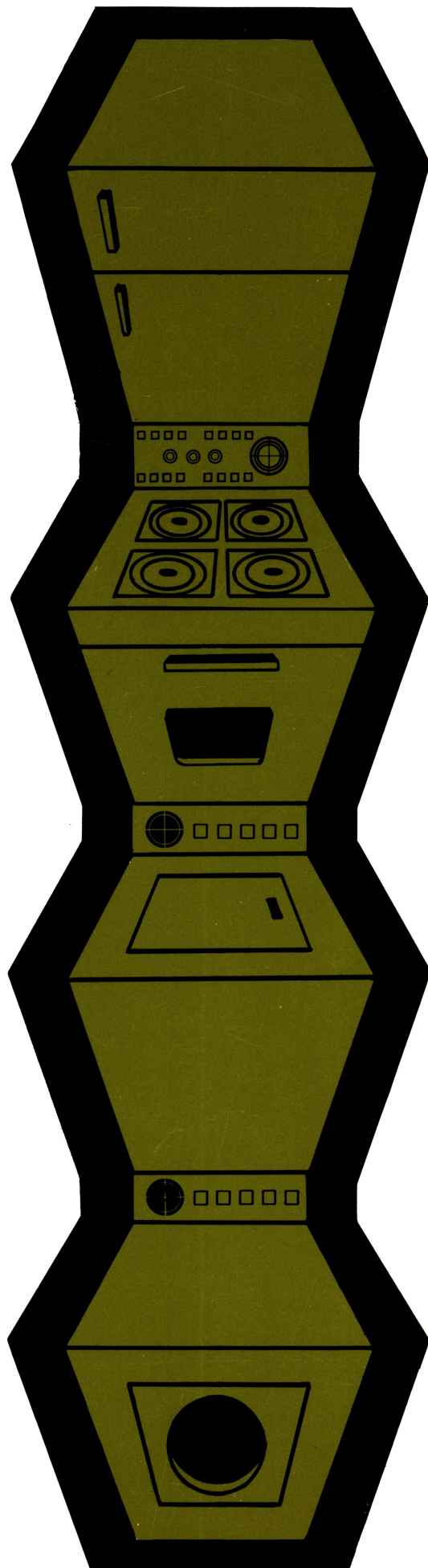


# MAJOR HOUSEHOLD APPLIANCES

CHANGING LOCATION  
REQUIREMENTS  
AND OPPORTUNITIES  
FOR MISSOURI



Prepared for  
MISSOURI DIVISION OF COMMERCE  
AND INDUSTRIAL DEVELOPMENT

by  
OFFICE OF INDUSTRIAL DEVELOPMENT STUDIES  
UNIVERSITY OF MISSOURI

# **MAJOR HOUSEHOLD APPLIANCES**

**Changing Location Requirements and  
Opportunities for Missouri**

by

**Jerrold L. Stark**

*Senior Research Analyst*

**Industrial Development Studies**

sponsored by

**Missouri Division of Commerce  
and Industrial Development**

**APRIL, 1970**

# *Contents*

<b>Highlights</b>	<b>1</b>
<b>I. Introduction</b>	<b>2</b>
<b>II. Description of the Industry</b>	<b>3</b>
<b>III. Location Factors</b>	<b>9</b>
<b>IV. Missouri As a Plant Location</b>	<b>16</b>

## Highlights

The demand for household appliances will continue to increase due to rising personal income, household formations, and replacement of obsolete or worn out units. This increased demand will require increased production capacity.

The increase in production capacity can be provided by expansion of existing plants which are concentrated in the northeastern one-fourth of the United States or by building new plants. A combination of factors suggests that manufacturers should consider building new plants outside the traditional manufacturing area - particularly in the Midwest. The center of population has shifted westward and labor is relatively more available at lower costs.

Missouri offers many advantages as a site for manufacturing appliances.

(1) The center of population is near St. Louis. The center of population is expected to continue shifting westward; therefore, the center of population will be in Missouri for many years.

(2) Few states can match Missouri in the variety of transportation facilities available to industry. These include two major rail terminals, barge facilities on both the Missouri and Mississippi Rivers and a wide selection of truck freight lines.

(3) Labor is relatively more available in Missouri as compared to the industrial Northeast.

(4) The average weekly manufacturing wage was \$78 or less in one-half of Missouri's counties during 1967. Nearly all of these counties are readily accessible by rail and/or truck transportation.

## I. Introduction

Home appliances have become commonplace in modern homes for labor saving and convenience. Nearly every home is equipped with at least one appliance while many homes have five, ten or even fifteen or more separate units. While the term "appliance" includes a multitude of products of various sizes and uses, this study will consider only eight larger appliances:

Refrigerators	Ranges
Freezers	Dishwashers
Clothes Washers	Water Heaters
Clothes Dryers	Room Air Conditioners

The manufacture of these larger appliances has been historically concentrated in the northeastern portion of the United States. Although manufacturing plants have recently been established in the Midwest, South, and Far West, only a limited number are located in Missouri.

The purpose of this report is (a) to examine the important locational factors for the manufacture of larger home appliances and (b) to determine the advantages offered by Missouri to appliance manufacturers.

## II. Description of the Industry

### Growth of the Industry

Many appliances such as ranges, refrigerators and clothes washers are considered necessities, while others such as dishwashers and clothes dryers tend to be classified as luxuries. In some instances regional differences affect the classification. For example, room air conditioners tend to be classified as a necessity or luxury depending on the climate of the locality. In warm areas such as the South and Southwest, some form of cooling for houses may be considered a necessity while in the cooler climates of the northern areas it may be considered a luxury. During recent years factory shipments of both luxury and necessary appliances have increased substantially.

The illustration on page 4 shows large increases in shipments for dishwashers, room air conditioners and clothes dryers during the period 1958-1968. Although these appliances may be classified generally as luxuries, it appears that increased personal income, product innovations and competitive pricing will eventually result in a large segment of the population considering these appliances to be necessities.

