MONTHLY REVIEW

Magnified cross sections of man-made fibers form unusual patterns.

FEDERAL RESERVE BANK OF RICHMOND

APRIL 1959

Man-made Fibers

Zefran, acrylic alloy fiber, in production, July 22, 1958 at Williamsburg, Virginia.

Textile glass fiber, in production, April 1, 1959 at Shelby, North Carolina.

Teron, polyester fiber, multi-million dollar plant under construction near Shelby, North Carolina, production starting, April 1960.

Textile glass fiber, plans being completed for new plant at Laurens, South Carolina.

These new plants are the latest major additions to the Fifth District's already impressive roll of man-made fiber facilities. This list of new fibers and new plants typifies what has been happening in this dynamic industry.

RAYON EARLIEST The rayon processes were first developed in Europe at the end of the nineteenth century but commercial production was not established in the United States until 1910. The District got its first rayon plant in 1917 at Roanoke, Virginia. By 1940 the District had 11 rayon plants—some of them the largest in the nation—and that same year saw a nylon plant opened at Martinsville, Virginia. Since then the number of man-made fiber plants in the District has tripled, giving the area about two-fifths of total United States facilities. Virginia has the greatest concentration of units in the nation, with a total of 16 product plants.

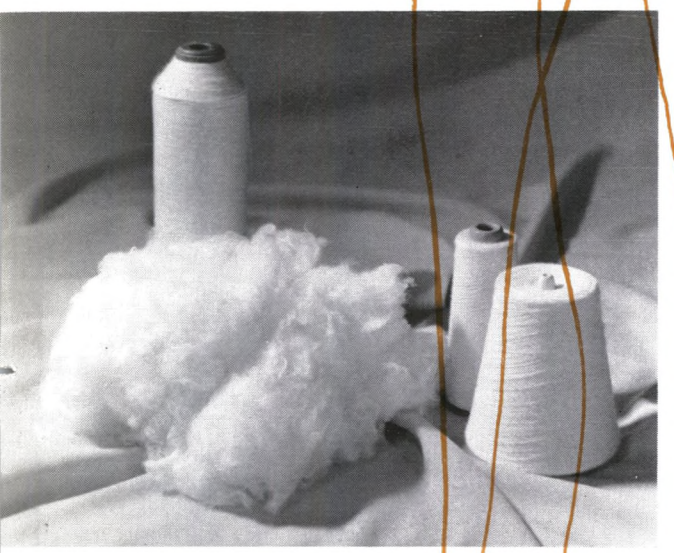
District plants—many of them giants in this field—account for a tremendous hunk of United States capacity. Vastly important to the cities and areas in which they are located, they furnish employment to 30,000 people in the District and pay out annually about $160 million in wages and salaries.

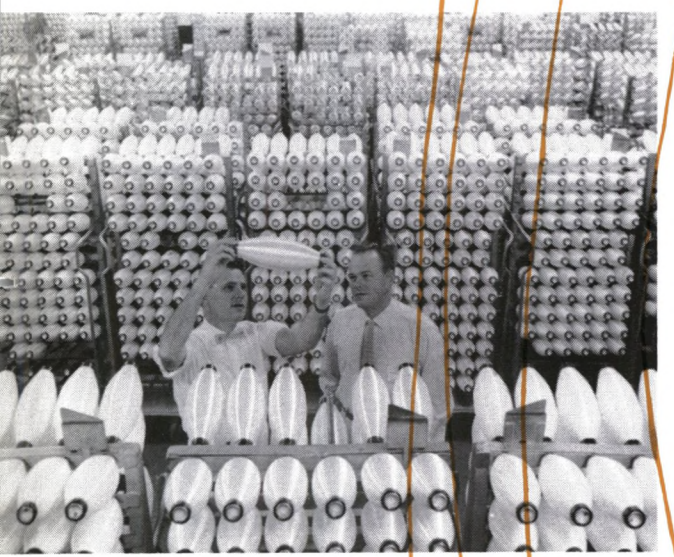
Large investment in fixed equipment—comparable with that of steel and petroleum—is one of the dominating characteristics of the man-made fiber industry. Each plant is usually designed to produce one particular fiber, and for efficient operation each one must have a fairly substantial output. Most plants in this industry are capable of producing at least 5 million pounds a year, and some few have a capacity of well over 100 million pounds. The majority, however, are built with annual capacities of from 10 to 60 million pounds a year. The cost of the facilities, roughly speaking, is $1 per pound of annual capacity.

