An Investigation of Production Control Systems and Methods Used in Selected Small Commercial Printing Plants

Donald Nelso Rollo

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AN INVESTIGATION OF PRODUCTION CONTROL
SYSTEMS AND METHODS USED IN SELECTED
SMALL COMMERCIAL PRINTING PLANTS

BY
DONALD NELSON ROLLO

A thesis submitted
in partial fulfillment of the requirements for the
degree of Master of Science, Department of
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Mechanic Arts

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AN INVESTIGATION OF PRODUCTION CONTROL
SYSTEMS AND METHODS USED IN SELECTED
SMALL COMMERCIAL PRINTING PLANTS

This thesis is approved as a creditable, independent investigation by a candidate for the degree, Master of Science, and acceptable as meeting the thesis requirements for this degree; but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Advisor

Head of the Major Department
ACKNOWLEDGMENTS

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Dr.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Reasons for Undertaking the Study</td>
<td>1</td>
</tr>
<tr>
<td>Objectives of the Study</td>
<td>3</td>
</tr>
<tr>
<td>Organization and Procedure of the Study</td>
<td>4</td>
</tr>
<tr>
<td>II. THE PROBLEM</td>
<td>7</td>
</tr>
<tr>
<td>Theory of Printing Production Controls</td>
<td>7</td>
</tr>
<tr>
<td>Production Control Aids of an Intangible Nature</td>
<td>9</td>
</tr>
<tr>
<td>Production Control Aids of a Tangible Nature</td>
<td>11</td>
</tr>
<tr>
<td>Forecasting</td>
<td>11</td>
</tr>
<tr>
<td>Estimating</td>
<td>12</td>
</tr>
<tr>
<td>Planning</td>
<td>14</td>
</tr>
<tr>
<td>Routing</td>
<td>17</td>
</tr>
<tr>
<td>The Production Order Form</td>
<td>19</td>
</tr>
<tr>
<td>Scheduling</td>
<td>20</td>
</tr>
<tr>
<td>Auxiliary Functions of Production Control</td>
<td>24</td>
</tr>
<tr>
<td>III. THE SITUATION</td>
<td>28</td>
</tr>
<tr>
<td>Example Number 1 - Marland's Printing</td>
<td>28</td>
</tr>
<tr>
<td>Example Number 2 - Hanle's Printery</td>
<td>32</td>
</tr>
<tr>
<td>Example Number 3 - Educat Supply</td>
<td>36</td>
</tr>
<tr>
<td>Example Number 4 - Argue Company</td>
<td>39</td>
</tr>
<tr>
<td>Example Number 5 - Brown &amp; Saenger</td>
<td>43</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Example Number 6 - Modern Press</td>
<td>47</td>
</tr>
<tr>
<td>Example Number 7 - Hayes Brother's Printing</td>
<td>53</td>
</tr>
<tr>
<td>Example Number 8 - Tippecanoe Press</td>
<td>57</td>
</tr>
<tr>
<td>Example Number 9 - Central Michigan Press</td>
<td>65</td>
</tr>
<tr>
<td>IV. SUMMARY AND CONCLUSIONS</td>
<td>70</td>
</tr>
<tr>
<td>LITERATURE CITED</td>
<td>75</td>
</tr>
<tr>
<td>APPENDIX</td>
<td>76</td>
</tr>
<tr>
<td>Example of Form Letter Mailed to Small Commercial Printers</td>
<td>77</td>
</tr>
<tr>
<td>Example of Schedule of Questions Used in Each Interview</td>
<td>78</td>
</tr>
</tbody>
</table>
# List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sample of Production Order Form Recommended by Printing Industry of America as a Guide for its Members</td>
<td>21</td>
</tr>
<tr>
<td>2.</td>
<td>Example of Production Order Form in Use by Modern Press, Sioux Falls, South Dakota</td>
<td>50</td>
</tr>
<tr>
<td>3.</td>
<td>Example of Job Specification Form in Use by Tippecanoe Press, Inc., Shelbyville, Indiana</td>
<td>58</td>
</tr>
<tr>
<td>4.</td>
<td>Example of Production Order Ticket Form in Use by Tippecanoe Press, Inc., Shelbyville, Indiana</td>
<td>59</td>
</tr>
<tr>
<td>5.</td>
<td>Example of Job Scheduling Form in Use by Tippecanoe Press, Inc., Shelbyville, Indiana</td>
<td>62</td>
</tr>
<tr>
<td>6.</td>
<td>Example of Record of Performance Form in Use by Tippecanoe Press, Inc., Shelbyville, Indiana</td>
<td>64</td>
</tr>
<tr>
<td>7.</td>
<td>Example of Production Order Form in Use by Central Michigan Press, Battle Creek, Michigan</td>
<td>66</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

Reasons for Undertaking the Study

The subject of production control systems in small commercial printing plants is a fascinating one to this author. It involves employment of every management technique that has been devised by manufacturing production engineers. It involves the application of business sense—both the common sense applied as by experts in this field and the science of economics. It requires management personnel who have a good background in the technical end of printing. Finally, it requires some thought and preparation in the area of industrial human psychology.

Printing ranks as the sixth largest industry in this country, according to United States Department of Labor statistics. Receipts of the commercial printing industry reached $6 billion in 1958 (5). Printing ranks third in the 20 major manufacturing groups, eighth in value added by manufacture and ninth in number of employees—U. S., Census of Manufactures (2).

Commercial printing activities are defined as all those printing plants producing a printed product on a jobbing basis. Further clarification of printing industry activities is the separation of printing and publishing activities; publishing being limited to the printing of newspapers, magazines and periodicals, books and miscellaneous items of like nature (2). Jobbing shops are those whose operations are usually of a non-repetitive nature, because the output is not produced in quantity.
Machinery employed in a jobbing shop must therefore be adaptable to a variety of work (14). The operations and machines of mass production shops are designed for repetitive work in which large quantities of the manufactured product are fabricated. These shops are highly specialized and often limit their manufacturing to only one product (14).

The small commercial printing plant is usually defined as that shop employing 20 or less total personnel. Approximately 80 per cent of all commercial printing establishments fall in this "small shop" category (2).

The main reason for undertaking this study of production control systems of small commercial printing plants is that no formal books have been written on this subject and what information there is available to printers is generally published in printing trade periodicals or circulated by personal contacts. With so limited a source of information on proper production methods, and so few examples of successful incorporation of such principles, this investigation was carried out to determine how small printing plants actually control production.

One reason for undertaking this study was to determine the principles of production control as it should be applied to printing plants, with particular emphasis on those shops considered in the small category—those with 20 or fewer shop employees. Another reason was to suggest and explain any methods or devices which should prove beneficial to the small printing plant, although no attempt will be made to formulate a production control system for all such plants. Rather, any suggestion and its explanation will serve as a guide which any particular shop may follow as it
adapts and customizes its own system. Finally, a further purpose was to investigate various production control systems and production management methods in use by larger printing plants to determine if modifications of these methods would be practical for a smaller shop.

**Objectives of the Study**

The management staffs of smaller printing plants should realize that expansion of personnel and plant production facilities eventually forces a more elaborate production control system in order to maintain efficiency. Several plants included in this investigation could be said to operate simply by word-of-mouth. Yet they appeared as profit-making organizations. The amount of human control and attention required by these plants to insure that orders would be produced properly and on time, however, were a great deal more than seem necessary. It is peculiar that these plants operate for years with only personal contacts between management and back shop personnel as the means to maintain production. In such plants, few details and instructions are in writing and only simple control aids are used. As long as such plants continue to turn out the work, little effort will be made to change their methods. The fault of such a system lies in the fact that the removal of a key individual in such a plant will throw production into confusion until a replacement again brings about control.

The operation of small printing plants with little or no production control system depends on human factors to keep production moving. This is contrary to all accepted principles of formal production management, printing or otherwise ([1]). This thesis contains several investigations
of this type of printing plant and attempts to evaluate their present systems to compare what is being done to what might be initiated for more efficiency. The fact that such plants appeared in a profitable operating condition did not indicate, to the writer, that their methods would be acceptable in other plants of a like situation, but rather that the method of operation suited the peculiar conditions of each. The investigation of plants of this nature will not change their operating methods but might indicate to an impartial observer where flaws exist and what remedies could be incorporated for a more successful operation.

In contrast, several plants evaluated in this investigation were controlled by formal production methods. These more progressive organizations had eliminated a good deal of the attentive human control required by the plants with little or no formal production organization. The organizations with production control systems were also profitable business enterprises and their very business-like nature seems to indicate a mere successful transition to the larger plant status, should the change be necessary. As a manufacturing enterprise grows in size its operational problems also increase. Although it is impossible to assume future happenings, this writer hopes to leave the conclusion that printing plants requiring a great deal of human control and observance during production must accept more formal production control measures as they increase in size or face the consequences of confusion and a poor profit record due to plant inefficiency.

Organization and Procedure of Study

This thesis is an investigation into the theory and practice of
production control in small commercial printing plants. The recommen-
dations of Chapter Four are partially based on practices accepted and ad-
vocated by printing management specialists. These experts are feature
writers for printing trade periodicals, where a good deal of background
material for this report was located. Only one book, Management of Print-
ing Production, was found that contained specific information on produc-
tion control for the printing industry. (9)

Another source of background information was the investigator's
experience. Having worked in several small printing plants, the investi-
gator became aware of the production methods used in such shops. Several
of these plants utilized simple production control methods, but the over-
all picture was one of confusion as to what was right or wrong in reference
to such control devices. It is believed that the work experience gained
by the investigator in these plants served to stimulate sufficient curi-
osity to undertake a full-scale investigation of this subject—to prepare
a thesis on production control systems in small commercial printing plants.