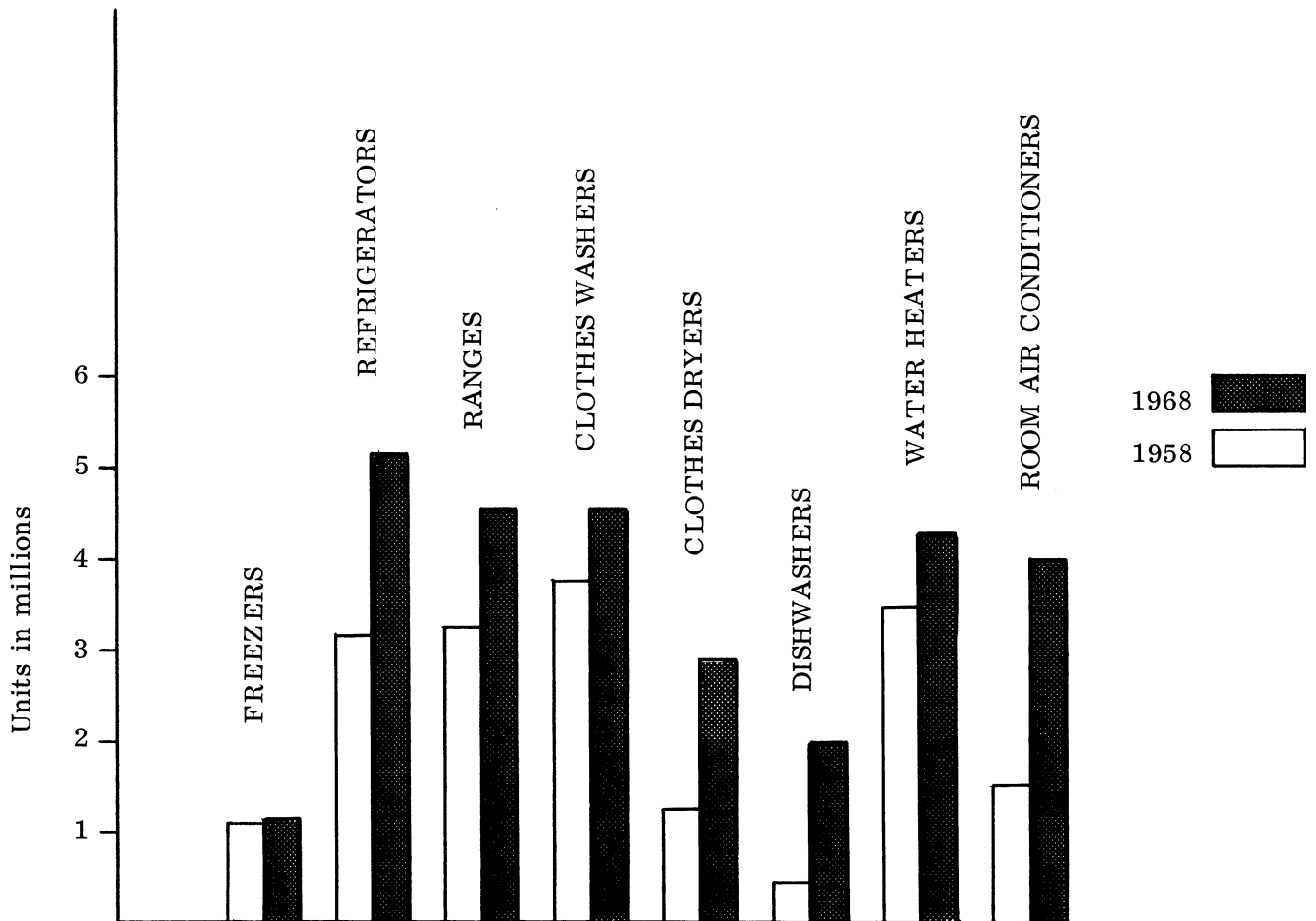
Recent studies indicate that less than 20 percent of all U.S. homes are equipped with a dishwasher, and only about one-third have a clothes dryer, while about one-third have at least one window air conditioner. The acceptance of these appliances as necessities provides a vast market potential.

In addition, two other factors will contribute to continued expansion in the appliance industry; namely family formations and

replacement of worn out or obsolete units.

The number of households is expected to increase rapidly during the 1970's. One report projected the number of households in the United States to increase from 59.4 million during

## Growth in the Appliance Industry



1967 to 68.2 million by 1975 and to 74.7 million by 1980.<sup>1</sup> Most of these additional households will require at least the basic appliances (range, refrigerator, clothes washer and water heater) and many will have several others in addition.

The replacement of worn out or obsolete appliances presents a potential similar to past sales. For example, the expected useful life of a clothes washer is about ten years, which means that replacement sales during 1970 will be similar to the original sales during 1960. Other appliances have a useful life ranging from seven to twenty-five years. Growth in the replacement demand can, therefore, be approximated by examining past sales.

In summary, three factors will tend to increase sales of appliances. Continued increases in personal income will foster re-classification of selected appliances from "luxuries" to "necessities." Household formations are expected to increase rapidly during the 1970's and finally, replacement demand will increase parallel to past sales.

### Industry Location

Most major appliance manufacturing plants are located in the Northeastern one-fourth of the United States. The fourteen states of New York, Pennsylvania, New Jersey, Connecticut, Massachusetts, Rhode Island, Michigan, Illinois, Indiana, Ohio, Kentucky, Minnesota, Iowa and Wisconsin accounted for nearly two-thirds of all appliance manufacturing plants during 1959. A noticeable shift from the Northeast can be detected by examining the location of new plants in 1959-67. During the period 1959-67, 137 plants were added; twenty-nine of which were added in the

---

<sup>1</sup>Looking Ahead. Volume 17, No. 4, May 1969, National Planning Association, 1606 New Hampshire Avenue, N.W., Washington, D. C.

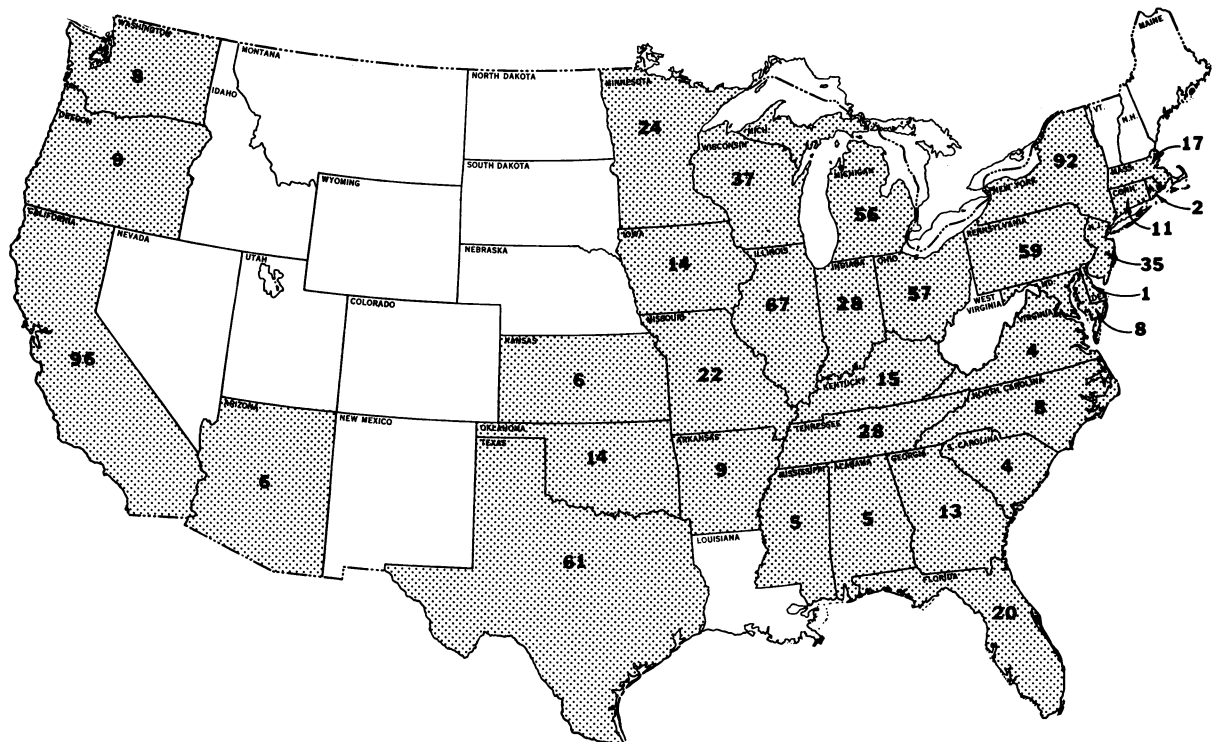


fourteen states listed above and the remaining 108 were scattered through the other states. During 1967 the fourteen major producing states still accounted for 61 percent of all appliance manufacturing plants.