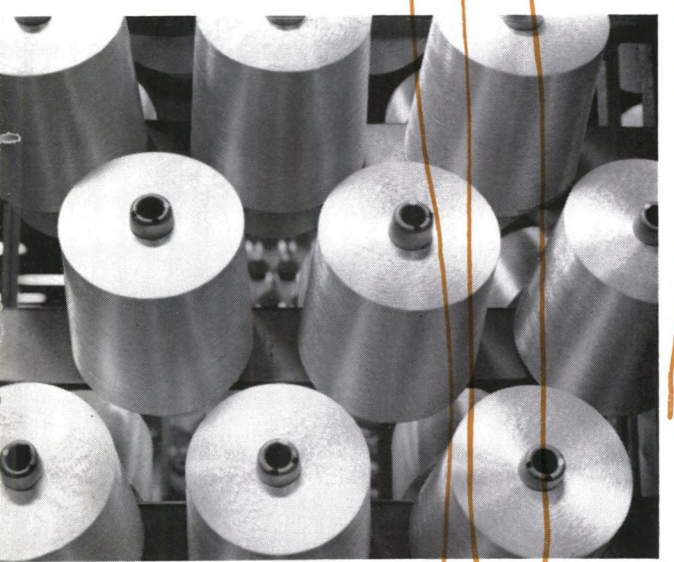
THE FIBERS Just what are these so-called man-made fibers? Generally they are divided into three large groups: cellulosic, non-cellulosic, and textile glass fiber. The cellulosic fibers—rayon and acetate—were the first big break away from natural fibers. They are man-made, however, only in the mechanical sense of the word, because cellulose—usually taken from cotton or wood pulp—is a natural material. Most rayon is made by the viscose process, and the viscose production of rayon is closely similar to the making of acetate, the other cellulosic fiber.

Details of the man-made fiber processes quickly confuse the layman without a good background in chemistry. A simple description of one process, however, serves to give a clearer understanding of the entire industry.

For the viscose process, cellulose arrives from the pulp or cotton mill in sheets. The first step is the blending of these sheets to assure a uniform product. The sheets are steeped for several hours in a solution of caustic soda to produce sodium cellulose. The excess caustic soda is removed by hydraulic presses. A shredder then reduces the







Zefran staple fiber—newest fiber in production in District,
Inspection of nylon fiber,
Cones of Arnel triacetate yarn ready for shipment to customers.

sheets to fluffy crumbs which are stored in aging cans at a constant temperature for many hours. The crumbs are then placed in rotating drums and mixed with carbon bisulphide.

In a few hours the pulp is reduced to an orange-colored, spongy mass. This mass is conveyed to a mixer, where it is stirred in a weak solution of caustic soda to form the viscose for spinning. The viscose solution—resembling molasses—is drawn into tanks, filtered to remove foreign and undissolved matter, and then stored in vats to ripen for four or five days.

The rayon thread is formed by pumping the ripened viscose solution through a spinneret about the size of a thimble and containing many nearly invisible holes. The solution emerges in fine liquid streams which are coagulated into filaments upon contact with an acid bath. The filaments are spun after they leave the bath.

THE NON-CELLULOSICS The non-cellulosics are wholly man-made fibers. Nylon was the first really all-chemical fiber produced and it is still the only one that has reached volume production by industry standards, ranking next to viscose rayon in man-made fiber production. Seven of the nation's fifteen nylon producing plants are located in the District.

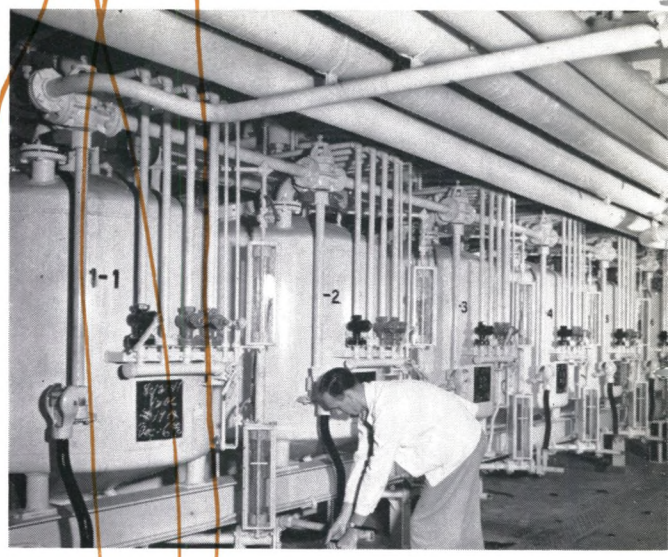
Next to nylon, the acrylic fibers have shown the most growth among the non-cellulosics. Dynel, Orlon, and Zefran are made in the District. Of the acrylic fibers, Orlon—produced for the nation at Waynesboro, Virginia, and Camden, South Carolina—is currently leading the field productionwise.

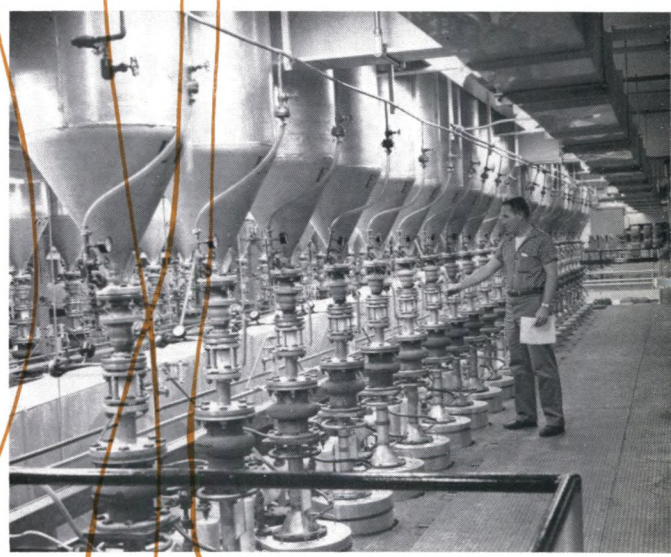
Another all-chemical fiber group is the polyester family. Dacron, introduced in 1953, has been the only polyester fiber produced commercially since then. Production has been centered at Kinston, North Carolina, but other plants are already under construction outside the District.