Chapter Three of this paper contains case histories on this sub-
ject as observed by the writer. Plant visits were arranged with nearby
commercial printing plants that met the size requirements of this report.
These printers were contacted by mail and an interview was requested.
Each was asked a schedule of questions (samples reproduced in Appendix)
concerning the production control system and devices utilized in his plant.
The results of each visit were written up in report form in this chapter.

Personal visits were required in order to obtain the necessary in-
formation on each plant's system. A mail questionnaire as complete as
the Schedule of Questions would probably have been poorly received by these busy people. Also, there is an alarming misunderstanding on the theory of production control and most small plants shy away from formal systems, preferring to keep a more personal touch in their business. Yet several interviews were at plants that made use of intelligent production control devices, whether or not they would admit to such formal labeling. It was this investigator's problem to evaluate the extent of such systems in each plant. This was best accomplished by the personal interview.

There are two examples in Chapter Three taken directly from information supplied by printing trade journals. An investigation of over 100 such periodicals revealed only two articles which were complete descriptions of production control systems used in small printing plants. This fact, alone, attests to the scarcity of specific information on this subject. There are probably many small printing plants which have devised successful production control systems to increase their production efficiency, but the desire to share this knowledge seems rather well hidden.

The subject matter of this thesis has not been covered in any previous report known to the investigator. The problem and solutions are difficult to uncover because well managed and efficient small plants do not remain in this position for any length of time. They tend to grow in size and personnel because their system has allowed them to produce more and better printing and at a lower cost than competitors.
CHAPTER II

THE PROBLEM

Theory of Printing Production Controls

The purposes of production control systems are to improve quality of the manufactured product by eliminating possible errors in the process of production and to improve service to the customer. This definition will hold true for most industries. Some method of controlling production can be found in every manufacturing plant—from the smallest, or one-man operation, to the largest firms. The variety of production control systems ranges from the memory system used in one-man plants, usually based on the individual's experience, to special Production Control Departments in larger firms. In the latter, such things as scheduling boards, electronic data machines, communication devices, and production control business forms are utilized by trained personnel.

"Production is the core of manufacturing, the focus of all other activities, the very objective of the business itself." (9). Production control is the heart of good production management. Haphazard control of production is dangerous to the economic welfare of any manufacturing firm; the successful operation of any manufacturing plant, other than possibly the one-man operation, demands some attention be given to the principles of production control.

Commercial printing is unique in manufacturing. Regardless of the amount, kind, or degree of automated equipment a printer has, he still sells craftsmanship. Though his machines do the actual producing, he
still sells a service. Printing is classed as a manufacturing industry because, at the completion of every order, a product has resulted; a printer adds value to raw material with his machines and craftsmen in the process of turning out a mass produced item. It is entirely possible, however, that a printer may never receive two identical orders.

Production control methods are highly refined in those industries mass producing products of a limited nature, or range. Because of the constantly changing sales picture facing the commercial printing industry, production efficiency is a major problem. It is difficult to stabilise the work load of a job shop in any industry because customer requirements and frequency of orders are difficult to predict. In the printing industry, this problem is magnified because a customer frequently depends on the printer to evaluate and help decide upon the final order. In other words, a printer is frequently called upon to design a printed piece or submit several designs for approval. The actual order based on these presentations may or may not materialize. In any event, time has been consumed and if approval is obtained, the printer places the order into production.

Service to the customer is very important to the successful operation of a commercial printing plant. Once a customer places an order with the printer, he expects relatively speedy delivery, though this may be in terms of hours, days, weeks or months, depending upon the size or volume of the order. As each printing order is different from every other order, to a degree, the printer must rely on experience to render an acceptable delivery date. Though complications in production may never materialize,
the uniqueness of each order leaves a printer vulnerable to missed delivery dates unless a time buffer is allowed to compensate for production difficulties. Printing plants utilizing accepted control methods will establish an efficiency rate to enable the plant to meet delivery commitments. These figures are usually a percentage of actual production work hours and range from 75 per cent to as high as 90 per cent (8). Plants which do not know their own production efficiency rate, base most scheduling and delivery commitments on past performance of the plant and usually make a "guesstimate." Because a major factor in the printing industry is service to the customer, any production controls and aids which permit a plant to meet delivery commitments should be utilized to remove human error.

There are two basic types of production control aids available for use in commercial printing plants—the intangible, and the tangible devices.

**Production Control Aids of an Intangible Nature**

Whenever management of a manufacturing activity is concerned with men, materials and machines, it must understand and put into practice the three C's of production management—co-ordination, co-operation, and communication—in order to stay in business at a profit (9). This business principle is true in any situation except, possibly, the one-man operation. Smaller printing plants are just as concerned with these intangibles as are larger shops. As a business expands in size and personnel, it may accept a more complex system to control plant production, but the system itself is only as good as the management's adherence to the rules of the
three C's.

Co-ordination of plant functions is the responsibility of management. Properly performed, co-ordination of all functions of production will entail delegation of responsibility through the chain of command as set forth by management. Execution of such duties at the proper time, and follow-up on the system of co-ordination is essential for management to insure that it is continually practiced.

Communication may be defined as the method by which management informs all plant personnel concerned with what is expected of them and when. It is essential that there be adequate communication between all elements of a business (9). The principle of adequate communication becomes more important as a plant increases in size, for if any area of the plant is unaware of all that transpires in any other area, costly overlap of production, purchasing, and needless effort surely will result.

Co-operation between personnel, or departments, cannot be taken for granted in any manufacturing industry. The need for co-operation is obvious; it is successfully achieved by management's efforts, not by compulsion or arbitration, but rather when understanding takes place and it is voluntarily accepted (9).

The three C's—co-ordination, communication, and co-operation—are classed as intangible side to production management because they represent a state of mind, rather than a control form or a list of rules. The responsibility for achieving maximum use of the three C's rests solely on the management staff of a plant; the degree of inclusion of these principles into the production system of a plant will largely determine the
success of that activity as a manufacturing operation.

Production Control Aids of a Tangible Nature

Forecasting

Many production managers rely on intuition and experience to forecast plant production capacity. In smaller plants, this unorganized procedure may serve adequately, but the degree of accuracy depends on human factors. In small, medium or large plants, an established system of forecasting will serve as a mechanism by which firm commitments may be made and kept. In the absence of a formal forecasting procedure, sooner or later unreliable data on capacity will lead to a delivery promise which cannot be kept (9).

In order to devise an accurate job scheduling system, a plant must know its true production capacity. Plant capacity is measured by forecasting. In jobbing plants, the problem of accurate forecasting is greater than in those plants which produce uniform products, but the need for forecasting is correspondingly greater (9).

The basis for determining plant capacity in the printing industry is usually the hourly rate. The use of "units of output" as a guide to measuring production capacity is not practical in a jobbing industry because of the uniqueness and dissimilarity of each order. Standards for forecasting can be obtained two ways and both are in use in the printing industry. The first is a plant's reliance on records of performance or history of production capacity. The use of this method will allow the highest rates of accuracy but is expensive and time consuming. The second method concerns standards for the industry which are prepared
by experts as a commercial service. Examples are the Printing Industry
of America's PAR system and Fred Hoeh's "Estimating Standards for Printers."
These commercially available systems are averages obtained throughout the
industry—average times of processing an operation in a printing plant.
When the management of any printing plant subscribes to either of these
systems, it will insist that shop personnel will equal, or better, the
time standards indicated for any operation in order that the plant remain
profitable in a competitive situation. When plant production standards
equal those indicated in the commercially available systems, management
has an accurate forecasting device to predict plant capacity at any given
time and to complete production orders successfully on agreed delivery
dates.

Estimating

Estimating is the first step in the production process (9). With
any jobbing industry, and especially printing, the uniqueness of the pro-
duct of each order makes the preparation of formal quotations a must. The
quotation forms are completed from the information contained in the job
order estimate. Price quotations are issued on very few orders until a
good deal of figuring and production planning has taken place by the
estimator.

The estimating function is part of the selling operation of a plant
(10). Estimates are generally prepared before a job is sold and many
times the successful conclusion of a sales effort depends upon the ac-
curacy and ingenuity of the estimator's findings.

Estimating normally is not considered a true function of production
control (10). Accurate and thorough estimating, however, does embody several production control functions and is therefore classified as allied operation. Such functions as job planning, routing and even scheduling are referred to in estimating an order. It is the responsibility of the estimator to know the production capacity of his shop and the kinds, sizes, capabilities and limitations of production machinery. He relies on his experience and ingenuity to plan and route each prospective order through the production cycle of the plant in the most economical manner. Job estimates are usually prepared on a company form—an original and two copies. The original, retained in the estimator’s files, will be used to prepare the quotation form which is sent to the customer. One copy of this estimate will be retained by the salesman concerned with the order and the second is usually routed to the person or area concerned with plant production control.

The above description of an estimating system is used by many printing plants and, in these cases, estimating of job orders is an ally to production planning and control. In too many printing plants, however, and especially in smaller plants, the planning, routing and estimating functions performed in making a job estimate are not incorporated into the production planning and control operations. No obvious reason is ever mentioned for this lack of co-operation and communication except, possibly, that specialists in the area of production planning and control feel better qualified to make the final decisions on these subjects. The systems for operation of printing plants are as varied as their number.

Another possible tie-up between estimating functions and those of
production planning and control comes under the heading of records of performance. In those printing plants that have developed an estimating system to meet their specific needs, records of performance supply a good deal of information for accurate estimating. Man hours per operation and units of production for an area or department are recorded and used by both the estimating and production planning and control departments as guides to determine job scheduling and delivery dates. The responsibility for securing such records is usually vested in the production planning and control department. Therefore, adequate co-operation and communication must be maintained between both these plant divisions in order that each may utilize these records. Also, care must be taken to see that personnel from both the estimating and production control departments have available the same specifications for their individual use.