The only area that gained in the number of plants manufacturing each item during the 1959-67 period was an area including Arkansas, Louisiana, Tennessee, Mississippi, and Alabama.

The future location trends of the industry are dependent on a combination of factors which will be discussed in later sections. It is the author's opinion that a number of new plants will be established in the central and south central part of the United States to supply a portion of the projected increased demand for appliances.

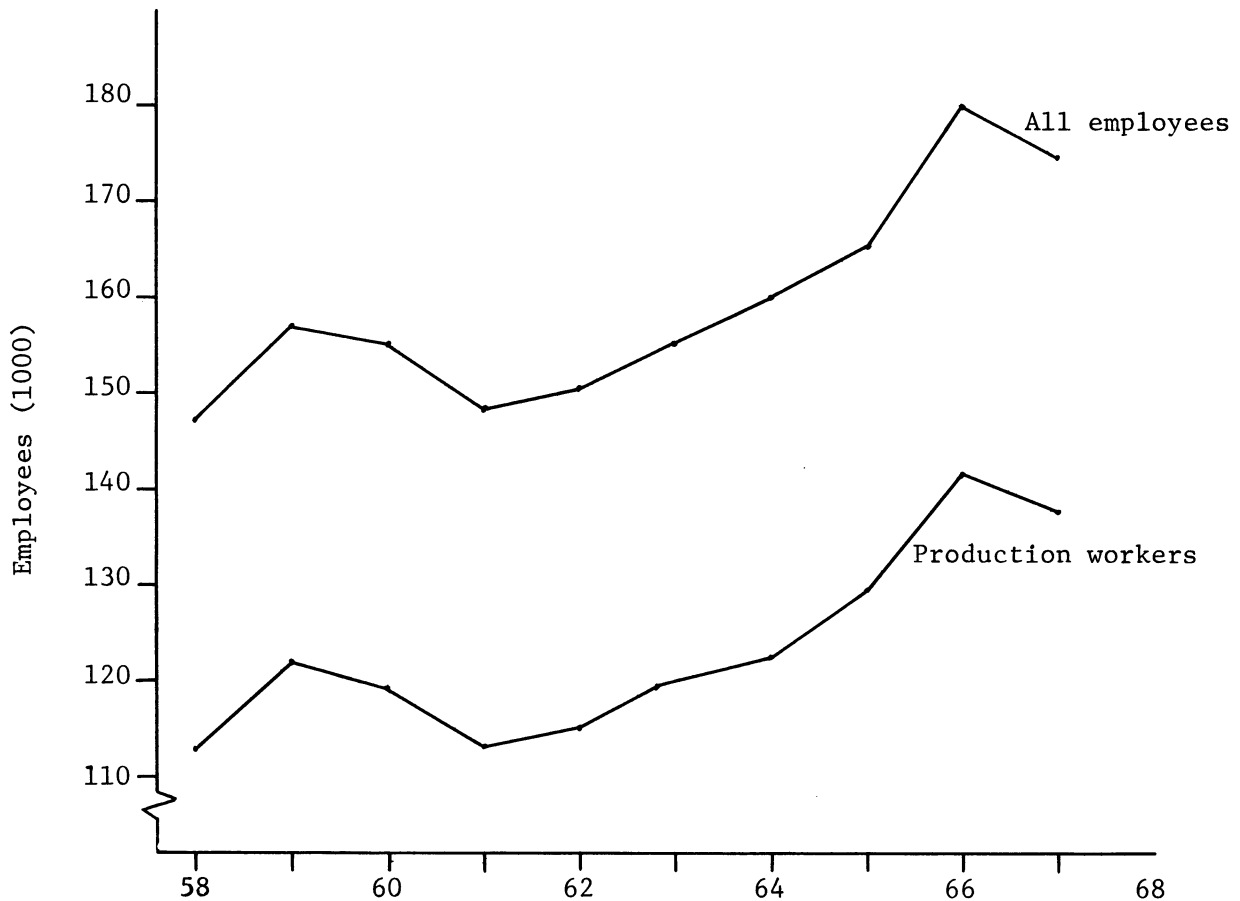
## Location of Appliance Manufacturers



## Industry Employment and Wages

Employment in the home appliance industry has shown gains during the period 1958-67, although there were year-to-year declines during 1960, 1961, and 1967. During 1967, a total of 174,500 were employed as compared to 147,000 during 1968, an increase of more than 18 percent.

### Employment Has Increased



Continued increase in employment can be expected as a result of projected increases in appliance sales.

Wage rate levels in this industry have been slightly higher than the "all manufacturing" average. The higher level is likely due to the extensive metal working requirements for appliance

manufacture. Metal workers normally command a higher wage than do assembly line workers. At any rate, historic weekly wage levels for appliance production workers and all manufacturing production workers is presented in Appendix A. For comparative purposes, the average weekly wage level for all manufacturing production workers is shown for Missouri. It should be noted that the "average" wage is a composite of many wage levels. As will be shown later, in many parts of Missouri the manufacturing wages are considerably below the state average.

### **III. Location Factors**

#### Major Location Factors

Visits with representatives of the appliance industry revealed that plant site selection is based on a combination of factors, including inbound freight costs, outbound freight costs, labor cost and labor availability. No single factor is dominant, but rather the most favorable combination is sought.

Locational factors will be discussed here in general terms. Generation of a useful model is not possible since the assumptions regarding external variables would determine the model structure. For example, the product or product mix to be manufactured, the geographic market served, the company's existing plant locations and capacities would each affect the structure of the model. For this reason, locational factors will be examined in general terms with the hope of providing data and comments which may be helpful to individual firms in selecting manufacturing locations.

In discussing the location factors for plant sites of the several appliances, a categorical grouping may be helpful. Groups are based on the major raw materials used in manufacture; and the relative weight of the finished product.

The weight of the finished appliance is an important factor in outbound freight. Carload lot tariffs stipulate a minimum carload weight. The shipment is charged for the minimum weight even though the actual weight may be less than the minimum. The three groupings shown in Table 1 will be considered. Based on these broad groupings, location factors can be appraised in a general manner.

## Product Groups

GROUP I HEAVY	GROUP II LIGHT	GROUP III VERY LIGHT
Refrigerators Freezers Air Conditioners	Dishwashers Clothes Washers Clothes Dryers	Ranges Water Heaters
<u>Major raw materials-</u> compressors, sheet metal.	<u>Major raw materials-</u> sheet metal motors, iron.	<u>Major raw materials-</u> iron, sheet metal.

