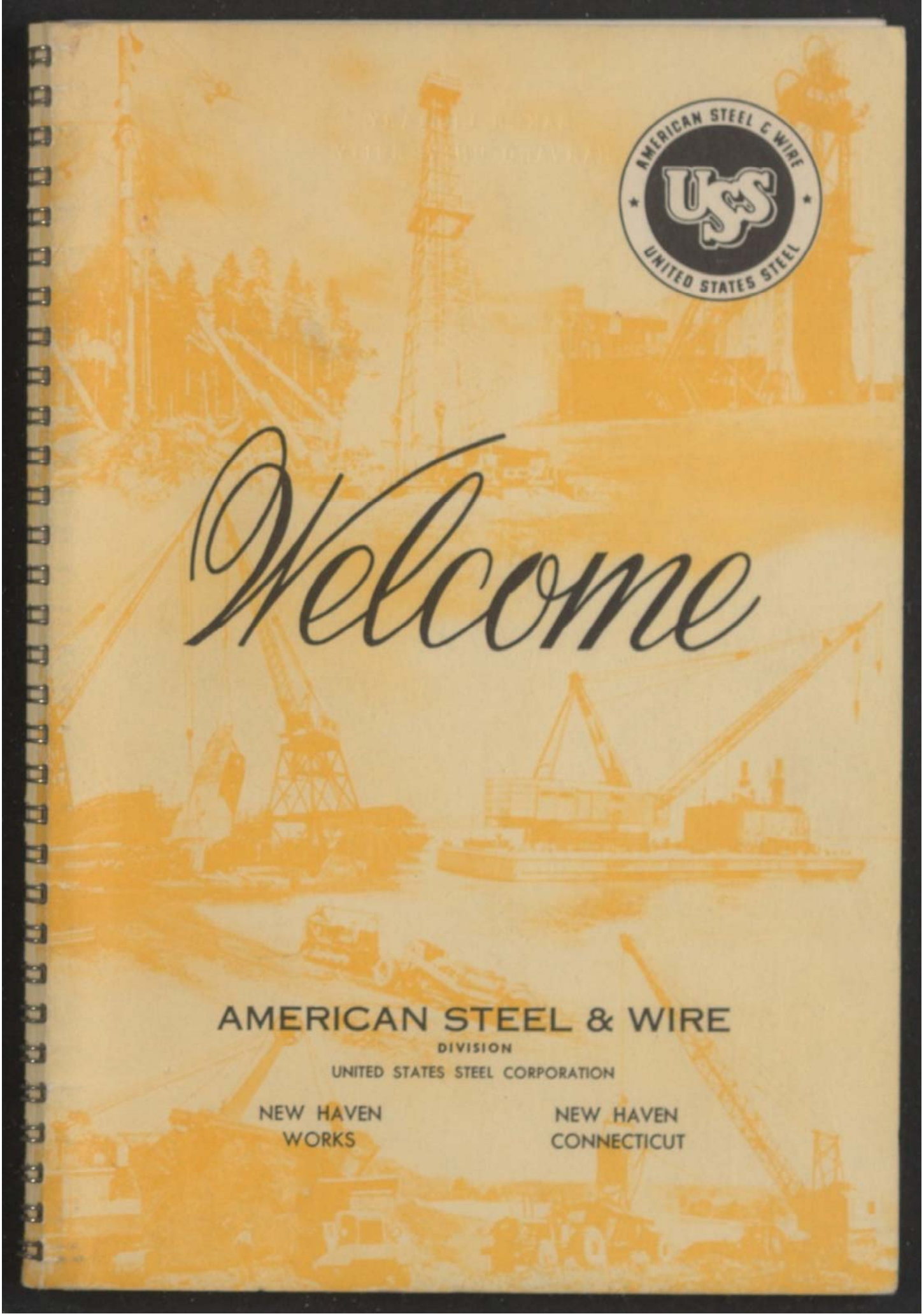


Corporation
G

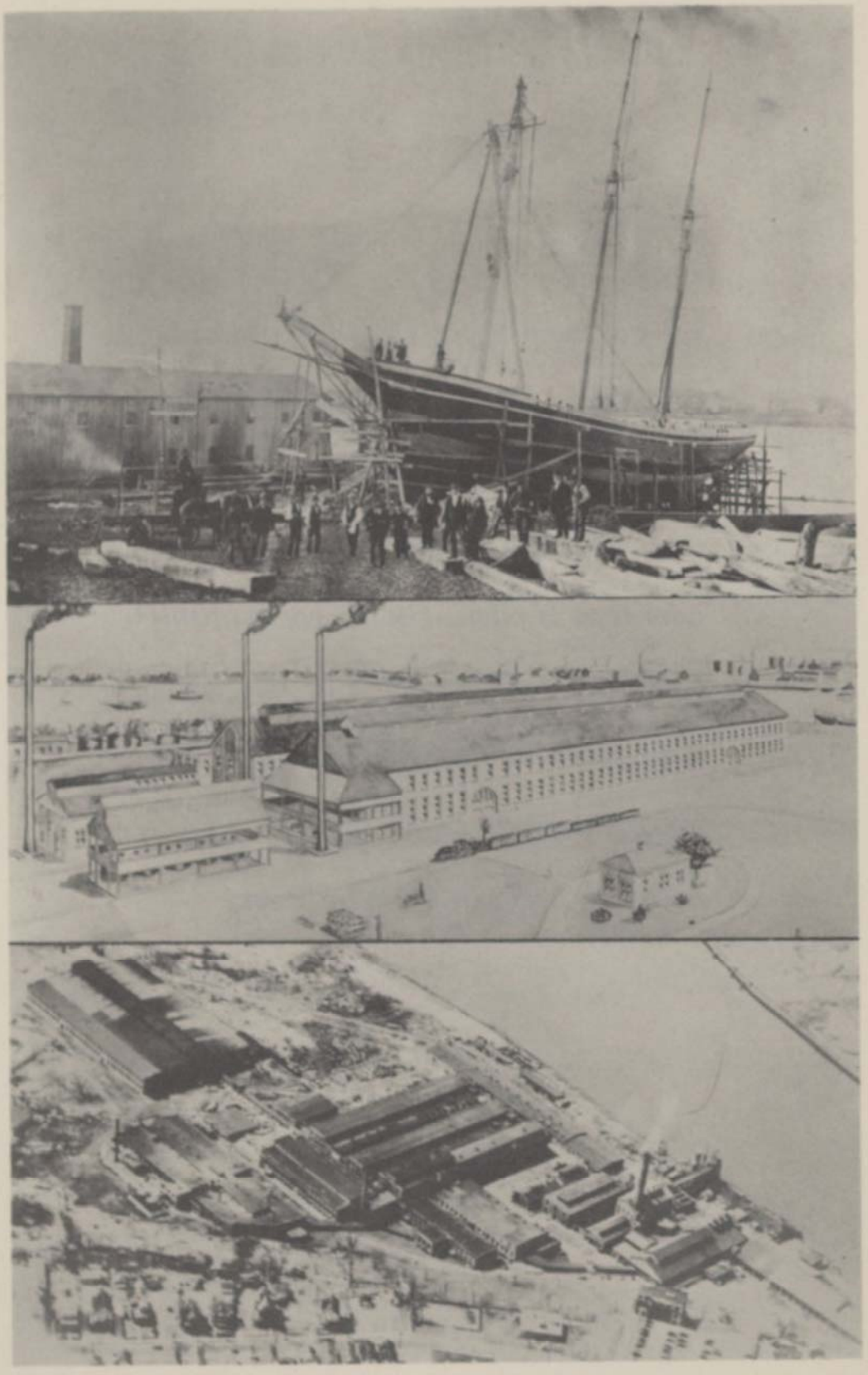
WELCOME

THE employees of the New Haven Works, American Steel & Wire Division, United States Steel Corp., welcome you to their open house in observance of the one hundred and twenty-fifth anniversary of the drawing of steel wire in the United States. They trust that your trip through the plant will be enjoyable and instructive, and that it will give you a better understanding of the operations involved in producing, testing and finishing wire rope, so vital to every-day existence of people everywhere.