Planning

The need for job planning every order in a jobbing situation is obvious; few orders are like any other, except in general terms. The person delegated to perform this function with whatever methods are chosen, must be able to plan each order to allow it to go through the various production processes in the most economical and fastest way. This function, job planning, is generally performed by a plant production planning and control department. The function of this department is to analyze the specifications, information and qualifications of each job order, prepare a production plan based on this investigation, initiate action on the production plan and follow each step of job production
from the estimator’s form to final delivery (13).

In a printing situation, the production control personnel check proofs, explain customer corrections and alterations to production personnel, and verify that accurate changes have been made. All job planning is centrally performed by this department; it is responsible for scheduling delivery dates that customers accept and which the plant can meet. Orders are routed, by this department, to the equipment best suited to the job requirements; records of performance are collected for standards on which to base future scheduling. Secondary functions include purchase requisitioning, dispatching and control of stores and stock. At all times, the key to the success of a production planning and control system is adequate follow-up of these functions performed on each order (13).

Job planning by a centralized department is relatively new in the printing industry. Few plants operated under such a system until the mechanization period of the 1920’s (4). Even today many shops leave this function to back shop personnel—to the printers, who should know best how to handle each order. Centralized job planning control, however, has proved its merit in most plants, from small to large, which have given it a thorough testing period and followed the basic principles. With centralized control, job planning for each order is the responsibility of one or more production experts. Nothing is left to chance or guesswork on the worker’s part. The production planning department has engineered the planning of the job down to the final instructions on shipping (6). This system of handling orders pays by dividends; it reduces error, makes sure an order is produced according to the customer’s
instructions, and eliminates having the worker check back with his foreman or the salesman on a questionable point.

Every printing order involves planning decisions—decisions which specify how the work will be done. For example, an order may be imposed for presswork 2-up, 4-up, 8-up, 16-up, and so on. The final decision on the above alternatives will depend on many factors. The size and kinds of presses available, the paper to be used, inking requirements, quality required and printing method desired are some of the questions which must be answered for every order. In plants where these decisions are left to the production personnel, proper planning may or may not come about. With centralized control of the planning function, a large increase in plant production efficiency may come about. Back shop personnel are generally highly paid and the time each takes to properly plan his operations on an order reduces the time he can spend on his primary objective—production. Under the centralized job planning system, production experts are required to make this innovation pay, but experience has proved that the fast and accurate planning decisions by these experts does free back shop personnel to increase their production output (9).

The advantages for a printing plant operating a centralized production planning department depend on one fundamental, the stipulation that its planning decisions must be authoritative, that the planning department's decisions are binding upon back shop personnel (9). It stands to reason that the operation of a planning department costs money. If production personnel disregard job planning instructions in favor of their own ideas, the initial mental work by central planning has been wasted.
This is not to say that back shop personnel do not have good ideas; here again communication and co-operation enter the picture. The most successful central planning systems occur when front and back shop work together. Authority on final decisions, however, must remain with the planning department (9).

Routing

Routing is a production planning and control technique that is quite important to the printing industry; in a competitive situation many orders are won or lost because of superior or inferior routing (9). Routing is the process of charting the path of work through the production area of the shop. All printing plants make use of the job routing function although many times the route an order will take through the shop depends on decisions of a production foreman whose experience is his guide. In this case, formal routing is not referred to in planning production; the person in charge of production makes on-the-spot job process decisions for each order as it is brought to his attention.

Formal routing by production control principles is merely an extension of such practical job routing; it is a refinement designed to permit a business form to accomplish this function and to remove the possibility of errors of human judgment which often occur in practical job routing. In very small printing plants, or those of a specialized nature, a foreman in charge of production might conceivably perform the routing function alone, and adequately, with on-the-spot decisions. This person is concerned with a good many other areas of production besides job routing, however, and a memory system of production control must be performed
by a super type of human to come close to the accuracy achieved with a
formal system. A system based on forms and mechanical aids to production
will out-last and out-perform that of the one-man control.

Many routing decisions on the various orders received by a print-
ing plant are rather commonplace. The decisions on what equipment to use
in the various production areas may be rather simple if a plant has little,
or lack of variety, in equipment. There are enough cases, however, in
which good routing is a requisite to economical production to warrant
establishment of a formal control system (9).

A formal routing operation can be as simple or as complex as re-
quired by an individual printing company. A majority of smaller plants
depend on one form, the production order, to route orders through produc-
tion. Greater control can be achieved if a separate job ticket is de-
ivered to each production area of a plant—each containing all the rout-
ing information described on the production order. The routing form should
be typed if possible; the time spent by an office girl typing instructions
on a routing sheet costs money but usually far less than having expensive
shop personnel checking back with a production order writer because the
handwriting on the form may be illegible (11).

Routing decisions should be made by the production planning and
control staff. In a smaller plant, the entire department may be handled
as a part-time assignment of the estimator. Nevertheless, this department
should have expert personnel and its decisions should be authoritative.
Provisions on a routing form can be made for necessary changes but, gen-
erally, proper job routing requires few departures from the initial
instructions.

Personnel performing formal job routing functions must have up-to-date information on equipment loading. As presses are likely to be the most varied type of equipment in a commercial printing plant, press loading charts may be maintained by those plants desiring a high degree of routing efficiency. Briefly, a press loading chart graphically displays the up-to-date press hours sold and press hours available for scheduling and routing on each piece of equipment. The information needed to maintain this chart is received, first, from time estimates given on the Estimating Form and press performance reports received from the production area, usually several times each day.

Each routing decision is essentially a problem in job economics (9). The purpose of job routing is to see that each order is produced at the lowest cost. These decisions must take into account the equipment and time available, costs, quality and processes desired. Job routing will be performed whether or not a formal system is employed. A formal system of job routing under centralized production control, however, will free production personnel from the costly time-consuming job of making such decisions.

The Production Order Form

The job order ticket is probably the greatest single production planning and control device used in printing plants, large and small. There can be no such thing as a uniform job ticket in the printing industry because each firm has its different operations, customers and equipment. A sample production order form, designed by the Printing Industry of
America as a guide for its members, is shown in Figure 1.

The job order envelope is used almost exclusively by smaller printing plants. First, it is a consecutively numbered form which helps to keep track of each customer's order. Second the envelope serves as a container for press proofs and special instructions. This job envelope will follow its order through the plant as the various production processes are performed.

The production order form can be as detailed as desired in any particular plant. The simplest production order will be a consecutively numbered envelope; the customer's name and all necessary production information will be written, or typed, on this form. Successful industrial management engineers advocate a completely detailed production order, a production guide down to the last operation (?). They have found it important, and profit-increasing, to list every detail and every operation on a production order (synonymously referred to as a job ticket.)

Smaller commercial printing plants advantageously use the production order to plan and route jobs and to indicate stock and cutting requirements, materials required and shipping instructions. When properly designed and filled in by a competent production man, a production order form will adequately control these functions for the small plant.

Scheduling

Scheduling is an extremely important function of production control in a commercial printing plant because it determines, to a large extent, the degree of service that a given company can render to its customers. Scheduling to control production and meet customer requirements is an
# Figure 1

Sample of Production Order Form Recommended by Printing Industry of America as a Guide for its Members.
important aim of all manufacturing; in a service industry such as commercial printing, good scheduling ranks on equal terms with quality of product as a means for satisfying customers and securing repeat business (12).

Printing probably ranks first in scheduling difficulties in comparison with other jobbing industries. This is true because of the extreme variation from job to job, of the service characteristic of the business and because control of most printing jobs is surrendered once, twice or more when proofs are submitted to a customer (9). As long as proofs remain in this state of flux, traveling from printer to customer and back, accurate scheduling cannot be performed. Therefore, printing orders are usually sold with the understanding that a firm delivery date will be given when all customer proofs are returned for the last time.

In order to schedule a job intelligently, it is necessary to establish a common denominator usable for all types of jobs (12). The most useful standard in the printing industry for this common denominator is time, expressed in hours or parts thereof. When such a system is used, the estimating and scheduling functions become closely allied. If, in estimating, each order is carefully analyzed and broken down into units of time required for each of the work centers that the order will be processed through, this information becomes the basis for accurate scheduling.

Each order to be scheduled, after all proofs are finally in, must be inserted into the production scheme with all other orders. It then becomes necessary for personnel concerned with job scheduling to know the
number of work hours available for each process center and these hours already sold for each of these areas. Good scheduling comes about when new orders are scheduled concurrently with, or immediately following, work in progress to ensure a smooth, continuous flow of work in a plant (12).

In many smaller plants, job scheduling is quite likely to consist of an order of work established by each foreman who arranges the work as he thinks best, generally with regard only for what he has in hand (9). This is the simplest scheduling procedure but lacks the required degree of accuracy unless plant overtime is considered normal to meet delivery dates when difficulties occur, such as rush orders or production breakdowns. In a more refined system, the scheduling function utilizes a "scheduling" of time to overcome such difficulties without resorting to overtime or requesting an extension of delivery time from a customer.

There are many types of mechanical aids which are used in the more progressive printing plants to effect more accurate job scheduling of orders. Whatever devices are used, they fall all under one of the two classifications of scheduling aids—those prepared and maintained by production management personnel, and those furnished to shop shop personnel. Those under the first classification are generally called scheduling boards or devices. Their purpose is to graphically show the production status of any order in processing, its scheduled delivery date, the work loads and commitments of the various centers of operations, and the actual completion date. Information to keep such a device constantly up-to-date must come from production performance reports received from the various
production areas.

Personal in charge of scheduling are responsible for stipulating delivery dates; up-to-date scheduling boards provide the information for making such decisions.

In order for a printing plant to meet its promised delivery dates, back shop personnel must know what is expected of them and when. This information is prepared by production management personnel and closely corresponds to the master production schedule maintained by these personnel. Work schedules for production areas are generally prepared daily. Basically, each is a "List of Things to do Today," with the order of production indicated. Staff and production personnel must work closely in order that the scheduling function corresponds with actual production. Production performance reports, therefore, are regularly routed from back shop to persons in charge of scheduling; constant adjustments are required to keep actual production in line with theoretical scheduling, but it will not be a failure of such a system if a "time cushion" is allowed to accommodate unforeseen difficulties and rush orders.