Saran-type fibers are the fourth commercially successful all-chemical group. Total capacity of this group is not large. In the District, saran-type fibers are produced at Waynesboro, Virginia and Odenton, Maryland.

There are other exciting things going on in the non-cellulosic field in the District. The initial American production of polypropylene fiber at Waynesboro, Virginia and Spartanburg, South Carolina took place last year. Quantities of polyethylene fibers are also produced at these same

Viscose solution is aged in tanks at a controlled temperature,
Melt spinning area of a modern nylon plant,
Cakes of rayon yarn go into tunnel dryers for conditioning.





locations. Teflon, manufactured at Richmond, has been well received for industrial purposes.

Textile glass fibers rank next to nylon in volume of production, according to available trade estimates. While only 1.4 million pounds were produced in 1940, the textile glass fiber manufacturers turned out 103.4 million pounds in 1958—off 4% from 1957. The District has three textile glass fiber plants.

PLACE IN THE FIELD The first man-made fibers were produced in attempts to duplicate silk. The man-made fiber manufacturer no longer works to make a substitute for a natural fiber, but tries to create one to fill certain needs. That these fibers do meet textile needs to a large extent is shown by their increasing importance among total fibers consumed at mills.

In 1940, cotton accounted for 81.0% of total United States mill consumption, wool, 8.3%, and all of the man-made fibers, 10.0%. By 1958, cotton's share of mill consumption had dropped to 65.9% and wool to 5.8%, as man-made fibers had grown to 28.2%. Cotton is far out in front in terms of volume consumed—3,942 million pounds in 1958 as against 1,686 million pounds for man-made fibers. Two things complicate the comparison of natural and man-made fibers: The covering power of man-made fibers is usually higher than that of other fibers—more yards of cloth can be made from the same weight of yarn. All-chemical fibers tend to outlast others, so that replacement is at a slower rate.

In addition, man-made fibers generally resist sudden price changes because fiber cost and availability are more predictable since raw materials are not as subject to the weather and pests. As man-made capacity has increased and techniques improved, prices have moved downward.

CHARACTERISTICS One of the greatest advantages of man-made fibers is that they can be made in an endless variety of chemical combinations and physical forms. In the modern textile world, fabrics are engineered to utilize the special qualities of the individual fibers. Some of the special qualities of viscose and acetate are washability, strength, excellent affinity to dyes, high moisture absorption and retention, very little elasticity and very good conductivity of heat.

A run-down of properties of each of the non-cellulosics would soon become repetitious and

Strands of Dacron ready for stretching to give proper strength, Over 700 bobbins of acetate yarn are wound on one beam, Orlon plant—typical of large size man-made fiber facilities.

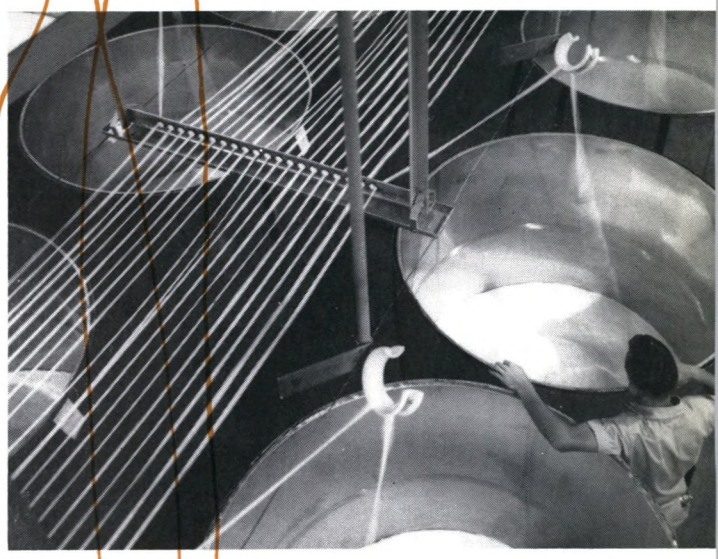
monotonous. Generally speaking, the non-cellulosics have high tensile strength relative to weight, resist abrasion, are washable, low in moisture absorption and retention, high in electrical insulation properties, difficult to dye except by use of special dyes or techniques, nonflammable, heat resistant up to the individual melting points which in some instances are relatively low. These properties may be good or bad depending on the end use of the final product. For instance, the low moisture retention property of the fiber also makes the fabric easy to launder but sometimes uncomfortable to wear.