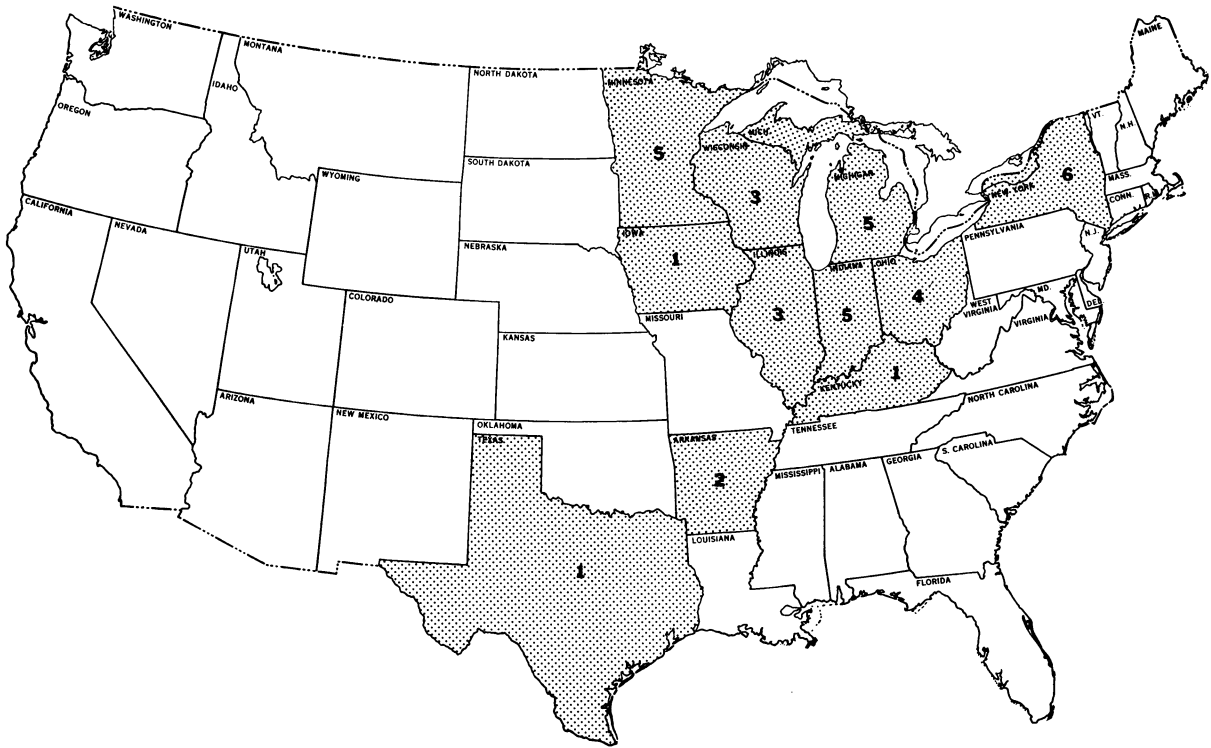
### Group I - Refrigerators, Freezers and Air Conditioners

The major raw materials used for the manufacture of this group of appliances include sheet metal and electric compressor units. (Gas operated units are outside the scope of this study.) Of course, there are many other raw materials used in the manufacture of these appliances such as electrical wiring, controls, switches, hardware, plastic parts, etc. These materials are not considered in this analysis since the per unit freight is minimal and the materials are readily available in many parts of the country.

Sheet metal is shipped freight equalized to the nearest producing mill while compressors are normally sold f. o. b. plant. Some major appliance manufacturers produce compressors for their own needs as well as marketing units to others. The major steel mills and compressor manufacturing plants are located in the northeastern United States. Since the minimum weights on outbound shipments can generally be met, appliances in this group can be manufactured in a single plant for national distribution. Ideally, the plant should be located near steel mills and compressor manufacturers.

# Refrigerators and Freezers

## Plant Numbers by State



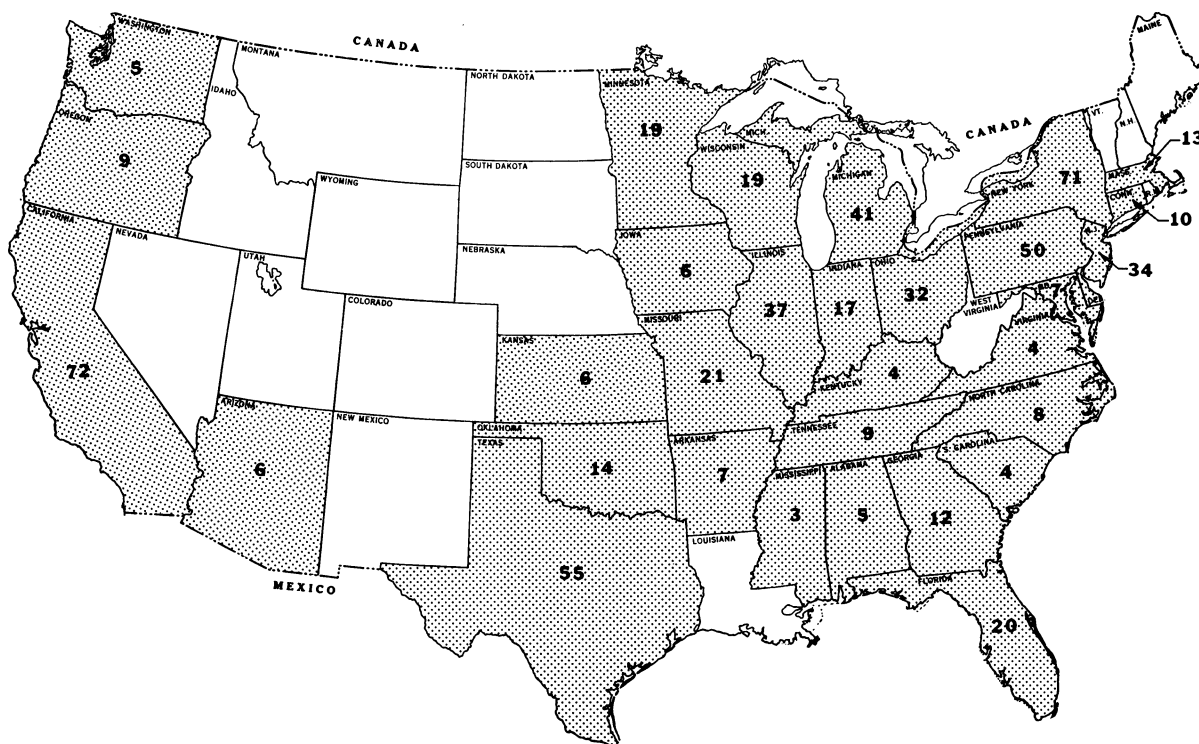
Source: County Business Patterns, 1967. U.S. Department of Commerce, Bureau of the Census.

Thus, while freight considerations would seem to dictate a northeastern location if distribution is to be national, labor considerations, the other important factor, do not. The supply of labor in the "manufacturing belt" has become extremely tight. Thus, some companies have found it beneficial to locate appliance plants in the Midwest and South where labor is not in such short supply and wage rates are somewhat lower. The decisive factor, of course, is whether the lower labor costs offset the added freight costs - and in many cases they will. At any rate, manufacturers should analyze the situation before assuming that the traditional areas still offer the greatest economic advantage. That Group I appliance manufacturers are becoming aware of these changing economies is evident from the number of new plants located outside the Northeast in recent years.

A midwest or southern location can be particularly beneficial if two plants are used to serve regional markets rather than one plant to serve the national market. If a company serving the national market from one plant in the Northeast is faced with plant expansion to meet increased demand, it may improve its market position by restricting the market of the existing plant to the Northeastern area and establishing a second plant in the Midwest or South to serve western and southern markets. As was noted earlier, companies have found that lower costs outside the industrialized Northeast often offset the increased inbound freight costs.<sup>1</sup>

## Air Conditioners - 1967

### Plant Numbers by State



Includes manufacturers of commercial refrigeration equipment.

Source: County Business Patterns, 1967. U.S. Department of Commerce, Bureau of the Census.

<sup>1</sup> Synopsis of a conversation with an industry executive.

It should be noted that refrigerators and freezers tend to be marketed under national brands, while many air conditioners are marketed under regional or local brands. Many small manufacturers assemble and market air conditioners in conjunction with their other operations. Although they have contributed significantly to the increase in the number of air conditioner manufacturers, these smaller manufacturers serving a local or regional market are outside the scope of this study.