Auxiliary Functions of Production Control

If a production system is to have complete control of a printing order from the time it is accepted until delivery, it is necessary that personnel in charge of this function have some authority over the purchasing and handling of materials. It is not sufficient that the methods used to control production are exercised in a business-like manner if materials are seldom available on time or in sufficient quantity; the printing industry produces a tangible product and efficient materials control is es
important as effective utilization of equipment.

There is an important relationship between production and purchasing; purchasing is not merely procurement but it should be a means of meeting the needs of a plant in terms of economy, delivery, quantity and quality of materials desired (9). The main essential for an effective purchasing-production relationship is good communication, in both directions. Personnel performing the production control functions know what materials are needed, and when. Personnel in charge of purchasing must know these needs and any red tape between these two plant divisions weakens the effectiveness of a production control system.

Production control personnel require a speedy and accurate system for regulating supply materials (1). They rely on the services of an effective purchasing department—one which ensures the required materials accurately and performs a follow-up service to assure delivery when such items are needed. Finally, verification of purchase deliveries from purchasing to production control means that production can proceed on schedule—this last being a prime goal of all divisions in a printing plant.

The term dispatching describes that production function which ensures all production materials and supplies will be available in each process center according to the master control plan (3). Although this may entail ensuring raw materials from outside a plant, generally it deals with the procurement of paper stock from stores, the delivery of plates and forms from storage to the press area, and insuring the availability of adequate amounts of production supplies to each process area.
when required (9). Although larger printing plants may utilize special forms to perform this function, most plants design their job ticket to control dispatching. All pertinent information on stock and supplies required for each order is indicated on this production order; the personnel responsible for dispatching will follow this guide, paying strict attention to the required dates written on this control device. Skillful dispatching requires an understanding of the relationships of all operations of production; it should be a workable system that is as mechanical as possible; or it is merely materials expediting under the guise of dispatching. It must assist the main production control functions in order that the system will operate smoothly.

Stores and stock storage areas are not formally within a production control system. Yet, very close co-ordination between the personnel of these two areas and purchasing is required. The major function of stores-keeping has been defined as the establishment and maintenance of reorder points as signals for replenishment (9). Also important are proper storage methods to reduce damage and waste to supplies and raw materials.

Paper is the major item in storage in a commercial printing plant. The more varied the types of customers, or customer requests, the greater the likelihood that stores will be larger and of many kinds. It has been found by printing plants using a materials inventory system that this method will reduce the many and costly mistakes that take place when a manual system of stock control is in force. Adequate reorder points of the most used stocks can be forgotten by busy individuals but seldom are overlooked in an effective stock control system. Just as the purchasing division must
secure material requisitioned by the production control unit. Storekeepers must maintain a record of received, purchases, and withdrawals in such a way that plant production is regularly informed as to what materials and supplies are on hand before they can complete the production planning and scheduling on any order.
CHAPTER III

THE SITUATION

Example Number One—Harold's Printing

(Source of Information: Plant Visit and Interview)

Harold's Printing, Brookings, South Dakota, is a typical job printing plant employing up to nine people. It has both letterpress and lithography departments although the offset section is much the smaller (the terms "lithography" and "offset" are considered synonymous by printers). Commercial printing constitutes the main volume of work but this plant also produces a weekly shopper by letterpress (a "shopper" is a newspaperman's term for a free-distribution advertising piece on a newspaper format).

Forecasting

Weekly work sheets of plant production are kept to help forecast production and selling effort. On this form are listed the jobs completed for each week, the number of impressions and a comparison with the same week of a year ago. The object is to give a running total of plant production against a standard (previous weekly work sheets for the same time period) to enable the production manager to estimate the rate of production. When work is lagging behind the standard, the production manager will investigate and attempt to find the cause of the production slowdown. If no slowdown exists, he will curtail the salesmen's efforts in certain areas until production catches up to the demand. Conversely, when production is running ahead of the standard, the production manager
can ask the salesmen to put a little more effort into selling jobs of a certain kind in order that the back shop will be kept full of work. Overtime is avoided whenever possible.

Estimating

Formal estimating of each job is not a function in this plant. Unless a customer specifically asks for this printer's bid on a job, no quotes are prepared. This plant uses the Franklin System of Estimating; in reality, this function should be termed "job costing" because the job prices are decided after production is completed. Also, with this system of estimating there is little need for records of performance. At one time these last-named devices were kept and incorporated into the shop's system but were finally discontinued when time and experience proved that efforts to maintain these records were costing more than the benefits received.

The Production Order (Job Ticket)

This plant utilizes a job ticket, prepared in duplicate, as its main source of production planning and job control. The ticket is not highly detailed and the production manager enters the pertinent items on each job. This ticket is prepared in duplicate by a secretary. From there it goes to the shop foreman who is responsible for routing of the shop job ticket to each department and for maintaining a constant follow-up to see that jobs are not neglected, forgotten or that the written instructions have not been misinterpreted.

The shop ticket follows the job through the plant; the production
manager's copy is kept on his desk in the front office. This office copy is the control for proofs made in the shop or the customer's copy and is used as a check on production in the back shop to insure that jobs are being completed on schedule. Formal specification sheets are not used by this plant, but by taking notes the salesman gets all the data to the production manager who writes it on the ticket. When each job is finished and ready for delivery, the shop copy of the job ticket is returned to the production manager. After the appropriate number of copies of the job are attached to this ticket and the job is costed, it is filed in numerical order for future reference. At one time, the production manager's copy of the job ticket was filed alphabetically (by customer's name) as a cross reference but this system has fallen into disuse.

Routing

This function is performed with the job ticket envelope. When the production foreman receives his job tickets, he assigns them to a control center on his desk. This device is a long narrow box with a number of slots. Each slot represents a department of the back shop. The foreman places these tickets in the slot representing the department in which he wants the operations to be performed. Each worker comes to this control device and picks up the tickets which are concerned with his area. When he completes a job he returns this ticket to this control center and the foreman assigns it to the slot which represents the next step in the progress of the job. For example--each ticket will probably go the Composing area first and will be placed in this slot. The worker in this area picks up his tickets and performs the composition on each job in the order that
the tickets were placed in this slot. "Rush" jobs receive priority over others. By this device, the foreman not only controls routing but also scheduling of each job. The production manager checks with the foreman when he wants to know the amount of completed production on any particular job.

Planning

The production manager indicates what he wants done on each job by writing up the job ticket. In the event the instructions are not clear, not complete or contain an obvious oversight, it is up to the foreman to check these details with the production manager.

Scheduling

Jobs are handled on a first come—first served basis unless the plant is committed to a "rush" order.

Dispatching

The production order becomes the dispatching notice. These details are indicated by the production manager when he fills out this form. The foreman is responsible for dispatching needed materials in the book shop for each job and receives his notification by way of the production order.

Records of Performance

No attempt is made to keep a record of a worker's time on each job. Records of production performance are recorded on the weekly work sheets as previously described.

Purchasing
This function is the responsibility of the production manager. As requisitions outside purchases for each job as the order comes in, he depends on communication with the production foreman for information on inventories of all stocks and materials, as records of these items are not kept. The foreman is responsible for maintaining adequate supplies of indirect materials and maintaining his own re-order points. He sends his requisitions to the production manager. Co-ordination between purchasing and availability is performed by the production manager who continually compares job tickets with their purchase requisitions; when delivery of outside materials takes place, the production manager notifies his foreman.

Summary

Control is vested in the person and not in mechanical forms; for the most part. Understandably, the production manager of this plant must have a very good memory and this attribute, plus years of experience, are the two reasons why jobs going into this shop are done properly, on time and at a profit. The one attempt of a formal production control device is the example of the simple job control center on the production foreman’s desk; it is religiously used in this plant because it proved to eliminate much confusion as to who is to do what jobs and when.

Example Number Two—Henle’s Printery

(Sources of Information: Plant Visit and Interview)

Henle’s Printery at Marshall, Minnesota, is quite a large plant for the size of the town in which it is located. It is entirely a
letterpress operation. The plant has a production and office staff of 10 people and one salesman. Renle's Printery has a specialty which limits the amount of general commercial work that it can handle. A large, free weekly newspaper which is really a shopper is the main job of this plant—most of the production time and methods are centered about it.

Forecasting

Because the newspaper-shopper is issued at the same time every week, a good deal of effort and ingenuity is exercised by the production manager to meet each deadline. He works closely with the advertising salesman in order to forecast the number of pages of each edition. Advertising for each issue is decided by the salesman and proofs are placed in a slotted cabinet; each week's proofs have their own slot. When the deadline for advertising for each issue is reached, the production manager decides on the number of pages for that edition. Delivery commitments (in this case, the edition an ad will appear in) are made verbally by the advertising salesman after consulting with the production manager.

Estimating

Formal estimating of commercial printing is not a function in this plant. Prices are quoted by the production manager after he examines the specifications, but no formal estimating system is used.

The Production Order

One job ticket envelope is filled out on each commercial printing
job. Its primary purpose is to serve as a guide for pricing once the job is ready for delivery as it indicates what took place in producing this job and what materials were used. The production manager fills in a ticket with the information that he feels is pertinent to each job. The envelope ticket has few details printed on it. This envelope will follow each job through the plant, but instructions are almost completely verbal between the working production manager and the back shop help. The ticket's greatest use comes about when the production manager is absent; in this case, it becomes a fully detailed plan of production for the back shop. All job ticket envelopes are filed for future reference as guides for re-printing and past costing procedures.

Beating

Each job assignment is designated, verbally, by the production manager. In his absence, experience guides each worker in handling a job, or part of a job.