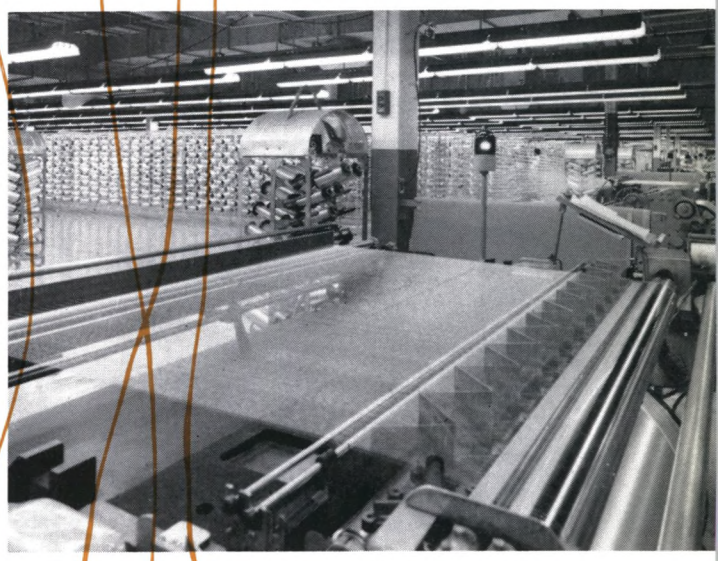
USES The Textile Economics Bureau survey of fiber end use in 1957 shows that the industrial market consumes one-third of all man-made fibers produced—the bulk going for tire cord in the form of viscose rayon. The apparel field uses almost another third with women's dresses and knit underwear consuming quantities of rayon and acetate, and sweaters and hosiery heading the list of non-cellulosic users.

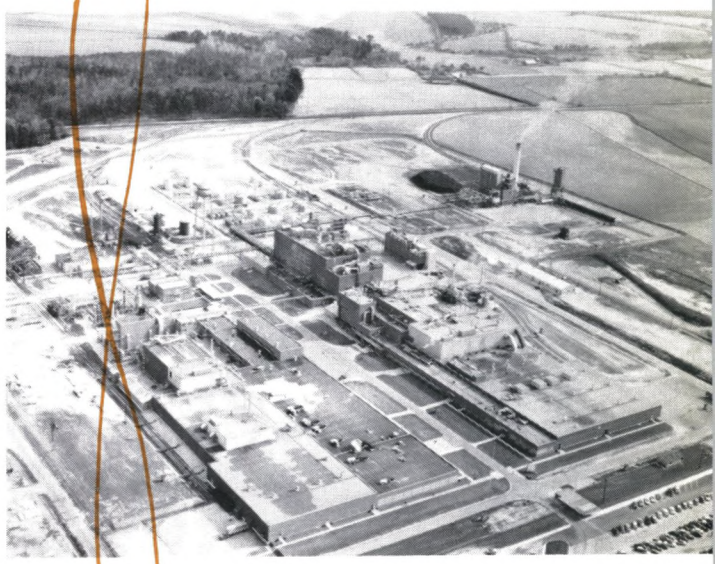
The home furnishings group uses an additional 22% of all man-made fibers. This category has grown considerably since 1953, when it used only 13% of total man-made fibers consumed. Some of this is doubtless due to the consistent rise in use of textile glass fibers for household items—especially curtains and draperies—and nylon and the acrylics for carpeting.

IMPORTANCE TO TEXTILES The importance of the man-made fiber industry to District textile mills cannot be overemphasized. More than 385,000 people—40% of the nation's textile workers—are employed in District mills. More significant, 57% of all textile spindles—cotton, wool, silk, and man-made—are located in this area.

The textile industry and the man-made fiber industry are truly interdependent. Thus, the textile mill and the man-made fiber plant jointly must meet the needs of the American customer to prosper. In the past there has existed a "cotton textile industry," a "woolen goods industry," and a "rayon weaving industry." As more and more blends of natural and man-made fibers are used, the lines of demarcation between the industries are becoming more indistinct. As customers have required different fabrics at particular prices, mills have changed their operations accordingly.