#### Group II - Dishwashers, Clothes Washers and Dryers

Outbound freight is likely to be a major consideration for these appliances since they are somewhat bulky and minimum car-load weights are difficult to achieve. The ideal location for manufacture is near the market to be served or, as an alternative, between the sources of raw materials and the market. A location between the sources of raw materials and the market provides the effect of "intransit processing." This arrangement eliminates the need to ship the finished appliance back toward the area of source of raw materials. Historically, these appliance manufacturers have concentrated in the northeastern United States where, in addition to considerable steel and electric motor production, there are large concentrations of population. As the center of population has shifted westward resulting in additional outbound freight, manufacturers have begun to examine locations in the Midwest and South.

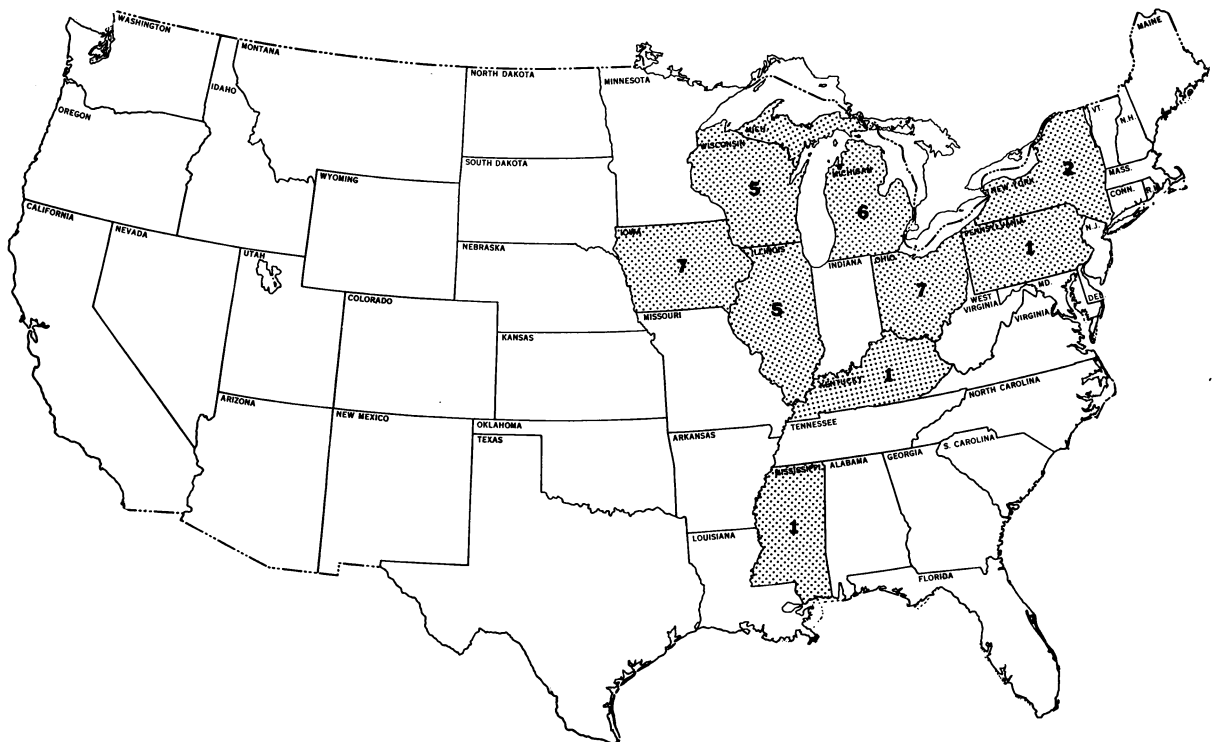
One manufacturer stated that their Great Lakes plant has been operating at about one-half capacity because of labor shortage. They have lowered their hiring standards to the point that labor turnover has caused excessive costs for training and administration. Their solution was to establish a second plant in the south central area to serve the South, Southeast and West and continue to operate the older plant at less than capacity. The increasing demand for appliances, the westward shift in center of population, and the relative availability of labor in the Midwest and South.



is expected to reinforce the trend of new plants being located outside the traditional area.

## Clothes Washers and Dryers - 1967

### Plant Numbers by State



Source: County Business Patterns, 1967. U.S. Department of Commerce, Bureau of the Census.

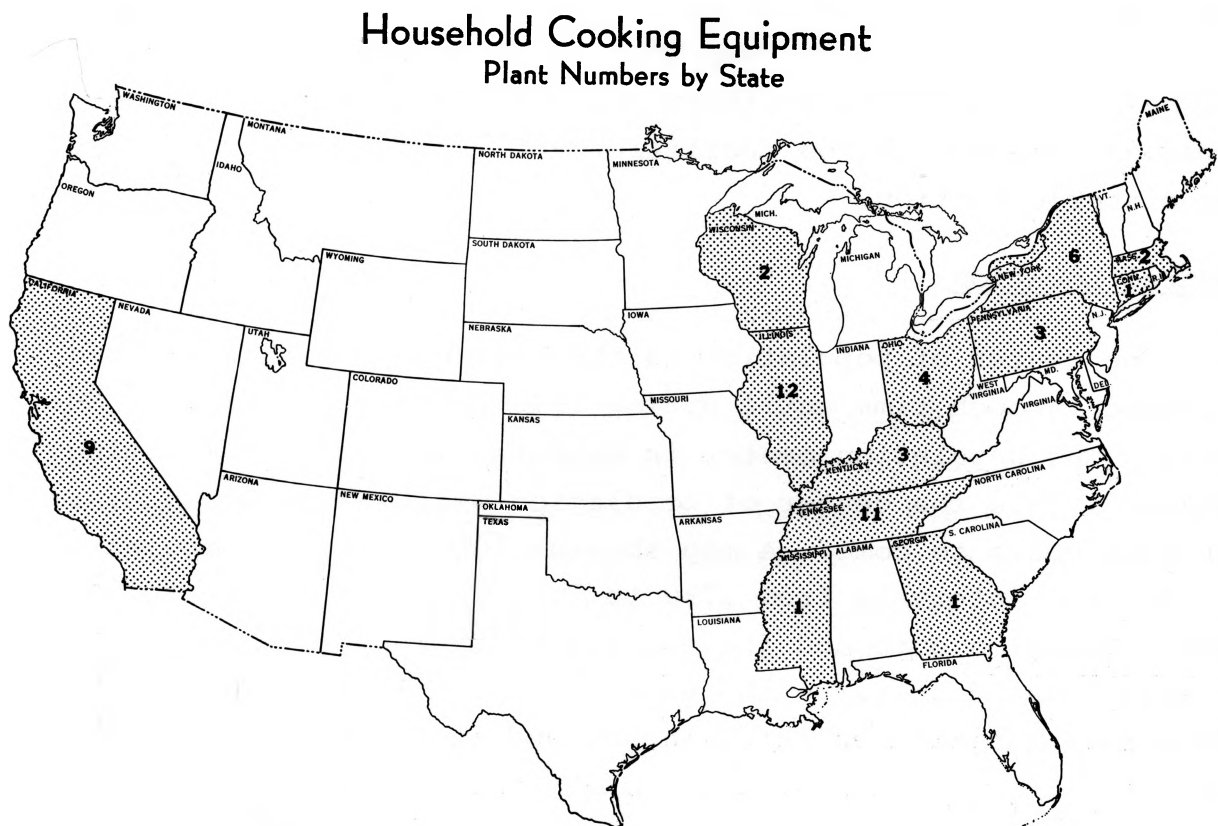
### Group III - Ranges and Water Heaters

These appliances represent somewhat of a special situation. They are very light and, therefore, manufacture near the market would tend to minimize freight costs. In practice, it is common to find these products manufactured in plants also manufacturing other products. For example, it is not unusual to find ranges

produced in plants that also manufacture refrigerators and/or clothes washers and dryers. Many times water heater manufacture is associated with the manufacture of other laundry or heating equipment. In these cases, the plant site is dependent on the locational characteristics of the companion products.