Planning

The working production manager indicates, verbally, how each job will be handled. In his absence, the production supervisor fills out each job ticket envelope with the necessary planning details.

Scheduling

"Rush" orders receive priority over others in this shop as delivery dates are flexible, but all commercial work is secondary to the weekly shopper.
Dispatching

Each production worker is responsible for securing all materials he will need for a job. Each worker relies partly on his experience to tell him what materials he will need and partly on verbal orders from the production manager.

Records of Performance

Neither records of production performances nor time sheets are kept by this plant. Jobs are priced in accordance with what the plant supervisor feels should be the cost, with little notice given to what works on what jobs in the back shop and how long the jobs take in each production area.

Purchasing

The plant supervisor or the production manager purchases production materials and supplies. The production manager depends on the back shop workers to indicate when any supplies in their area are getting low. Requests through the chain of command in this plant are generally verbal.

Stores and Stock

A stock inventory system is not kept in this shop. No special forms are utilized; the stock for each commercial printing job is described on the job ticket envelope. If the item indicated is not in stock, it is the responsibility of the production manager to order this material.

Overtime
This plant does not authorize overtime on any commercial job printing but has a regular overtime schedule to meet each deadline of the weekly shopper.

Summary

Production work and scheduling centers around the weekly shopper in this plant. Production control methods on commercial work are vested in the production manager and production supervisor who direct operations verbally rather than with forms or devices.

Example Number Three—Educator Supply Company

(Source of Information: Plant Visit and Interview)

The Educator Supply Company of Mitchell, South Dakota, combines commercial printing with publication work. It is strictly a letterpress shop. In the production area of this plant there are eight full-time employees. Four salesmen are in the field, which is comprised of the state of South Dakota.

Forecasting

Publication printing is the main item of work in this plant and all scheduling and forecasting are decided around these jobs. Delivery commitments and job leads are scheduled as far in advance as possible; selling of commercial printing jobs is done on the basis of plant capacity, to keep the production departments busy when publication work is slow. For delivery commitments on commercial printing, dates are suggested to customers and official notice is delivered by phone or salesman's follow-up. No forms for this purpose are used.
Estimating

Most customers usually request quotations for their printing and a formal estimate, on a company form, is prepared. The Franklin System of estimating is used for simple or standard-type jobs. For more complicated work this plant has its own system of job estimating. The production manager makes out the job ticket from the information contained on an estimate; however, the estimate is not used as a guide to planning a job. These production decisions which are part of an estimate are binding on the production staff if they are carried over onto the job ticket.

The Production Order

One formal job ticket envelope is filled out for each printing order. The information to complete this blank form is taken from the estimate sheet, if one is filled out, or from the salesmen's Specification sheets. The job envelope is well detailed with spaces to indicate each operation on a job as it goes through the production process. At the time the job envelope is filled out by the production manager, he also enters each order in a Customer Ledger. The name of the customer, the job ticket number, and the date promised are entered on one line of this journal. If a job envelope becomes misplaced or neglected, the production manager has this last record of the order and its due date in his office and can then perform the necessary follow-up.

A job envelope follows each printing order through the plant. A production foreman in each department is responsible for prompt production work on each order and for distributing job envelopes to his workers as he sees fit, or in compliance with special instructions that he receives
from the production manager. The job envelopes are filed, numerically, for future reference, both for job costing information and for production help in case of reprints.

Routing

The sequence of production performance on each job is decided by the department foreman. He delivers job envelopes to workers in his department in the order he wishes each task to be performed.

Planning

Production workers do their own job planning. The department foreman are available for advice and direction in case instructions or methods are not clearly indicated on the job envelope.

Scheduling

Scheduling of job orders consists of each department foreman entering incoming job envelopes on a work sheet and indicating when delivery takes place. This In-Out record serves to alert the foreman to delinquent performance on any order. The production manager has a tracer sheet for each order in his office which tells him the amount of daily production performed on each job. This information is recorded from time slips which each production worker fills out. If a tracer sheet shows a lack of production and the delivery deadline is drawing near, the production manager will send a notice to the foreman concerned.

Dispatching

Each worker, or his foreman, is responsible for securing all
materials (except paper) needed for an order. This information is usually secured from the job envelope.

Records of Performance

Different colored time sheets for each department are used to record the time a worker spends on each printing order. These time sheets are used for costing jobs and serve, somewhat, to set standards for better estimating on future orders of similar work.

Purchasing

The production manager or the department foremen are responsible for purchasing direct materials needed for each job. The department foremen are responsible for maintaining adequate supplies of indirect production materials. No special forms are used in either case. Co-ordination between production and availability of materials is maintained by verbal communication.

Stores and Stock

When a job envelope is filled out, a special stock cutting ticket is written. This ticket is routed to the paper cutter and indicates when stock is to be cut and delivered to the pressroom. A stock inventory system is not kept by this plant and the letterpress foreman is responsible for maintaining adequate supplies of standard items.

**Example Number Four—Argus Company**

(Source of Information: Plant Visit and Interview)

The Argus Company of Stickney, South Dakota, is a small combination
offset-letterpress commercial printing plant. It also publishes two weekly newspapers. Total full-time personnel averages about 17. There are no full-time salesmen. Most of the job printing orders come to this plant by mail.

Forecasting

This plant is kept at full production by an extensive, multi-state direct mail selling campaign. If the work load appears to be slacking, more effort is expended by those in charge of direct mail solicitations. In this manner, forecasting of plant production capacity is readily maintained under a full work load. Delivery commitments are made to customers by mail or phone.

Estimating

Estimating and price quoting are regular functions for most orders received by this plant. The estimating system is of this plant's own design. It is a rather loosely controlled system in that the production manager or the business office manager will estimate jobs for the letterpress department, while the offset department foreman generally computes the estimates and quotations for his area. The information on a prepared estimate is not generally used as a guide in the production area.

The Production Order

One job ticket envelope is filled out for each order by the production manager or the office manager. Specification forms are not required as orders come by mail to this plant. If the order specifications are complete, the job is given an estimate; if details are lacking, a letter
is written to the customer or agency requesting more information. The job ticket envelope form is mostly blank with space provided for writing pertinent instructions for each job. This ticket follows a job through the plant and is the main device for production control of each order. Each order is written in a customer ledger with its job envelope number. This journal becomes a cross reference on each job envelope and serves to alert the production staff if any order is delinquent in delivery because the ticket has been misplaced or overlooked, in the shop. Job ticket envelopes are filed numerically for future reference.

Routing

No special forms or devices are used for this function. The foreman of each area makes his production decisions after consulting the job envelope.

Planning

Consultations between the foremen and production manager are regular occurrences in planning the production on jobs. The job envelope contains most of the planning information for standard-type orders.

Scheduling

Each foreman of a production area is responsible for handling all orders in the fastest, most economical way. Orders are processed on a first come–first served basis; however, special "rush" orders do receive priority over regular jobs. A formal scheduling system is not used. It is the responsibility of the office manager to see that work is moving through the plant at normal speed. By periodic checks in the job register
ledger, orders needing immediate attention are singled out and notice is posted in the shop area to this effect.

Dispatching

Each foreman is responsible for the availability of adequate supplies of paper and materials for his area. His source of information is the job envelope.

Records of Performance

Workers are required to keep track of the time performed on each operation of an order; the back of the job envelope is utilized for this purpose. This information is used to cost each job and serves as a check on the estimates given in a quotation.

Purchasing

No special forms are used for this function. All purchasing is handled by the business office and requests for supplies or paper are furnished by the production manager or his shop foreman.

Stores and Stock

When the job ticket envelope is filled out, two copies of a cutting requisition are typed. One copy is routed to the paper cutter and the second to the person in charge of paper inventory. As a running inventory is kept on the paper supplies, the inventory copy of the cutting requisition is marked with the amount of the withdrawal and this slip routed back to the business office where the inventory records are kept. The foreman in charge of paper supplies is responsible for maintaining his own re-order
points of standard stock items.

Overtime

This plant schedules regular overtime to meet delivery commitments. Authorization for overtime is generally given by the production manager or the office manager.

Example Business Plan—Brown & Seanger

(Source of Information: Plant Visit and Interview)

Brown & Seanger of Sioux Falls, South Dakota, is one of the largest commercial printing plants in this state, with a total employment (in this division) of 20. This plant does not have a formal production planning and control system. It does, however, make use of a few simple devices which give some element of control in this area.

Forecasting

Three salesmen are placed in the field to keep the production area moving at a steady pace. Very seldom is it necessary to slow the selling pace to prevent an overload in this plant; rather, the back shop will be placed on overtime to complete production when normal work schedules seem to be falling behind because of a greater work load.

Estimating

Brown & Seanger developed their own system for estimating job printing. A special form is used, and estimating details are generally used as a guide to writing up a job envelope.

The Production Order
A specification sheet, or job order blank, is filled out for each new printing order. This form is usually completed by the salesmen. If an order is placed with this company, the specification sheet and the estimate form become the source of information for writing up a job ticket envelope.

This envelope generally becomes the main control of production on each order. The planning information contained on this ticket, however, may or may not be used by the production supervisor in the back shop. This person has the authority to change any sequence or operation as he sees fit in order to keep production moving at an even pace in the back shop.

One ticket which follows the job through the plant is filled out for each order. When an order is completed and billed, the job envelope is filed alphabetically for future reference on costing, or in case of reprinting.

Routing

This function is performed by the production supervisor. He has a number of boxes on his desk, each representing a production area of the shop. Each job envelope is placed in the appropriate box representing the department in which the supervisor wants the order to receive attention. Workers from the various departments come to this desk to pick up job envelopes which concern their area. As the various departments complete operations on an order, the job envelope is placed in a receiver box in the area labeled "Completed Operations." The production supervisor periodically picks up these envelopes and returns them to his desk.
where they are routed to the next department in the sequence of production, via a designated box.