.596

In the building of cities . . . hoisting tremendous loads . . . mining . . . oil fields . . . logging . . . elevators . . . ships —yes, wherever the world's work goes on, wire rope is vital. On the pages of this book, you will see some of the many steps taken in the manufacture of this important product—our pride—

American Tiger Brand Wire Rope.



THEN AND NOW

This book is an attempt to show you some of the members of the New Haven Works family at their appointed tasks and to indicate provisions to safeguard their health and to provide opportunities for their welfare. On the opposite page are photographs showing our plant when it was a shipyard (top), as it looked at the time of its acquisition by American Steel & Wire Division (center), and as the largest wire rope manufacturing plant in the world today (bottom).

We trust that this book will be of added interest to you since you have seen these operations on your inspection of the plant.

PEOPLE, PROGRESS, PRODUCTS

While there have been centuries of wire making–first, strips of metal hammered round, and later the discovery that wire could be made by pulling a rod through a hole in a metal plate smaller than the diameter of the rod–it was not until the year 1831 that the manufacture of wire reached a stage where it could not be classed as a novelty. It was then that Ichabod Washburn, father of the wire industry, and Benjamin Goddard began making iron wire in the Northville section of Worcester, Massachusetts. When it was decided to move the business nearer to the heart of the town, Mr. Goddard withdrew while Mr. Washburn went on to invent barbed wire and carry on to phenomenal growth. From him and his successors came the beginning of the American Steel & Wire Company in 1899.

The New Haven Works, located on the east bank of the Quinnipiac River, covers thirty-nine acres with ⅜ of a mile of river front. Shipbuilding was the first industry on this site. Two shipyards were here in the early eighteen sixties and here small gunboats were made for service in the Civil War. The first wire company here, the New Haven Wire Company, was established in the late eighteen sixties.

The plant was almost entirely destroyed by fire in 1901, but was soon rebuilt on a larger scale.

In the beginning, it was a rod mill and still continued to supply rod commercially even after a wire mill was put into full operation. American Steel & Wire Division took over the property December 30, 1907, starting with twenty-nine employees. Today, the number of employees has grown to over 750.

The plant, equipped to manufacture wire for a wide range of uses, was converted into a specialty mill for the manufacture of rope wire and wire ropes. Today, the plant has the largest capacity for the production of wire rope in the world. The operations include making of many varieties of rope wire and the fabricating of this wire into ropes of innumerable sizes and construction. The range runs from wire strand, which is used so commonly as guy wire for television antennae, seizing strand and clothesline, to the making of finished wire ropes used in elevators, dredges, lumbering, mining, oil well drilling, cranes, ships, and the cables used on aerial tramways.

It was in the New Haven Works that James A. Farrell, who was later to become president of United States Steel, worked as a wire drawer, a striking example that America is truly a land of opportunity.