For those plants that produce only ranges or water heaters, a location near the center of the market they serve is preferred.

## Household Cooking Equipment Plant Numbers by State



Source: County Business Patterns, 1967. U.S. Department of Commerce, Bureau of the Census.

## IV. Missouri As a Plant Location

### Appliance Manufacturers in Missouri

The 1969 Missouri Manufacturers' Directory reveals only a limited number of appliance manufacturers in Missouri. There were no refrigerators, freezer, clothes washer, clothes dryer, or water heater manufacturers reported and only one dishwasher and one range manufacturer. There were, however, ten manufacturers of room air conditioners.

Missouri offers an attractive location as a site for appliance manufacturers interested in establishing a plant for national distribution, as well as for manufacturers who are planning an additional plant to serve southern and western markets. The central location, transportation facilities and labor force are favorable for either situation.

### Central Location

The center of population in the United States has shifted westward through time until during 1970 the center was near St. Louis. The population center is expected to continue shifting westward, thus the center of population will likely be in Missouri for some years to come. A map showing the center of population at ten year intervals from 1790 to 1970 is shown on the following page. Based on outbound freight costs, a plant in Missouri would be well located to serve the sectional markets of the South and West, or a national market both now and in future years.

# The Center of Population Is Near St. Louis



## Transportation

Few states can match Missouri in the variety of transportation facilities available to industry. These include two major railroad terminals (Kansas City and St. Louis), barge facilities on both the Mississippi and Missouri Rivers, and a wide selection of truck freight lines. This makes possible the use of barge lines for inbound shipments of raw materials and truck or rail for outbound shipments in carload lots. In addition, truck shipments can be used for "pool shipments" with "drop shipments" at various locations. Appendix B shows the normal truck delivery times from Missouri to other states and Appendix C shows the rail network. The strategic location of the state in the "heart of America" makes possible delivery within three days for three-fourths of the United States.

# Missouri Transportation



## Labor

As was noted previously, labor availability is becoming a major consideration in plant site selection in the appliance industry. Labor force projections by the U.S. Department of Labor indicate a substantial increase in the labor supply for Missouri manufacturers. The projections for the years 1970 and 1980 are shown in the following table.

## Labor Force Projections

State	Estimated Labor Force		Increase
	1970	1980	
Arkansas	769,000	894,000	+125,000
Iowa	1,189,000	1,352,000	+163,000
Kansas	980,000	1,117,000	+137,000
Missouri	1,838,000	2,038,000	+200,000
Oklahoma	1,016,000	1,160,000	+ 44,000

Source: Special Labor Force Report No. 74, Labor Force Projections by State, 1970 and 1980, U.S. Department of Labor, October 1966.

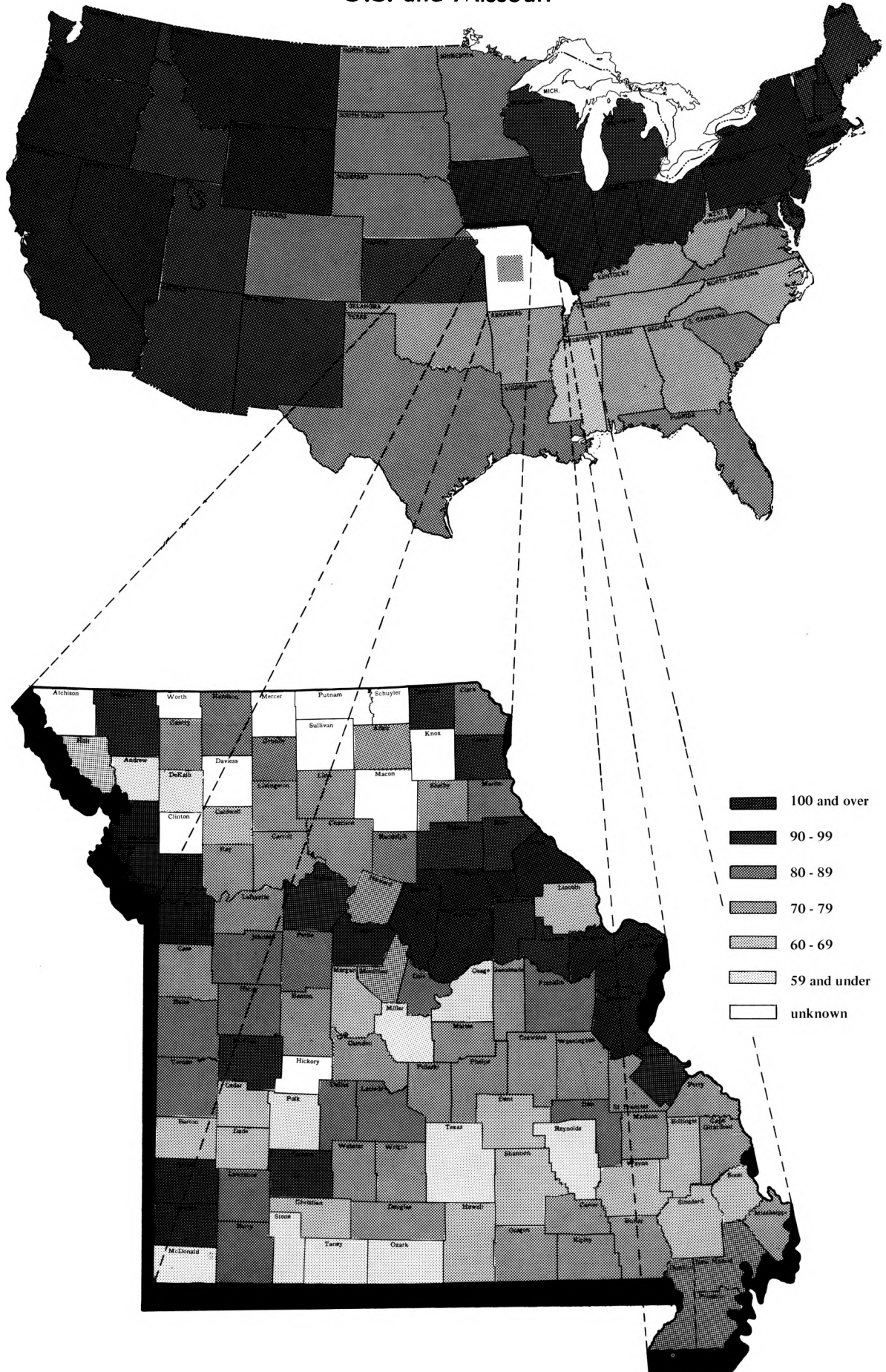
Although the South is generally assumed to be the area of low labor cost, Missouri compares very favorably in this respect. An analysis of the average weekly wage of manufacturing workers in Missouri, for the first quarter of 1967 revealed that the median average county wage was \$78.