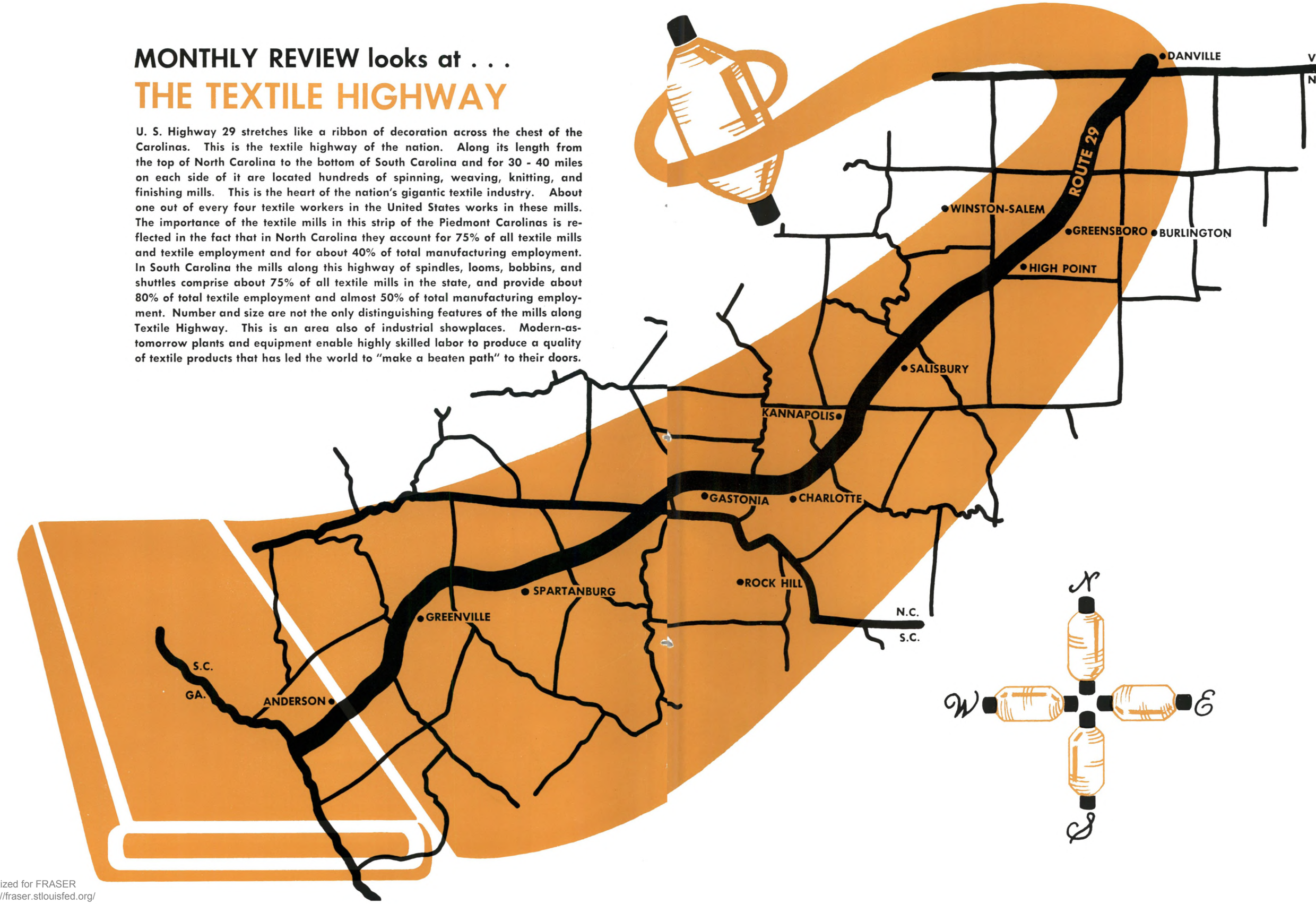




MONTHLY REVIEW looks at . . .

THE TEXTILE HIGHWAY

U. S. Highway 29 stretches like a ribbon of decoration across the chest of the Carolinas. This is the textile highway of the nation. Along its length from the top of North Carolina to the bottom of South Carolina and for 30 - 40 miles on each side of it are located hundreds of spinning, weaving, knitting, and finishing mills. This is the heart of the nation's gigantic textile industry. About one out of every four textile workers in the United States works in these mills. The importance of the textile mills in this strip of the Piedmont Carolinas is reflected in the fact that in North Carolina they account for 75% of all textile mills and textile employment and for about 40% of total manufacturing employment. In South Carolina the mills along this highway of spindles, looms, bobbins, and shuttles comprise about 75% of all textile mills in the state, and provide about 80% of total textile employment and almost 50% of total manufacturing employment. Number and size are not the only distinguishing features of the mills along Textile Highway. This is an area also of industrial showplaces. Modern-as-tomorrow plants and equipment enable highly skilled labor to produce a quality of textile products that has led the world to "make a beaten path" to their doors.



Trading "Over-the-Counter"

Telephones, teletype machines, and wire news services form the hub of operations in the over-the-counter securities market, where transactions aggregate not thousands, nor millions, but hundreds of billions of dollars annually—a larger dollar volume than that handled by any other line of business in the nation. This market has no designated, physical trading center as do the New York Stock Exchange and the Chicago commodity markets. Securities firms, located in cities scattered throughout the nation, are bound into a cohesive working unit by the "man on the phone." Brokers and dealers keep their finger on the pulse of the market and handle transactions with split-second timing over an elaborate system of telephone and private wire communications—the "counter" of modern-day operations.

MEET THE MARKET To the noninvestor, the "over-the-counter securities market" may be nothing more than a term he occasionally encounters as he flips the pages of his morning newspaper. To the novice investor, the little publicized activities in this market may appear to lack the excitement generated by the auction-type buying and selling typical of the exchanges—where, it has been said, "fortunes are made and lost in a day." But to the knowledgeable investor, whether the highly trained expert managing an account for some financial institution or an individual acting for his own account, the over-the-counter market is a finely developed, highly important financial organization designed to facilitate the conversion of idle funds into earning assets and the provision of financial resources to those who go to the market to raise new or additional capital. The over-the-counter market—with "market" used in the sense of encompassing all daily bids, offers, and sales covering the entire range of securities—is not only the largest securities market in the world. It is also a market which serves the needs of investors however large or small, one where single transactions may range in value from a few hundred to many millions of dollars.

