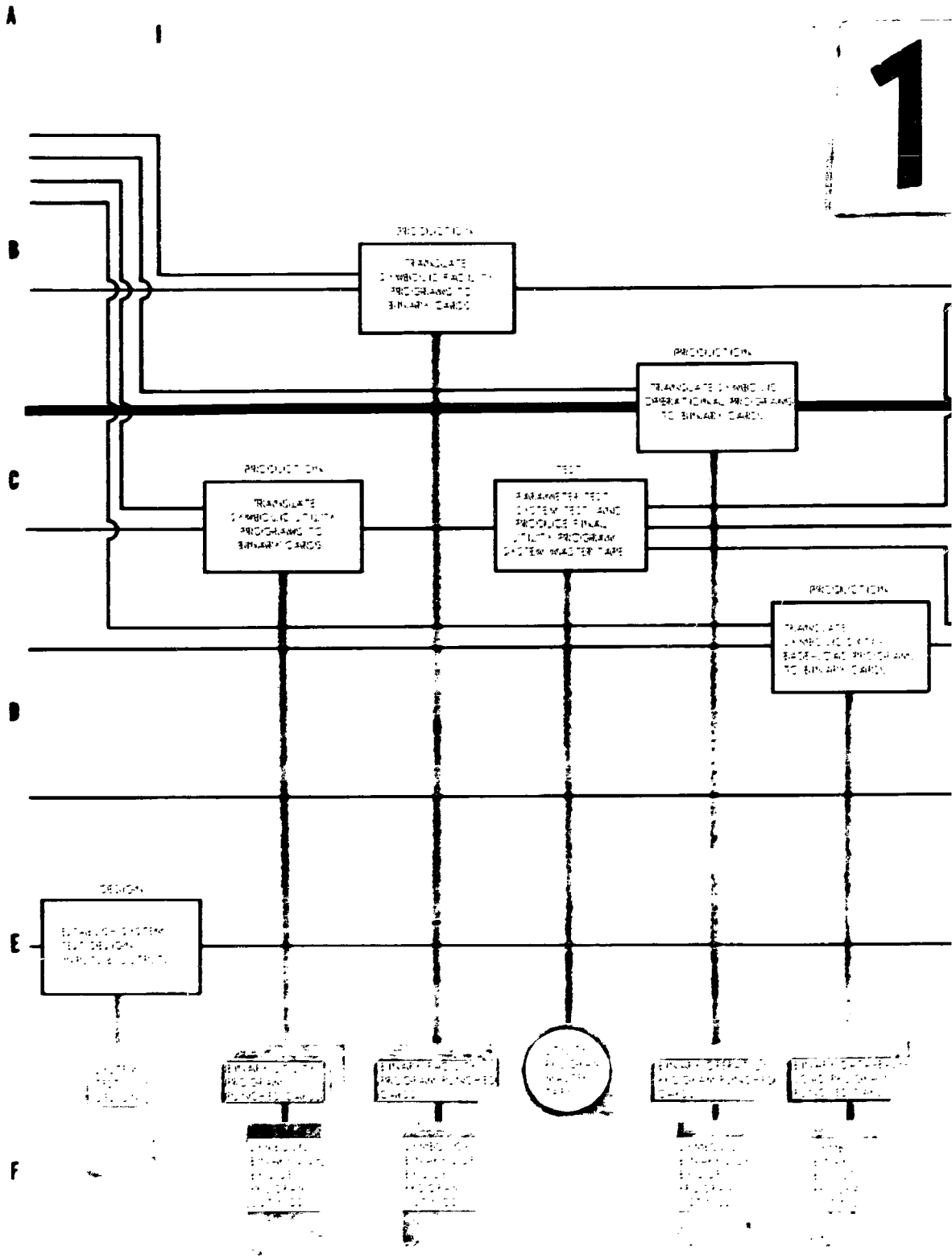
1

PROGRAM PRODUCTION PHASE

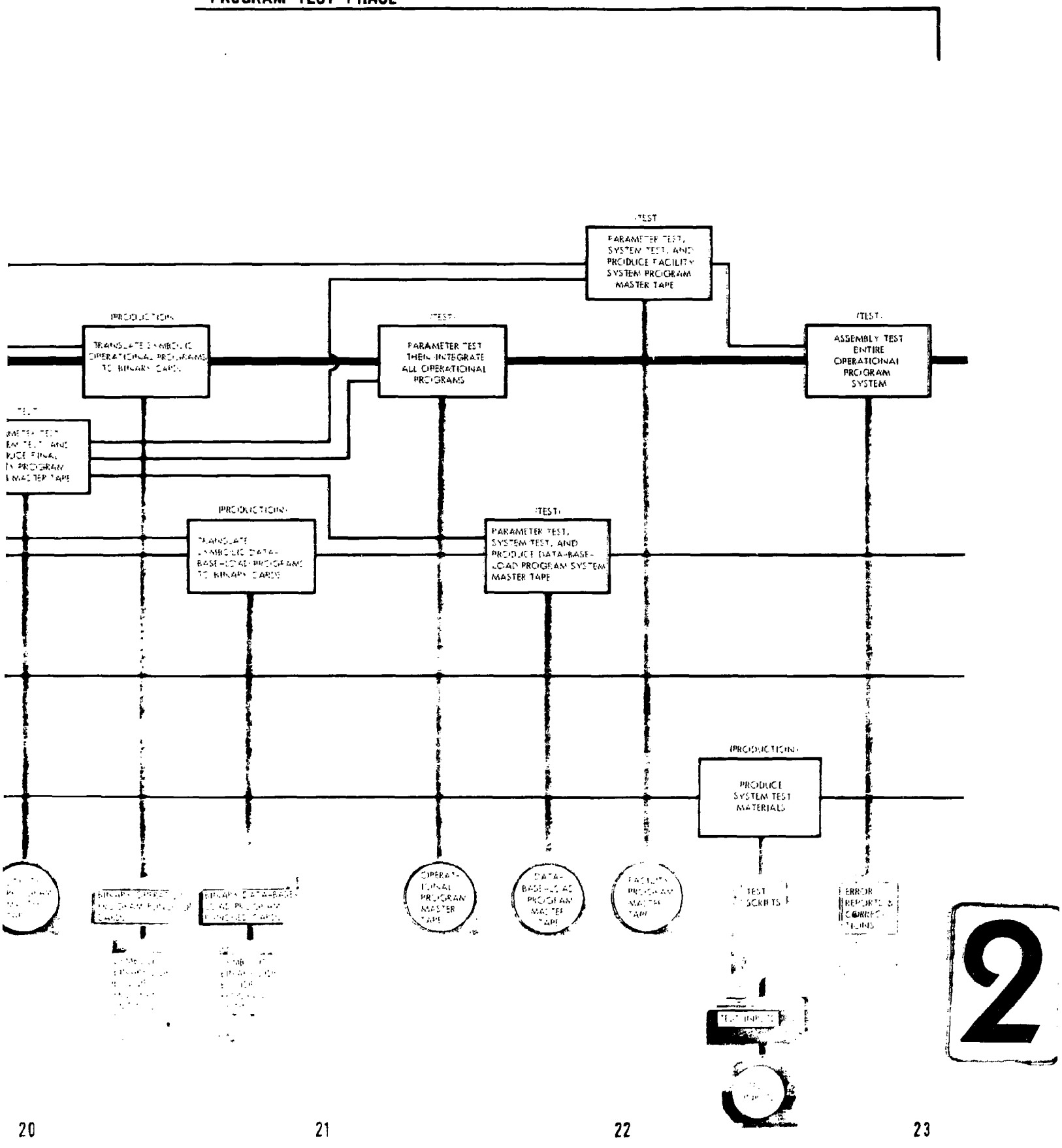


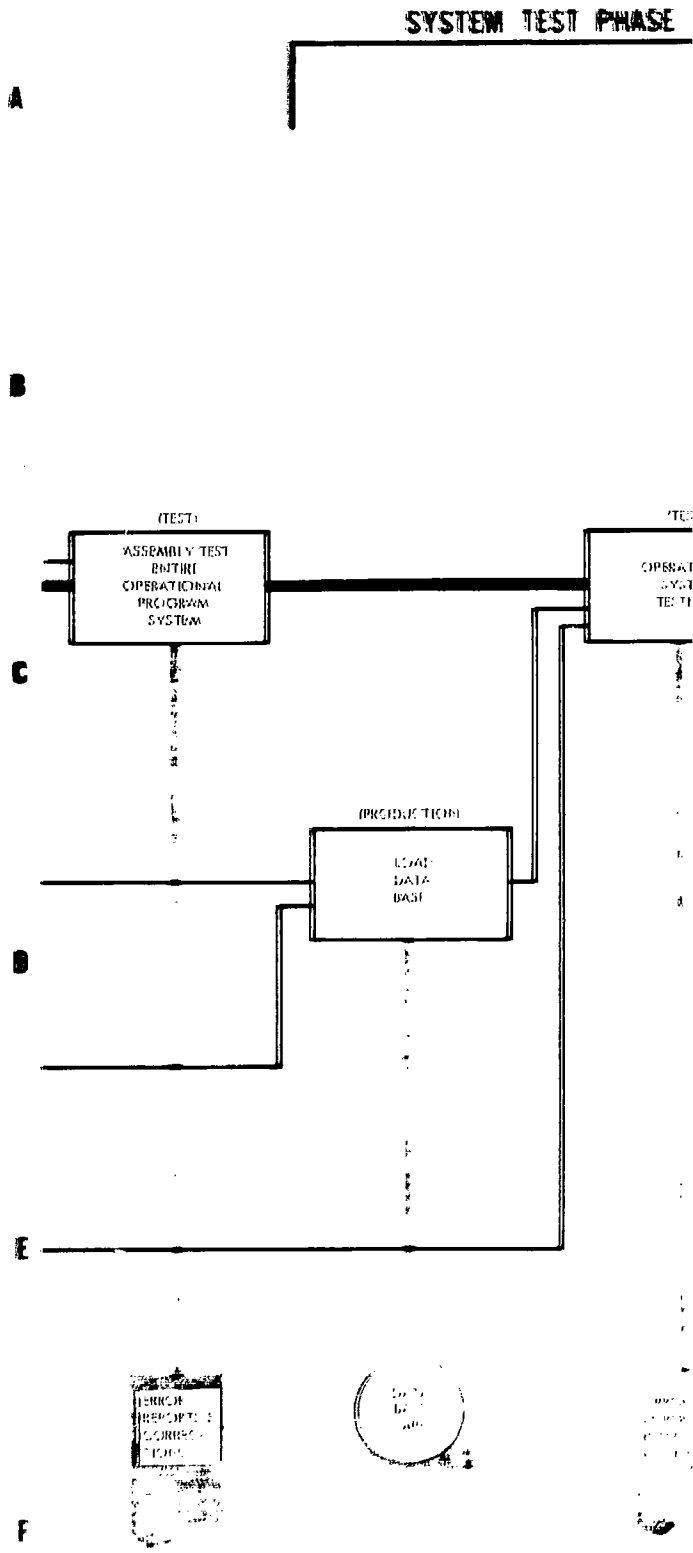
2

PROGRAM TEST



PROGRAM TEST PHASE




SYSTEM TEST PHASE
A
B
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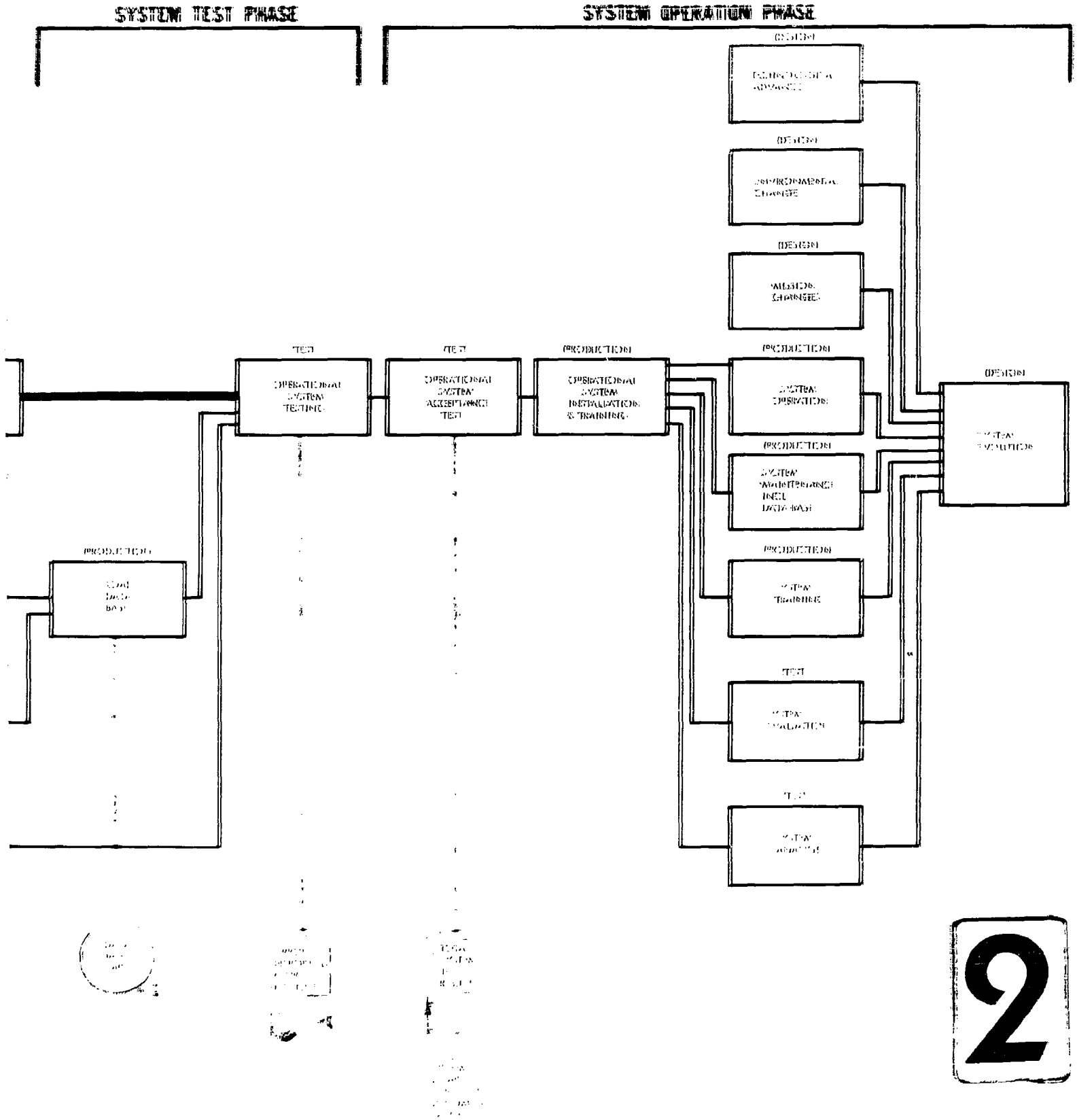
D
E
F
(TEST)
ASSEMBLY TEST
ENTIRE
OPERATIONAL
PROGRAM
SYSTEM
(PRODUCTION)