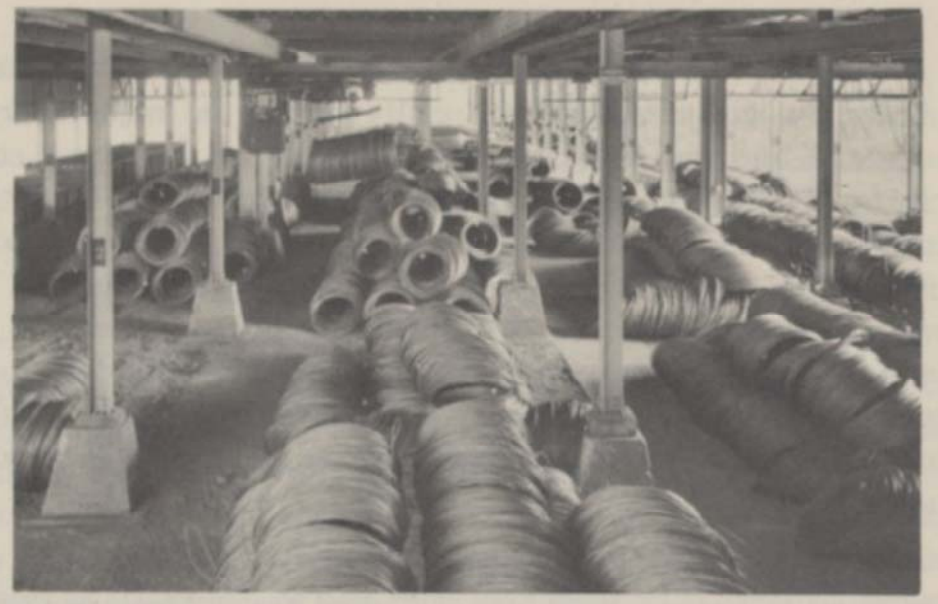
In the wire mill occurs the change in manufacturing wire from hot rolled rod to "cold working" into wire. The physical characteristics of the rod must be changed by heat treatment in carefully controlled "patenting" furnaces. After patenting, the rod must be cleaned to remove scale.

The steel rod is then drawn through a die, thereby reducing the diameter of the wire with a proportionate increase in the length of the wire. This process is known as "wire drawing."

Then follows the careful process of stranding wire and forming the strands in accordance with predetermined geometric patterns devised to meet the various conditions of service of the finished wire rope.

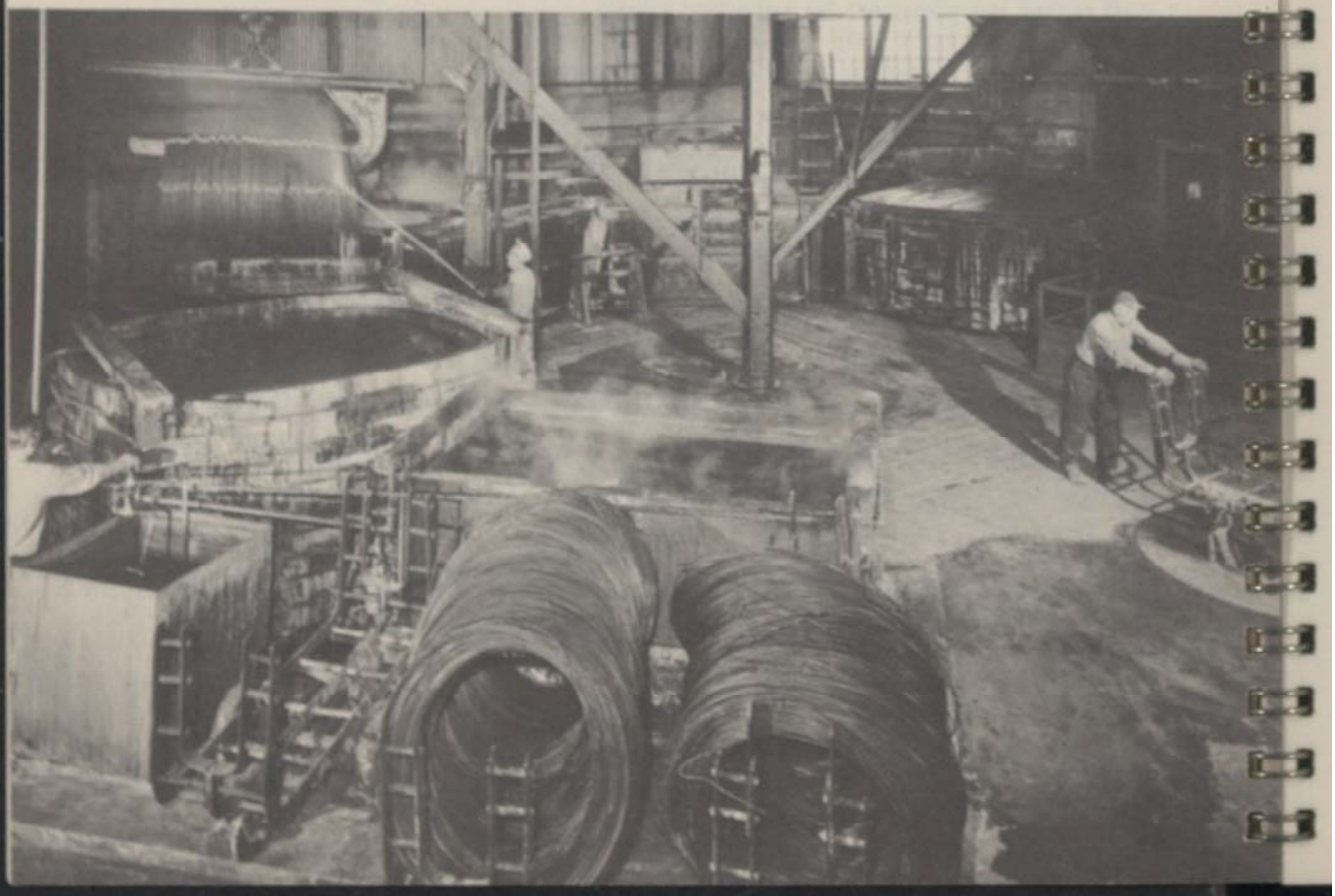
Ropes are further processed to meet customer requirements by cutting to desired lengths, or the fabrication of specially designed wire rope slings and assemblies.