Comprehensive information on the value of sales made by over-the-counter firms in any one year is not available. Some concept of its magnitude is given by a special study made by the Wharton School of Finance and Commerce in the fall of 1949, which found every $1 of sales made on stock exchanges matched by $9 of sales by over-the-counter firms. Applying those proportions to the $39.9 billion stock exchange sales volume in 1958 would indicate an astronomical $360 billion of over-the-counter sales last year.

The over-the-counter market is the primary—and in most instances the only—medium for marketing securities which are being offered to the public for the first time, although those securities may later be available on stock exchanges. This market provides the only public outlet for the many outstanding securities which are not traded on the stock exchanges, as well as an important trading medium for many of those which are. Apportioning the $360 billion estimated over-the-

A vast system of private wire communications forms the focal point for operations in the multi-billion dollar over-the-counter market.

Trading and dealing by the smaller securities firms also depends on direct wire contact with other firms and with customers.

counter sales volume for 1958 according to the relative importance of types of sales as given in the Wharton School study gives approximately $40 billion in sales of new securities, and about $320 billion in sales of outstanding issues. On the same basis, nearly $160 billion of 1958 sales by over-the-counter firms were issues that were also traded on the exchanges. This total was four times the total value of sales made on the exchanges last year.

SCOPE UNLIMITED The investor's range of choice among securities of governmental units in the over-the-counter market extends from obligations of the Federal Government through those of states, counties, cities, and towns which are financing needed recreational facilities, water supply systems, or other projects through bond issues. Bonds and stocks of corporations ranging in size from the giant manufacturer with nationwide factories to the small mill whose operations are concentrated in a single locality make a bid for his interest. Shares of public utilities, banks, insurance companies, trust companies—even securities of foreign governments and corporations—can be purchased over the counter to form a part of his investment portfolio. He can, in turn, liquidate holdings of these securities through brokers or dealers in the over-the-counter market.

So broad a trading field exists because the over-the-counter market encompasses virtually all sales of United States Government securities, state, municipal, and corporate bonds, and a large proportion of preferred stock sales. Common stock, characterized by wide distribution and active trading, is better suited to the public auction method of buying and selling characteristic of the stock exchanges and finds its principal market there. When the Wharton School study was made, less than one-third the total dollar volume of common stock sales was handled by over-the-counter firms.

MIDDLEMEN AND MERCHANTS The over-the-counter customer who prefers to handle his transactions through an agent has but to telephone his order for securities to a broker. The responsibility for locating someone who is willing to sell those securities, for handling the transfer, and for transmitting payment then devolves upon the broker. Out-of-pocket cost to the investor includes the price of the securities plus the broker's commission for handling the transaction. Since the broker does not at any time own the securities he handles, he does not run the risk of loss from a price decline nor have the prospect of gain from a price rise during the time which elapses between his receipt of the order for securities and their delivery to his customer.

If he prefers, the investor can purchase over-the counter securities directly from a dealer—a securities specialist who purchases securities for his own account and assumes the responsibility for their resale. His ownership may last no longer than the length of time necessary to make their purchase and their sale by telephone, or it may extend over months. He stands to lose, gain, or break even on sales according to the difference between the price at which he purchases securities and the amount he obtains from their sale. It is this element of risk, inherent in acting as a principal rather than an agent, which distinguishes the dealer's operations from those of the broker.

Although broker and dealer functions are diverse, both are frequently performed by the same firm. In customer contacts, however, the broker-dealer is careful to make clear how each transaction is handled, whether as an agent or as principal.

BEHIND THE SCENES Beyond these direct customer services lie broker and dealer activities which effect the issuance and distribution of new securities and the creation and maintenance of markets for those outstanding—the twofold function which constitutes the essence of the over-the-counter market.

Brokers and dealers frequently participate in the planning as well as in the marketing of new security issues. Their knowledge of security values and of current market conditions can be of considerable assistance to the issuer as he decides the amount and type of securities to be issued, their offering price, and the timing of their appearance on the market.

In addition to advisory service, brokers and dealers bring the new issue to the attention of prospective purchasers and effect its distribution. Generally speaking, securities of new issues are purchased and immediately reoffered for sale to the public, distributed to customers by securities specialists acting as agents for the issuer, or offered first to existing stockholders and others who have a primary right to their purchase, with any unsold portion reverting not to the issuer but to those who have undertaken the distribution.

In the past ten years corporations have increased the proportion of new securities which they offered for sale through public markets from slightly over one-half to nearly three-fourths of their total and have proportionately decreased the percentage privately placed with large investors or sold to owners of existing stock. The $8 billion worth of new corporate bonds and stocks offered for cash sale to the public during 1958 was double the amount ten years ago. Other new short- and long-term securities issued in this country last year included approximately $17 billion by the United States Government and federal agencies, about $12 billion by state and local governmental units, and nearly $1 billion by foreign governments.

The dealer's readiness to buy or sell securities to meet customer needs is basic to the creation and maintenance of over-the-counter markets for outstanding securities. In the jargon of financial circles, a dealer "creates" a market for a given security when he quotes a price at which he will buy and a price at which he will sell one trading unit of the security. He "maintains" the market when he continues to quote "bid" and "offer" prices over a period of time, perhaps accumulating an inventory or going "short" by borrowing securities if his sales exceed his purchases. Without the continuous flow of bids and offers thus provided, the resale potential of over-the-counter outstanding securities would remain unrealized.