Planning

Some jobs are completely planned by the estimator, in which case his instructions are carried out in the production area. Planning on other orders is carried out by the production supervisor. The decision as to which planning method is to be used is made by the supervisor.

Dispatching

All dispatching of materials and supplies is carried out by the production supervisor. He, in turn, verbally instructs workers in each area to secure certain materials from the storage and supplies department.

Scheduling

Job envelopes are processed on a first come—first served basis by the production department unless instructions on the envelope indicate an order is "rush"—in which case it receives prompt attention. When the job envelope is written up, a small time ticket envelope, spot glued to the larger envelope, is removed and remains in the time clerk's office. The delivery date desired on each order is designated on this envelope. Time tickets are prepared separately for each operation on each order. Twice a day these tickets are routed to the time clerk. The clerk sorts the time slips and inserts each into the appropriate envelope corresponding to the job order number on the slips. As the time slips build up in these envelopes, the time clerk is in a position to evaluate the status of each job. If production on an order is slower than normal and the
delivery date is drawing near, the time clerk notes this fact and sends an attention slip to the production supervisor, indicating the order which has fallen behind in production. The supervisor can now take appropriate action to see that the delinquent order will meet its scheduled delivery date.

Records of Performance

Time records on each order are part of this plant's system and are described in the section above. The time slips are used in costing jobs and serve as a check on the standards and prices used in estimating.

Purchasing

This function is performed in the front office by the production manager. Purchase requisitions are prepared in triplicate—one copy is routed to the costing area, one to the production supervisor (via the job envelope), and the last to the stock area. The production supervisor may request purchases and usually consults verbally with the production manager on the needs of his area.

Stores and Stock

A stock cutting ticket is prepared at the time the job envelope is filled out. This slip is routed directly to the paper cutter and serves to notify this area what stock needs cutting and when it is to be delivered. Availability of stock at a press at the proper time is assured with this system. The production supervisor is responsible for maintaining adequate stores and proper re-order points. No formal stock inventory system is used.
Overtime

The production supervisor has the authority to designate overtime for any department when extra work is required to complete wanted orders. As no formal job scheduling system is used, overtime is a stop-gap measure to insure most orders of completion on the date of the delivery commitment.

Example Number Six—Modern Press

(Source of Information: Plant Visit and Interview)

Modern Press of Sioux Falls, South Dakota, operates as a combination offset-letterpress commercial printing plant employing 17 people, nine of whom are direct production workers. This plant operates a formal, though limited, production planning and control system under the direction of the production manager. A working foreman is appointed for both the offset and letterpress areas. Though regular production conferences are not scheduled, periodic meetings are arranged, including the plant supervisor, production foreman and production manager, to derive the best production policy on any unusual or intricate job orders.

Forecasting

The plant supervisor directs the efforts of the sales personnel in an attempt to even out the work load of this plant. The purpose of his control is to reduce periods of excessive job commitments (probably requiring overtime) if at all possible. Experience indicates approaching busy periods and sales personnel are required to ask customers for more advanced job delivery dates. If the work load of the plant decreases to a point below full production capacity, the plant supervisor becomes an
extra salesman to bolster the sales power and increase the job orders to the level required by this shop for a comfortable, but not excessive, work load. As a guide to the proper job work load, the production supervisor maintains a machine loading chart that indicates at all times the estimated production hours sold, for each machine, for one month in advance.

This work load chart also guides the plant supervisor in estimating job delivery dates for his salesmen. If an order comes in that requires immediate attention to meet a proposed delivery date, and the press best suited for this order is busy for X number of days, the production supervisor will request the salesman concerned to seek a more liberal commitment. Many times the customer will comply with a salesman's request. If this is not possible, however, the order can still be completed on the desired delivery date by re-scheduling some other job(s) on the work load chart. In the event that re-scheduling is not possible because all jobs for this press have received firm delivery commitments, then the necessary overtime will be authorized to solve this problem. While this work load chart does not completely solve forecasting and scheduling problems, it does present at a glance a graphic picture of the amount of machine time sold and the next open date.

Estimating

Modern Press prepares an estimate on each job order. A simple estimate is all that is usually required for regular customers, but a complete estimate and quotation is prepared for new accounts or for large orders. This plant has its own estimating system and the form for
estimating is fairly complete in detail. Accepted estimates become a
guide in preparing job order envelopes.

The Production Order

One job order envelope is prepared for each printing order; an
example is reproduced as Figure 2. The information needed to write up
this envelope is taken from the customer's estimate form or the salesman's
specification sheet. The blank envelopes contain spaces or notations for
all production information required by back shop personnel, including the
delivery date. A job order envelope is usually prepared by the production
manager. It becomes the main device for production control in this plant.
Each envelope will follow its job through the production processes in the
shop. When an order is completed, the job envelope is returned to the
production manager and placed in a slot on his desk, marked "Completed
Orders." The reverse side of this envelope contains a pre-printed job
costing form which is filled in by the production manager. The job cost-
ing information serves as a check on estimating accuracy, as an indicator
for extra services requested by the customer after the estimate was ac-
cepted, and as future reference information. Job envelopes are filed
numerically in a special room of this plant. In a job order ledger, each
job is listed alphabetically by customer's name, the corresponding job
envelope number and the date delivered. This ledger quickly locates the
job order number for any customer in case of reprinting.

Routing

Routing a job envelope is accomplished, manually, by the production
Figure 2. Example of Production Order Form in Use by Modern Press, Sioux Falls, South Dakota.
manager. To help him in this function and to maintain better control on job order envelopes, his desk has a number of specially constructed, vertical compartments. When job envelopes are ready for production, they are placed in the compartment titled "Ready for Shop." When an order requires that type proofs be sent to a customer, the job envelope is routed to the composing area where the necessary work is completed and the proof and envelopes routed back to the production manager. While the proof is out of the plant, this job envelope is placed in a second compartment titled "Proof Out." In this way, the envelope is not lying in the back shop where there is a chance it will be misplaced, nor is it grouped with active order envelopes where confusion might take place. A third compartment in this desk holds envelopes of completed orders and ready for "Costing." A fourth compartment holds those envelopes waiting to be filed. In other words, if a job order envelope is not in the shop, controlling actual production, it will be in the appropriate compartment on the production manager's desk.

Planning

Planning requirements for each order are partially completed when the job envelope is prepared. Necessary extra instructions are transmitted to shop foreman by the production manager.

Scheduling

Scheduling of job orders is performed in two ways. First, the machine loading chart handles schedule commitments for each major piece of equipment. This device is used by the production manager, plant
supervisor and the salesmen. The second device is an individual work
sheet, prepared daily by the production manager, for each major machine.
This form contains the job order number and customer's name on each order
on which a machine operator will work that day. Production workers will
handle jobs in the order indicated on their sheet. Shop personnel know
what is required of them for each day. Many time consuming questions
concerning which jobs are next are eliminated by the use of these daily
forms.

Dispatching

This function is performed by appropriate entries on the job order
envelope. By this device, production workers secure their own materials
needed for each order.

Records of Performance

All production operations are timed. The back side of the job
order envelope contains a form where each worker will enter the time of
his operations. Records of performance supply much of the information
required to check estimating accuracy and for determining future schedul-
ing of like operations on the machine load chart.

Purchasing

Direct material purchases are handled by the plant supervisor or
the production manager. Indirect material purchases are the responsibility
of the individual workers concerned. No special forms or verification
methods are utilized.
Stores and Stock

A cutting ticket is prepared for each order at the time the job envelope is written up. These cutting slips are routed to the paper cutter and the stock prepared according to this form and on the date indicated by this slip.

A formal stock inventory system is not in use by this plant at the present time; however, this device will be incorporated into the production system as soon as possible. The production manager is presently responsible for maintaining proper re-order points.

Example Number Seven—Hayee Brother's Printing

(Source of Information: Plant Visit and Interview)

Hayee Brother's Printing, Aberdeen, South Dakota, operates as an offset-letterpress commercial printing shop with an average of 10 personnel. This plant does not operate a formal production planning and control system. Production conferences between front and back shop personal are not conducted at regular intervals; however, very close co-ordination does take place between these two groups.

Forecasting

The purpose of the selling process in this plant is to create sufficient job backlog to keep the production area at full work capacity. This forecasting function is performed by the plant supervisor with his control over sales personnel. The decisions are based on his experience and business intuition. No forms or devices are used with this method.

Estimating
A special estimating form is used by this plant. One is prepared for each order. Job specifications come into the plant on a simple order form. The Franklin System of Estimating is used exclusively. Job estimates are not used as guides for production planning, routing or dispatching.

The Production Order

One job order envelope is prepared for each order. The envelope is designed so that production details on each order are written in the appropriately designated spaces, with extra space for miscellaneous items. The production manager will prepare each envelope. His instructions on this form are intended to be a complete guide to the production of the job, but the shop foreman has a good deal of leeway to make his own decisions over a questionable item or in case of incomplete details.

The job envelope is the main device for production control in this plant. This envelope follows a job through the production processes in the back shop. When an order is completed, its job envelope is filed numerically in the front office.

Routing

This plant has a simple device for routing of each printing order. The production foreman has a cabinet with five drawers, each titled with a routing function. They are: 
 a) Ready for Production
 b) Waiting for Proof
 c) Waiting for Customer
 d) Cut Stock
 e) Finished Jobs

Each job envelope is first placed in drawer "a" (above). The foreman
routes this envelope to the production area where he wishes job operations to be performed. This envelope will stay with a job and move through the shop unless production is held up for (1) delivery of a proof, (2) because a customer requests it, (3) delay while stock is being prepared, or (4) the order has been delivered. If the above four exceptions do occur, the job envelope will be placed in the appropriate cabinet drawer by the foreman. With this method, any job envelope can be swiftly located and the status of production quickly determined by the shop foreman.