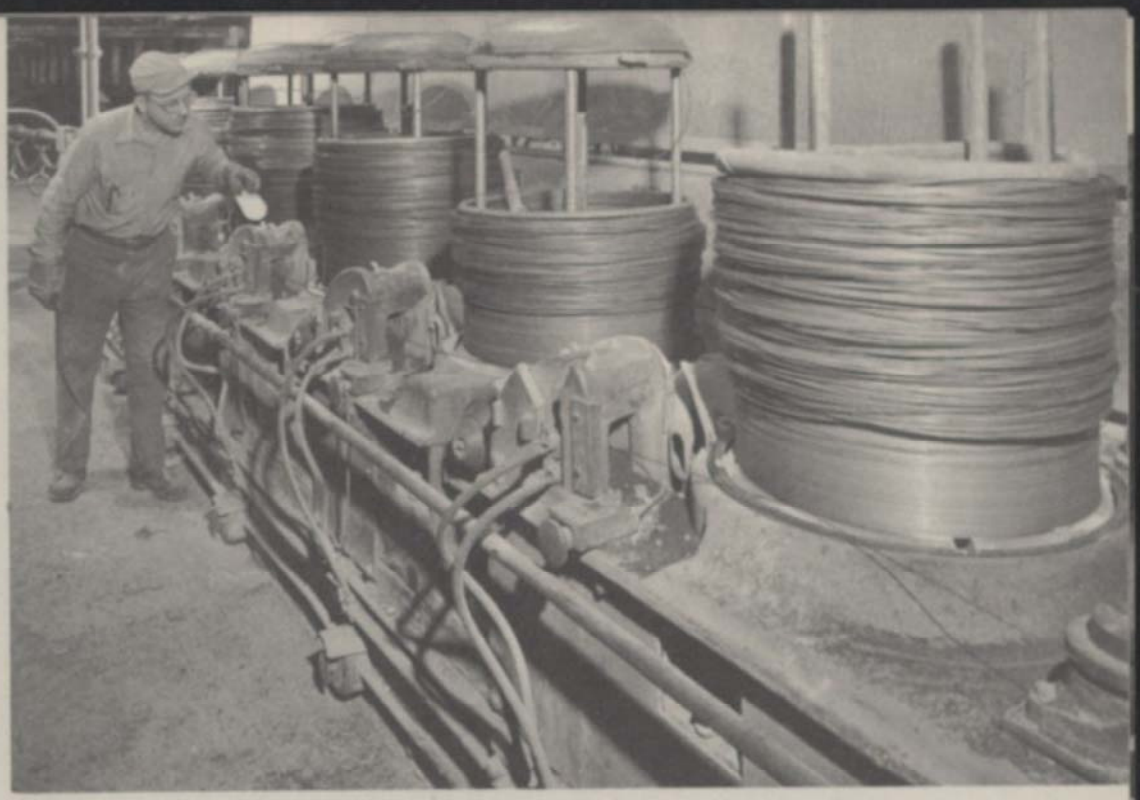
WIRE DEPARTMENT



High carbon rods received in open gondola railroad cars from American Steel & Wire South Works, Worcester, Massachusetts, picked up by overhead monorail crane, using hair-pin hook, and placed in storage according to type stock and heat number.