KNOWLEDGE + INTUITION As specialists, the broker-dealers are expected to base their own operations and the information given their customers on broad knowledge of individual securities and their issuers, of current market prices and yields, and of price relationships between different types of issues. In addition to keeping abreast of developments in their immediate field, they need to be alert to changes in national and international conditions, and to act quickly and decisively in order to keep pace with fluctuations in the market—so sensitive, so quick to change in response to economic and political developments. Even recognizing that the most experienced securities specialist can err in his judgment, investors consider his furnishing of information and advice equally as essential a function as his actual handling of transactions.

TODAY AND YESTERDAY The securities specialist contacting customers and closing transactions by telephone is as distinctly twentieth-century as the dignified banker in his powdered peruke, transferring securities hand to hand with his customers over the counter of his banking house, was distinctly late eighteenth-century. Modern business women are often as familiar with corporate bonds of jet plane manufacturers as moneyed entrepreneurs once were with those of canal boat builders. Once unrestricted, the issue and the marketing of securities today form the subject of Federal and state regulatory action.

All features of the securities market seem to have changed—all, that is, except one: the vital function it performs in providing the means whereby businesses and governments can raise new capital and institutional and individual investors can find adequate investment opportunities. This flow of funds into channels of business and industry was vital to economic and financial growth when the nation was very young. Its importance, far from diminishing through the years, has been enhanced by the demands of today's highly complex and industrialized society.

The Fifth District

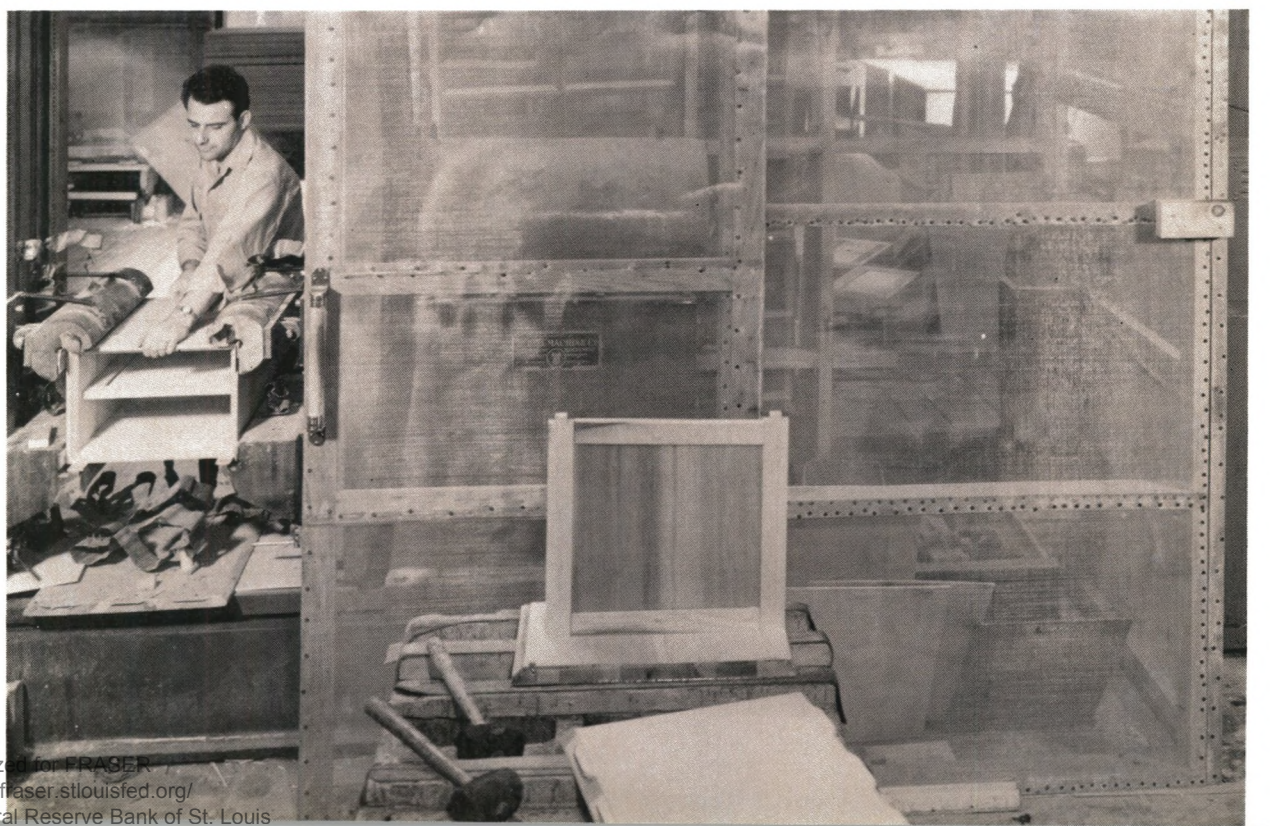
Business has continued to expand in the Fifth District, although the rate of gain has slowed from the early stages of the recovery last year. The slower pace of advance does not appear to be a symptom of underlying economic weakness. For the most part it is a development that economic history indicates is not unusual at this stage of the business cycle. Operations in the District's principal manufacturing industries are at relatively high levels, and considerable strength of demand characterizes retail trade.