Planning

Most planning functions are the responsibility of the production manager or the shop foreman. Some planning details may be indicated on a job envelope but most planning decisions are transmitted verbally by the production manager to his foreman, or the initiative left to the foreman entirely.

Scheduling

No formal scheduling system is used by this plant. Each job envelope contains a space titled—Date Promised. The responsibility for completing all job production on any order by the indicated date is up to the shop foreman. The production manager keeps track of the number and volume of jobs in the plant at any one time in order to schedule delivery dates for new orders.

Dispatching

Most of the information required to dispatch the needed materials for a job is written on the envelope. Each production worker is
reasonable for securing all materials needed to complete the job production in his area.

Records of Performance

Production workers are not required to record their time on job operations in this shop.

Purchasing

This function is handled entirely by the production manager. The kinds, amounts and availability are at his discretion.

Stores and Stock

Neither special forms nor an inventory system is used as an aid to controlling production. The production manager is responsible for maintaining adequate reorder points on all raw materials and supplies. Each of his information in controlling this item is received by verbal requests from both shop personnel.

The job envelope becomes the stock cutting slip in this plant. When an envelope is placed in the cutting drawer (described previously) titled Cut Stock, it is available for the person designated to perform cutting operations. The paper cutter returns his cutting slip (in this case, the job envelope) to the shop manager when he has delivered the prepared stock to a press.

Overtime

Overtime is avoided when possible. If a larger than normal volume of work, or unforeseen difficulties, slow production and prevent the plant
from meeting promised delivery dates, the production manager will authorize overtime to counteract this situation.

**Example Number Eight--Tippecanoe Press, Inc.**

(Source of Information: Feature Article--E. J. McKiser, "Production Control for the Small Plant," Inland Printer, 151:43-46 (June 1953).)

This article was selected because it is a description of a complete production control system used in a small commercial printing plant. The plant is identified as the Tippecanoe Press, Inc., Shelbyville, Indiana.

**Forecasting**

No mention of this function is made in the magazine article. This plant operates an effective job scheduling program, however, from which most information for operations forecasting can be obtained.

**Estimating**

That this plant uses a formal job estimating system is implied in the magazine article, but it is not specifically described.

**The Production Order**

A formal specification sheet is written up for each order; it is reproduced as Figure 3. This sheet becomes the guide in preparing the job ticket. A job order ticket is composed of three basic forms numbered in triplicate: a job summary sheet, a stock preparation slip, and the job envelope as shown in Figure 4. The top sheet is the job summary form and remains at the production manager's desk until the order is finished and delivered. The second sheet is the stock preparation form. Both forms are printed on 16 lb. stock and tipped, in register, with spot
Order specification sheet gives complete details and instructions for the job. Note the items listed in the table:

<table>
<thead>
<tr>
<th>Firm</th>
<th>DATE</th>
<th>CAM</th>
<th>PLATE</th>
<th>COMP</th>
<th>CUT</th>
<th>VERT</th>
<th>HDLBRG</th>
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</tbody>
</table>

Customer Order No. Delivery Date How Ship

<table>
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<tr>
<th>By</th>
<th>Quoted</th>
<th>Amt. Charged</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

INSTRUCTION

- BINDERY:
  - Gather
  - Fold
  - In Pads of
  - Stitch
  - Punch
  - Trim
  - Wrap
  - Tipp.

Quantity | Finished Size | Qty. | Running Size | Up |
---------|--------------|-----|--------------|----|
Cut from: Kind | | Color | Size | Wt. |

Quantity | Finished Size | Qty. | Running Size | Up |
---------|--------------|-----|--------------|----|
Cut from: Kind | | Color | Size | Wt. |

INK

Quantity Run

- □ Same
- □ Different

Cost $ | Prev. Pr. $ | THIS ORDER TAKEN BY

Preceding No. Date

Ship. Notes
Three-part form (below, right) with No. 1 summary sheet on top, No. 2 is cutting sheet and No. 3 job envelope. Set is padded on left with one-time carbon inserted so forms can be made up together. The job envelope and cutting sheet (below, left) are matching forms.
carbon on their reverse sides, to the job envelope.

A job ticket is typed and the three forms separated. The job summary sheet is filed in an index binder where it becomes part of the alphabetical index of all jobs in the plant. All job information and costs are eventually recorded on this form; its final disposition is into a summary file where it is a valuable future reference for repeat orders and costing.

The job envelope follows each order through the plant. It is a completely detailed form and is written up by the production manager. When an order is completed and shipped, its job envelope is filed, numerically, in a job order file. It will contain samples of the printed piece(s), the cutting slip and other pertinent job information needed for future reference (such notations as the location of type forms, negatives, plates and remaining special stock).

Planning

Each job is planned by the production manager and he writes his instructions on the job envelope. Complete planning details are the rule rather than the exception and production personnel are required to abide by these instructions.

Routing

This function is performed by the various shop foremen. They are guided by specific shop procedure and instructions on the job envelope. Each foreman will pick up the job envelopes for his department from the production planning office and distribute same to workers in his area.
When job operations are completed, the foremen return these envelopes to the planning office.

**Scheduling**

This function is the most powerful production control device utilized by this plant. When a job order is written up, it is also entered on a scheduling form in the planning office; the form is reproduced in Figure 5. Orders are entered on this scheduling form in numerical sequence, which is also the priority sequence in which most jobs are processed. This form lists the job order number, the customer, quantity desired, order description, proof "in-out" details and numbered, individual check off boxes for each production department of this shop. For example, when a job is routed to a department, this information is indicated on the schedule form by drawing a slash mark through the designated box on the line of this form belonging to that order. The job envelope is routed back to the planning office when the indicated operations are completed, and a cancellation mark is made in the same box indicated above.

By this method, the exact location of any job envelope and the status of production on its order is known to the production manager at all times.

As a further check on production progress, all scheduling entries are made by the production manager as the act of completing the schedule sheets gives him a mental picture of the work constantly in progress.

New schedule sheets are made up as required and finished orders dropped from the schedule. The remaining orders are kept in numerical
### SCHEDULE SHEET

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<th>DESCRIPTION</th>
<th>WS</th>
<th>WC</th>
<th>M</th>
<th>PO</th>
<th>KEY</th>
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**Figure 5.** Example of Job Scheduling Form in Use by Tippecanoe Press, Inc., Shelbyville, Indiana.
sequence as this serves to draw attention to the older orders, requiring more attention, and steps can be taken to rush their completion.

Dispatching

All instructions concerning this function are entered on the job envelope.

Records of Performance

Workmen record the time of their operations on each order. A time card form is printed on the reverse side of the job envelope and is reproduced in Figure 6. By combining the time card form with the job envelope, there is little chance of recording under the wrong job number.

Purchasing

This function was not described in this magazine article.

Stock and Stores

As indicated previously, the stock preparation ticket is prepared as part of the job ticket forms. The stock cutting slip contains all specifications for proper preparation as well as date of availability at the presses. These details are determined by the production manager.

A paper stock control book is kept which shows the date of receipt of stock delivery, quantity purchased, withdrawals (information supplied by cutting ticket) and amounts on hand at any time.

Overtime

No mention of this detail was made in the article.
**EXTRA TIME CARDS**

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<th>HARD COMP</th>
<th>MACH. COMP</th>
<th>LUDLOW</th>
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<th>ARTWORK</th>
<th>PASTE UP</th>
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- **STRIP - OPAQ.**
- **RULING**
- **MAKE PRINTS**
- **MAKE PLATE**

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<th>MAKE READY</th>
<th>VERTICAL</th>
<th>HEIDELBERG</th>
<th>CYLINDER</th>
<th>MAKE READY</th>
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- **JOB PRESS**

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<th>PADDING</th>
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- **MACH. HELP.**

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**Figure 6. Example of Record of Performance Form in Use by Tippecanoe Press, Inc., Shelbyville, Indiana.**
Example Number Nine—Central Michigan Press


This magazine article describes the production planning and control system of Central Michigan Press, Battle Creek, Michigan. Though a small offset-letterpress plant (10 production employees, four management personnel) it has a production control system of the refined degree usually found only in plants of much larger size. Central Michigan Press is unique, as far as smaller printing plants are concerned, in that the management contracted the services of an expert in the field of production systems to design one especially for their plant. Olin Freedman, an authority in this field, designed the system in 1953 and Central Michigan Press has been well satisfied with the results. For example, using this system the plant has operated at an efficiency rating of as high as 90 per cent—about 15 per cent higher than what is normally considered satisfactory for printing plants of this size.

Freedman planned this system with the persons who were going to be working with it— the production personnel. By consulting with these people, Freedman sold them on the idea; this is very important as the best system is only as good as the efforts of the personnel who operate it.

Forecasting

This function was not specifically described although it would be easily performed with a system of this type.
Estimating

The prepared estimate of Central Michigan Press not only computes the price of an order, it prepares the complete production details as well. Before this plant installed its present system, it was necessary to plan each order after an estimate was accepted by a customer. Many times the planning details did not correspond to those on which the estimate was based. This could mean that any order could be over or under priced, resulting in poor customer relations or loss of profit for the plant.

Under the present system, complete specifications are written up for each order. On the basis of these details, a comprehensive estimate is prepared; full job planning details are included as part of the estimate, as many times proper planning will save money, even on ordinary jobs. Paper and cutting problems are handled with special care on the estimate as this again is an area where pre-planning saves profits.

The Production Order

The heart of the control system at Central Michigan Press is the job ticket. Six copies are typed at one time by means of carton tissue and each performs a control function. The first copy stays on the production manager's desk and because his device for keeping track of orders in the plant. The second copy is routed to the bookkeeper, for costing information when an order is complete. Number three is the envelope copy which follows the job through the plant and serves as a carrier for special instructions, proofs and press copies. The fourth, fifth and sixth copies are routed to the composing room, bindery and presswork departments.
respectively. The purpose of the six copies is to insure that all personnel are informed of work coming into any department.