## Missouri Wage Levels

Average Weekly Wage	No. of Counties	Percent
\$100 and over	14	12.3
\$90-99	11	9.7
\$80-89	21	18.4
\$70-79	27	23.6
\$60-69	22	19.3
\$59 and under	9	7.9
Unknown	<u>10</u>	<u>8.8</u>
Total	114	100.0

Source: County Business Patterns, 1967.

# Average Weekly Manufacturing Wage Levels U.S. and Missouri

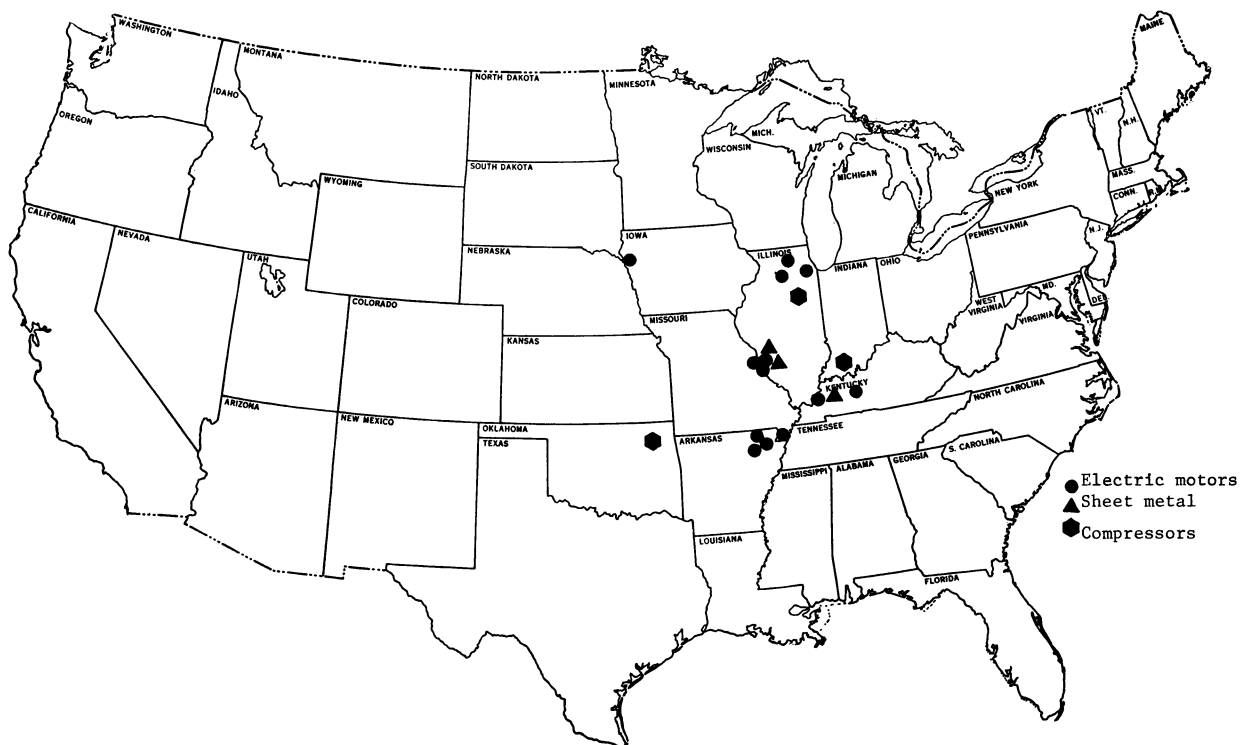


These data suggest that although the statewide average manufacturing wage in Missouri is comparable to the national average, there are many areas of the state where wages are substantially lower. The median of \$78 means that one-half of Missouri counties had an average weekly manufacturing wage below that figure in 1967. The rail and highway network in Missouri make most of the lower wage areas readily accessible to manufacturers.

### Raw Materials

The raw materials for appliance manufacture (sheet metal, compressors, motors) are readily available either from Missouri manufacturers or from manufacturers located in the surrounding states.

## Raw Materials are Available to Missouri Appliance Manufacturers





Sheet metal is produced at plants in Alton and Granite City, Illinois, and in Owensboro, Kentucky. As was noted earlier, steel is sold freight equalized to the nearest producing mill; therefore, freight to a Missouri plant would be equalized to one of these plants.

Although compressors are not manufactured in Missouri, there are producers in Tulsa, Oklahoma; Decatur, Illinois; and Evansville, Indiana. These four nearby suppliers should provide competitive prices and services to a Missouri appliance manufacturer.

Electric motors are available from a number of manufacturers in Missouri and adjoining states. There are reported to be four such manufacturers in Missouri, three in Illinois, three in Arkansas, two in Kentucky and one in Iowa.

### Summary

Missouri provides locational advantages which should be attractive to appliance manufacturers.

A major factor is labor availability and lower labor costs. During 1967, more than one-half of Missouri counties had an average manufacturing wage of less than \$78 per week. Manufacturers have discovered that increased inbound freight costs are more than offset by the reduced labor costs when locating plants in the Midwest and South.

Not only are wage rates in Missouri comparable to southern states, but Missouri also offers a range of transportation facilities not offered by other states. The rail network is supported by two major rail terminals - Kansas City and St. Louis. Barge facilities are available along on both the Mississippi and Missouri Rivers, thus providing water transportation along the entire eastern border and across the mid-section of the state.

Major highway facilities include two interstate highways which transverse the state, contributing to prompt truck freight deliveries.

Finally, major raw materials could be provided by either Missouri manufacturers or by manufacturers in nearby states. Since it is likely that more than one manufacturer of each raw material would compete to supply a new Missouri appliance manufacturer, pricing and services should be attractive.