FURNITURE New orders received in February by furniture makers fell below the unusually large volume written in January. Taken individually, the 47% increase in new business in January and the 23% decrease in February are misleading. The latter drop is a consequence in large part of the bulge in orders placed during January. The latter, in turn, stemmed largely from the Chicago furniture market and represented orders that otherwise might have been spread over a couple of months. Preliminary reports indicate favorable levels of orders and operations in District factories during March with a seasonal slackening in orders toward the end of the month. The southern furniture market opens on April 11, and it is usually preceded by a couple of weeks of slow new business for the factories.

LUMBER The high level of contract awards for construction, particularly residential, in recent months has provided a firm basis for expansion of the lumber industry. So far this year there has been a steady increase in the volume of orders received by District mills and a noticeable rise in the optimistic attitude held by lumbermen about business prospects this spring. In general, mills are approaching the busy season with relatively low inventories. In some areas of the District, however, mills do have fairly substantial stocks of lumber that are not dry. These mills are also holding, however, a considerable backlog of unfilled orders. Retail lumber dealers are reported as still working with minimum inventories. Indicative of expanding activity are the figures on the southern pine industry for the first 10 weeks of this year: Production was 12% larger than a year ago, shipments were up even more, 22%, while new orders received by mills had risen 25%.

TEXTILES The principal market forces affecting District cotton mill operations during March included: (1) a strong demand for immediate and nearby deliveries of a wide range of gray goods, (2) very scarce supplies of such goods and, accordingly, premium prices, (3) a substantial volume of orders for shipment during the second quarter that left very little production scheduled

Receipt of new orders and production so far this year at District furniture factories are running substantially ahead of a year ago.



for that period available for sale, and (4) considerable price strength in general for cotton gray goods.

With mills unable to take orders for immediate delivery and practically sold out through the second quarter, and with buyers still refraining from placing third quarter orders in any sizeable volume in the hope that prices will soften, the volume of new business being put on the books of District mills had dwindled considerably by the end of March. One of the bases for buyer hopes of lower prices is the feeling that mills might expand output through lengthening the work week. The producers continued through March to deny intentions of abandoning the five-day operating week.

The scarcity of supply to fill orders for immediate delivery has been marked in the market for industrial gray cotton cloth in recent weeks. This has forced buyers to abandon the practice of hand-to-mouth purchasing and to place orders to cover distant requirements. District mills have received orders during the past month for heavy, wide industrial cloth for delivery through the second quarter and during the third quarter.

Production and shipments continued in large volume through March in most sectors of the knitting industry. The characteristic knitting mill situation during the month was one of a fairly substantial volume of orders that maintained a sizeable backlog of unfilled orders and low inventories. Market reports project present high levels of output through the second quarter. Production of nylon seamless hosiery, for example, is reported sold ahead as far as eight weeks.

Prices continued to strengthen during the past month for rayon, acetate, and other man-made fiber cloths. The substantial backlogs of orders for second-quarter shipment together with favorable reports of retail sales of apparel and other textile products indicate relatively high levels of mill operations for some weeks ahead.

COAL MINING Bituminous coal production continues to move contrary to the rising trend of general business activity. The District output declined slightly in February—the fifth consecutive monthly contraction. Early March figures indicate a still further decline. Foreign cargo shipments, a major cause of this industry's recession, have continued on their downward course. Coal loadings at District ports for foreign destinations dropped 19% in the four weeks ended March 7 from the preceding period and were almost one-third smaller than they were a year ago. Reflecting lagging bituminous coal consumption, mining employment in West Virginia declined 1.5%, after seasonal adjustment, in February from the preceding month and was almost 11% smaller than it was a year ago.

EMPLOYMENT The gradually expanding volume of business activity in the District is evidenced by the increasing number of workers on the payrolls of manufacturing industries and other businesses. The latest figures available show employment gains, after making allowance for seasonal forces, pretty much across the board during February. Both the durable and nondurable manufacturing groups increased from their January levels, and varying gains were chalked up in contract construction, transportation, communication, and public utilities, trade, service industries, and government. The only two major categories to show declines were mining and the finance, insurance, and real estate group.

Total nonagricultural employment increased in each of the five states of the Fifth District, with the range of gains running from 0.3% to 0.5%. Nonmanufacturing employment rose slightly in each state except West Virginia. All of the states had increases in their manufacturing employment, with the smallest gain, 0.2%, in South Carolina and the largest, 1.6%, in West Virginia. Despite the rise in employment since the end of the recession a year ago, the total number of workers in each District state, as in the nation, is still short of the prerecession peaks.

Rising employment in February was accompanied by longer work weeks in manufacturing industries. The result was an increase of 1.4% in total manufacturing man-hours, seasonally adjusted. Both the durable and nondurable goods groups showed gains with substantial individual increases accruing to primary metals, stone, clay and glass, and cigarettes.

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