The production order (job ticket) is reproduced in Figure 7. The design of the form is excellent as it contains adequate notations and space for all planning operations and specifications.

Routing

The production and cost copies of the job ticket remain in the office area. The remaining four copies of this ticket are routed to the composing area. Here the composing and envelope copies are used to start an order while the bindery and presswork copies are routed to those departments to serve to alert their foremen of the coming work load.

Planning

All jobs receive thorough job planning attention. The estimator or the production manager is responsible for completing the production details on the job ticket. As all planning functions are predeterminded, it is not necessary for shop personnel to hold up production pending decisions.

Scheduling

The operation of this function was not described in this magazine article.

Dispatching

All dispatching details are carefully entered on the job ticket form. Each production worker, or his foreman, is responsible for securing
Figure 7. Example of Production Order Form in Use by Central Michigan Press, Battle Creek, Michigan.
all materials indicated on this form.

Records of performance

The times for each production operation are estimated and entered on the job ticket form before parts of same are routed to the production area. This method guides production workers as to time standards allowed for each operation and helps to keep jobs moving through the plant.

Purchasing

This function was not described in this article.

Stores and Stock

The binding copy of the job ticket form is routed to the binding from the composing area. All cutting and stock preparation operations, as well as date of availability, are clearly entered on this form. The responsibility for proper performance then rests with binding personnel.

Overtime

This function was not described in this article.
CHAPTER IV

SUMMARY AND CONCLUSIONS

The most notable point uncovered by this investigation of production control systems in small commercial printing plants is the lack of control. This deficiency is explained in two ways: the first is the lack of understanding and application of sound production control principles by management of these printing plants, and the second is the economic limitations of such plants to employ a formal control system. These two reasons, however, do not justify the situation.

The operation of a printing plant is similar to that of any manufacturing business; its reason for remaining in operation is to make an acceptable profit on the capital investment. Several sections of this thesis have elaborated on the uniqueness of the printing industry when compared to other manufacturing activities, yet the sound business principles advocated by any manual on accepted management principles for those industries producing a product can, and should be, applied to the commercial printing industry. For example, a common excuse given by printers who rely very little on pencil work is that each order they receive may be different from any other printing job and that they can best meet and handle a situation as it arises. The fact that printing orders are ever completed in shops of this type is remarkable considering the uniqueness of each product and the requirements of an extraordinary memory system to keep track of the ever growing list of details.

A formal system of production control is designed to accomplish
what man could do if it were not for the normal human shortcoming of forgetfulness. Small commercial print shops require some degree of formal control of production although it might not be on the more complicated plane of larger plants. The mere act of writing facts down on paper decreases the possibility of forgetting those facts by about one-half. If this writing is coupled with intelligently designed production control forms and the complete system is constantly in practice, an increase in plant efficiency and a decrease in production headaches are certain to result.

This investigation substantiated one fact that most authorities of printing management have stated—that production control in the smaller commercial printing plants should begin with a production order. All shops and their systems detailed in Chapter III make use of a job order ticket, or envelope. This production order serves as an order control device because it contains the customer's name and job instructions for each printing order. Also, each envelope is numbered consecutively with all others, this eliminates the possibility of orders becoming confused because of similar customer names or relatively unintelligible writing on a job order envelope. The envelope size and the detailed descriptions printed on the envelopes did vary considerably. The simplest forms are 10 commercial envelopes numbered consecutively and with provisions for indicating customer's name and address; all other information is written or typed on the blank space remaining. The more detailed forms follow the example of a well designed business form; a production control device with printed instruction blanks that allow an order to be pre-engineered
by the production foreman on this control device before it reaches the back shop area of a plant. These last forms are a move in the direction of systematic production control in a printing plant, although none of the production order forms examined was as thorough and completely detailed as is deemed desirable.

A second defect uncovered concerning the production order forms was the incompleteness of instructions that these forms received. Small shop owners seem to feel that the time spent in filling out such a form is a necessary evil and, consequently, cut as many corners as possible. The result is an incomplete picture of the job requirements that may, or may not, necessitate back shop personnel to repeatedly confer with their superiors on some point of production not clearly explained on the production order.

Scheduling of orders in small commercial printing plants is less critical than that desired in medium or large sized shops. This is probably due to the fewer number of orders and the ability of personnel to control orders without the aid of mechanical devices. Nevertheless, a formal system of job scheduling will enable any sized plant to meet more of its delivery commitment dates.

Small commercial printing plants should make greater use of the estimating function. This investigation indicated that only one shop utilized the information prepared by the estimator as a production guide for each order. It is a waste of management time if a detailed estimate is prepared that takes into consideration all facets of production on an order and the production staff re-plans these same orders without making
use of the estimator's preparations.

The purpose of a formal production control system in a printing plant is to increase and maintain production efficiency while giving better service to the customer. Whether or not a plant has a simple system or one more complicated, the measure of success is the degree that this system has benefited the business enterprise of the organisation. In general, management of small plants shies away from formal production control systems even when these men realize some of the benefits that might be achieved. They fear that the cost of maintaining such a system will be greater than the advantages. Yet, formal production control is a theory, not a device with a price tag. All that it takes to initiate such a system in any printing plant is enthusiasm and a sound background of the principles. For those plants wishing to give formal production control an honest try, there are enough production areas which can be handled separately and one might be selected and the principles applied until success with this project has cleared the way for further expansion. The ultimate aim should be a system that removes human shortcomings as much as possible from the production control functions which are performed in every commercial printing plant whether formally or otherwise.

The application of sound production control principles in small commercial printing plants will pay many dividends. Such aids will systematize work schedules and prevent overlap of effort by various departments. It will reduce the number of decisions which are now being made by back shop personnel. It can reduce, to writing and forms, many of the countless production details which are now being collected and
stored in the minds of production personnel where the inability of an individual to recall or the absence of such persons will remove such necessary information from the plant. It should increase the service that a plant can give to its customers, for smoothly running production facilities can produce orders on time. Finally, the small plant that has worked with production control principles and developed proficiency, even though the present system is simple, has a firm foundation to incorporate a more complicated control system which will be required as the plant grows in size, personnel and production problems.
LITERATURE CITED


APPENDIX
Example of Form Letter Mailed to Small Commercial Printers

April 2, 1960

Production Manager
Stickney Argus
Stickney, South Dakota

Dear Sir:

As a Graduate student in Printing Management at South Dakota State College, I am writing a thesis on production systems and forms used in small, commercial printing plants. Part of my information will come from field trips and I would like to visit your plant and talk with you on your system and production aids which best suit your operating conditions. If you would grant me this request, please name any time at your convenience (except Thursdays) in the next few weeks. It will be a brief interview of non-personal questions and can be limited to about fifteen minutes.

I hope that you will help me with this survey and suggest a date for a visit. Thank you.

Sincerely,

Donald N. Rollo

enc

DHR
Example of Schedule of Questions Used in Each Interview

SCHEDULE OF QUESTIONS - PRODUCTION CONTROL FORMS AND SYSTEMS

Name of company ____________________________________________

1) Plant (general)
   a) Number of production workers ___________________________
   b) Number of total personnel ________________________________
   c) Type of jobs handled __________________________________
   d) Specialties ___________________________________________
   e) Does plant operate formal PP and C system ________________
   f) Are production conferences a regular occurrence ___________

2) FORECASTING
   a) Is selling over done on basis of plant capacity _____________
   b) How are delivery commitments made to customers ___________
   c) Are such things as machine loading (est. hours and scheduling)
       formally performed ________________________________

3) THE PRODUCTION ORDER
   a) Does shop utilize formal job ticket _________________________
   b) Is one filled out for each order ___________________________
   c) Does shop utilize formal Specification Sheets ______________
   d) If so, are they complete as far as estimating and planning informa-
      tion requirements ______________________________________
   e) Is production order main control of production for each order
      ________________________________
   f) If so, is ticket designed to detail complete specifications and
      procedures to become a production guide __________________
g) Is more than one copy of job ticket made ____________________________

h) If so, distributed to what areas ________________________________

i) Are job tickets filed for future reference _____________________________

4) ESTIMATING

a) Is formal estimating of most jobs a regular function ________________

b) Is special form used _________________________________________

c) Are estimates used as guide to production (planning, routing) ________________

   d) Are estimating decisions binding on production staff ____________

5) ROUTING (determination of process sequence and path job is to follow through shop)

a) Are special forms used _________________________________________

b) What way is this function performed _______________________________

6) PLANNING (detailed instructions as to how each job will be handled on the process chosen)

a) How are jobs planned _________________________________________

b) Special forms used _________________________________________

c) By whom; area of responsibility ________________________________

7) SCHEDULING (dates for order of work)

a) Is formal scheduling system used _________________________________

b) Special forms or devices used _________________________________

c) How is follow-up performed _________________________________

d) How are outside purchases and services tied in with scheduling ________________________________

8) DISPATCHING

a) Special forms used for dispatching (paper, ink, proof) ________________
b) Who is responsible for co-ordination of various parts and materials for each job ____________________________

c) RECORDS OF PERFORMANCE

Are records of performance kept ____________________________

b) Special forms ____________________________

c) How are records of performance utilised for future ____________________________

10) PURCHASING

a) Special forms used ____________________________

b) How are direct materials purchases handled ____________________________

c) How are indirect material purchases handled ____________________________

d) How is co-ordination obtained with production (verification) ____________________________

11) STORES AND STOCK

a) Special forms, requisitions ____________________________

b) Perpetual inventory system ____________________________

c) Provisions for re-order points ____________________________

d) Provisions for availability when needed ____________________________

12) OVERTIME

a) Who authorizes it and when is it necessary (generally) to schedule overtime ____________________________

13) SPECIAL