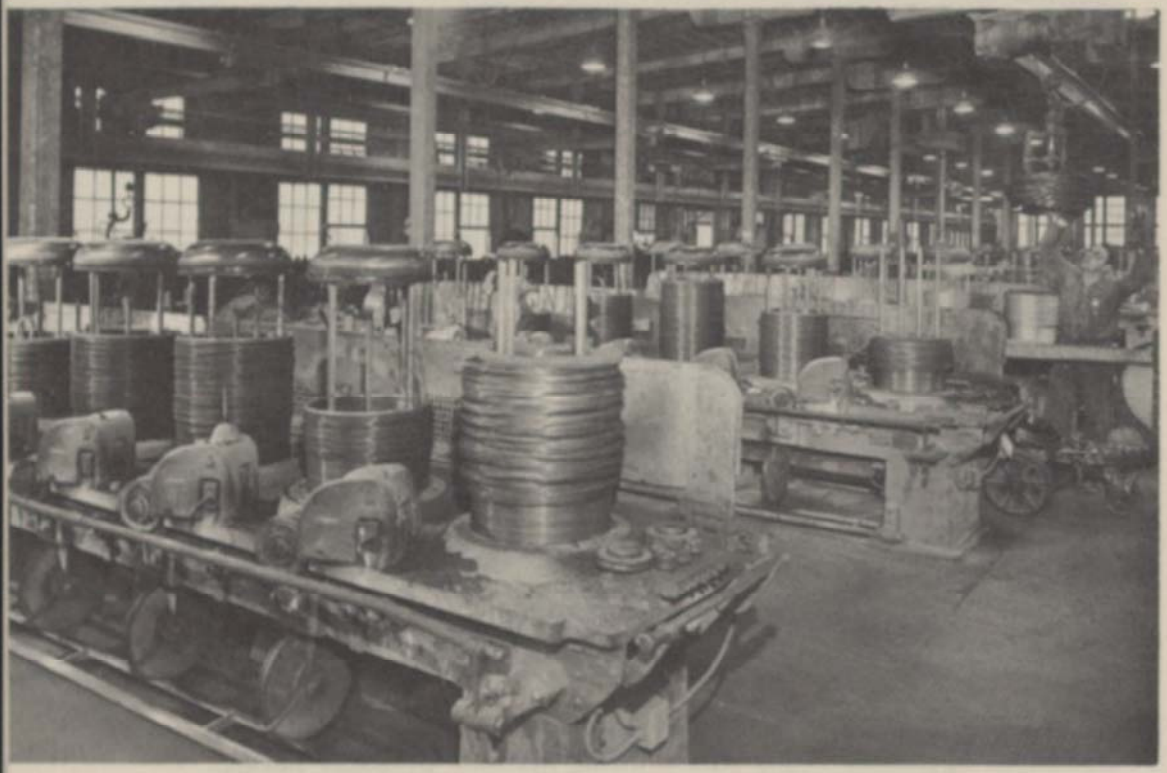
Rods placed in sulphuric acid solution for the removal of scale, rinsed by high pressure water hose shown in photograph, coated and placed on wire buggy for drying in bake house.