LOAD
DATA
BASE


SYSTEM TEST PHASE
SYSTEM OPERATION PHASE
TEST
OPERATIONAL SYSTEM TESTING
TEST
OPERATIONAL SYSTEM ACCEPTANCE TEST
PRODUCTION
OPERATIONAL SYSTEM INSTALLATION & TRAINING
PRODUCTION
SYSTEM OPERATION
PRODUCTION
SYSTEM MAINTENANCE INCL DATA BASE
PRODUCTION
SYSTEM TRAINING
TEST
DESIGN
DESIGN
DESIGN
DESIGN
2

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A DESCRIPTION OF THE COMPUTER PROGRAM
IMPLEMENTATION PROCESS: A PROCESS FLOW.
Scientific rept., TM-1021/003/00, by
R. E. Kleier. 9 May 1963, 15p.
(Contract SD-97)

Unclassified report

DESCRIPTORS: Programming (Computers).

Reports that the Computer Program
Implementation Process (CPIP) project, UNCLASSIFIED

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part of the System Development UNCLASSIFIED
Corporation's ARPA (Advanced
Research Projects Agency) project
for Command Research, has as its
objective the analysis and
identification of management
techniques for large computer
programming jobs in command-
control system development.
Presents a flow diagram that
illustrates one of several ways
in which the computer program
implementation process occurs. UNCLASSIFIED