APPENDIX A  
Average Weekly Earnings

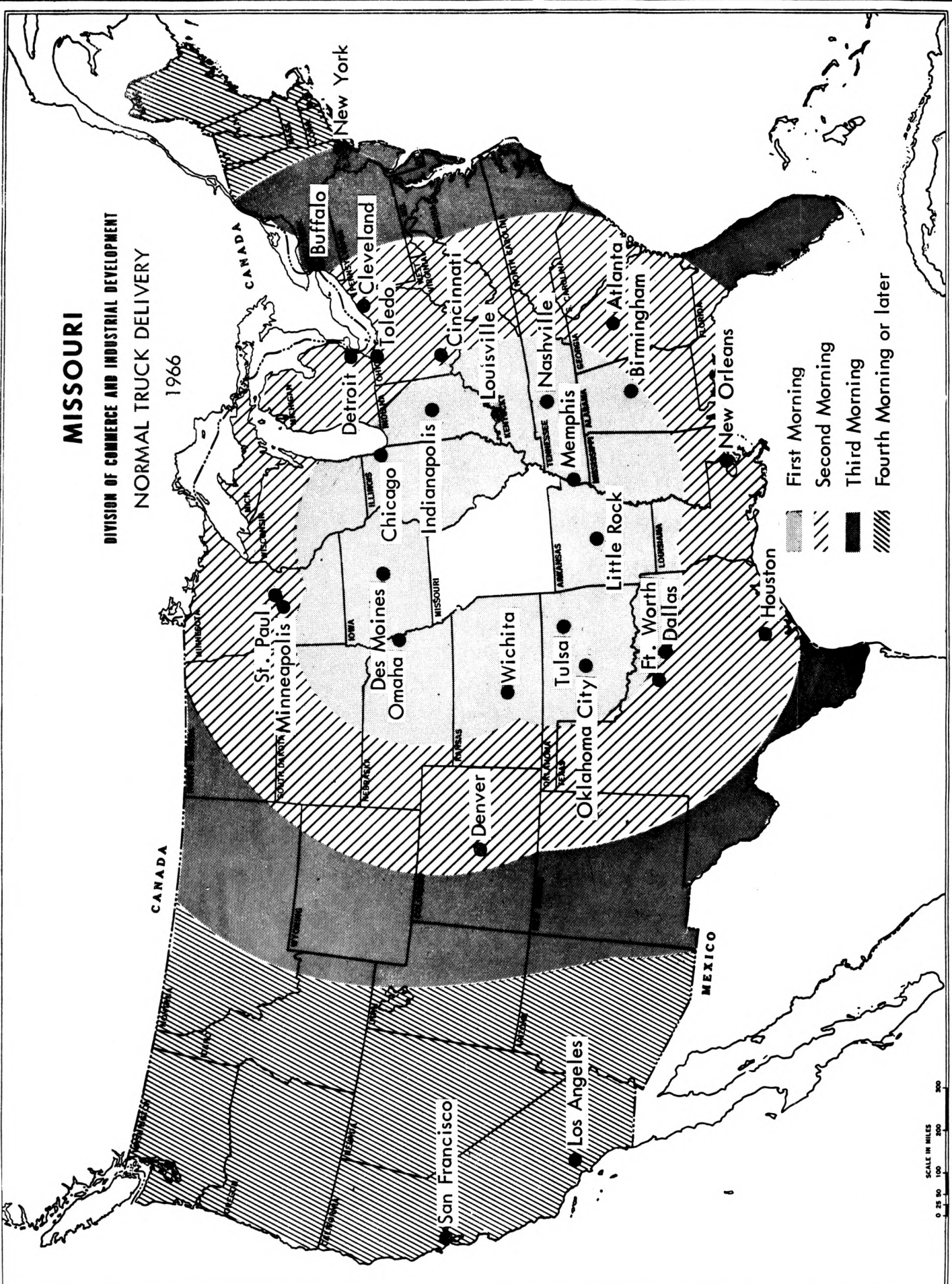
	All Production Workers			Appliance Mfg. Production Workers		
	<u>1960</u>	<u>1965</u>	<u>1968</u>	<u>1960</u>	<u>1965</u>	<u>1968</u>
United States	\$89.92	107.53	122.51	\$96.23	114.95	127.89
Missouri	\$87.57	105.51	122.31	NA	NA	NA

# MISSOURI

DIVISION OF COMMERCE AND INDUSTRIAL DEVELOPMENT

NORMAL TRUCK DELIVERY

1966



SCALE IN MILES  
0 25 50 100 200 300

Missouri

ILLINOIS

KENTUCKY

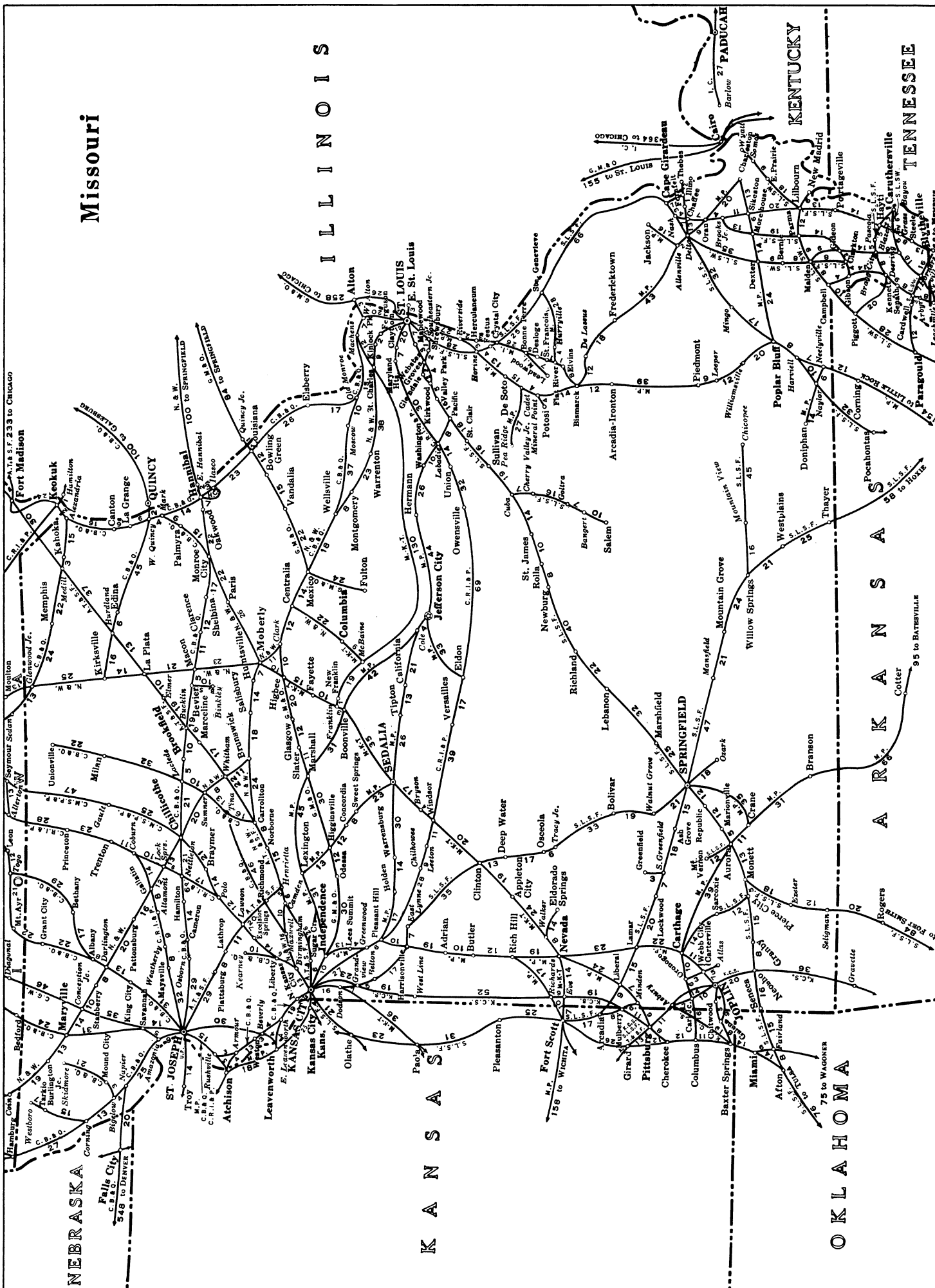
TENNESSEE

NEBRASKA

KANSAS

OKLAHOMA

ARKANSAS



UNIVERSITY OF MISSOURI - COLUMBIA  
ELL SPC SPEC-M  
HD9999.H83 M85



010-006881706

IBM H159714

**DO NOT REMOVE THIS CARD**

IF THIS CARD IS LOST OR MUTILATED BEYOND  
USE IT WILL BE NECESSARY TO CHARGE \$1.00  
FOR REPLACEMENT.

STARK. MAJOR\*HOUSEHOLD I\*APPL I AN

AUTH DR AND T I E



MISSOURI

UNIVERSITY

LIBRARY

SPEC-M  
HD  
9999  
.H83  
.M85  
H15941