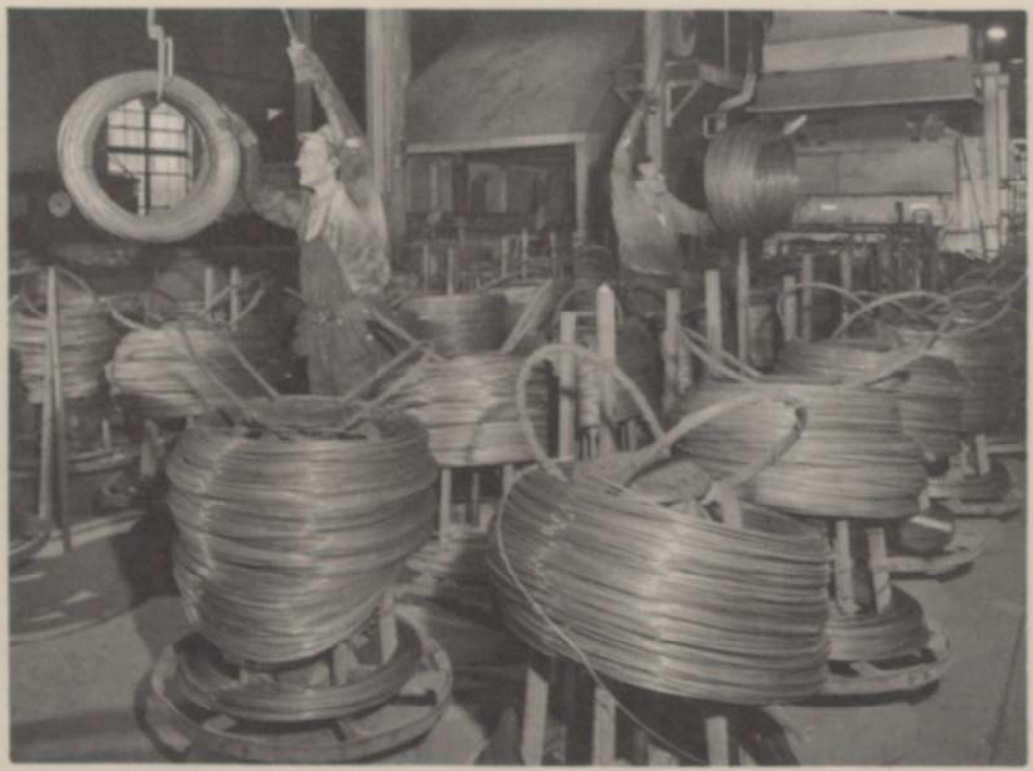
High carbon rods drawn 4, 5 or 6 reductions to finished size in one continuous operation. This wire drawing machine produces finished wire at the rate of 1500 feet per minute. The tungsten carbide dies are water cooled.

Operator is checking his wire after the second draft. The wire will be drawn 3 more reductions to finished size in continuous operation at 1200 feet per minute.

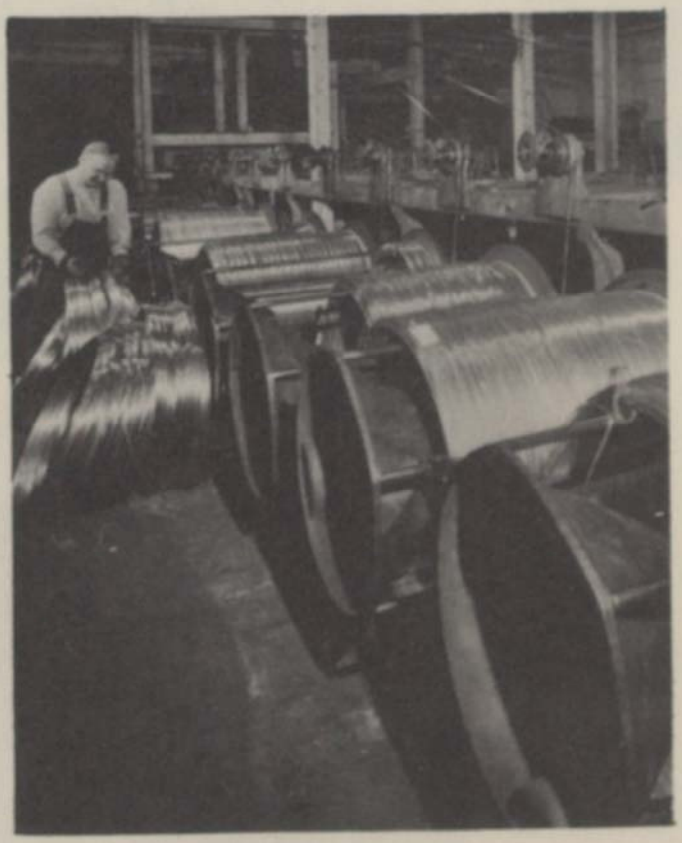


The operator is lowering a finished 200 lb. bundle to buggy for delivery to heat treating or galvanizing department for further processing.

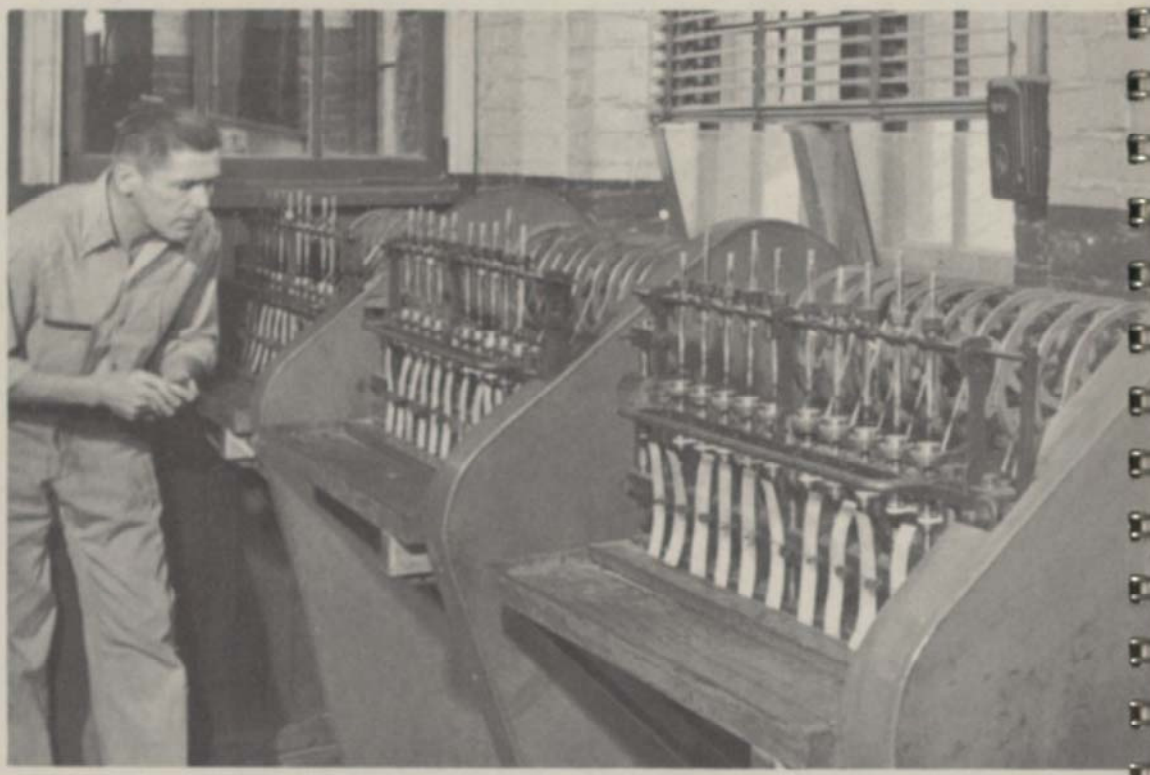
Wire is being loaded onto reels prior to heat treatment.



Wire is being drawn in a liquid solution which acts both as a lubricant and as a means of dissipating heat. Both tungsten carbide and diamond dies are used in this operation. Wire in photograph is being drawn directly onto 25 pound spools for stranding in the rope mill.



Operator bundling coil of wire after wire has received a protective coating of zinc in the galvanizing furnace.

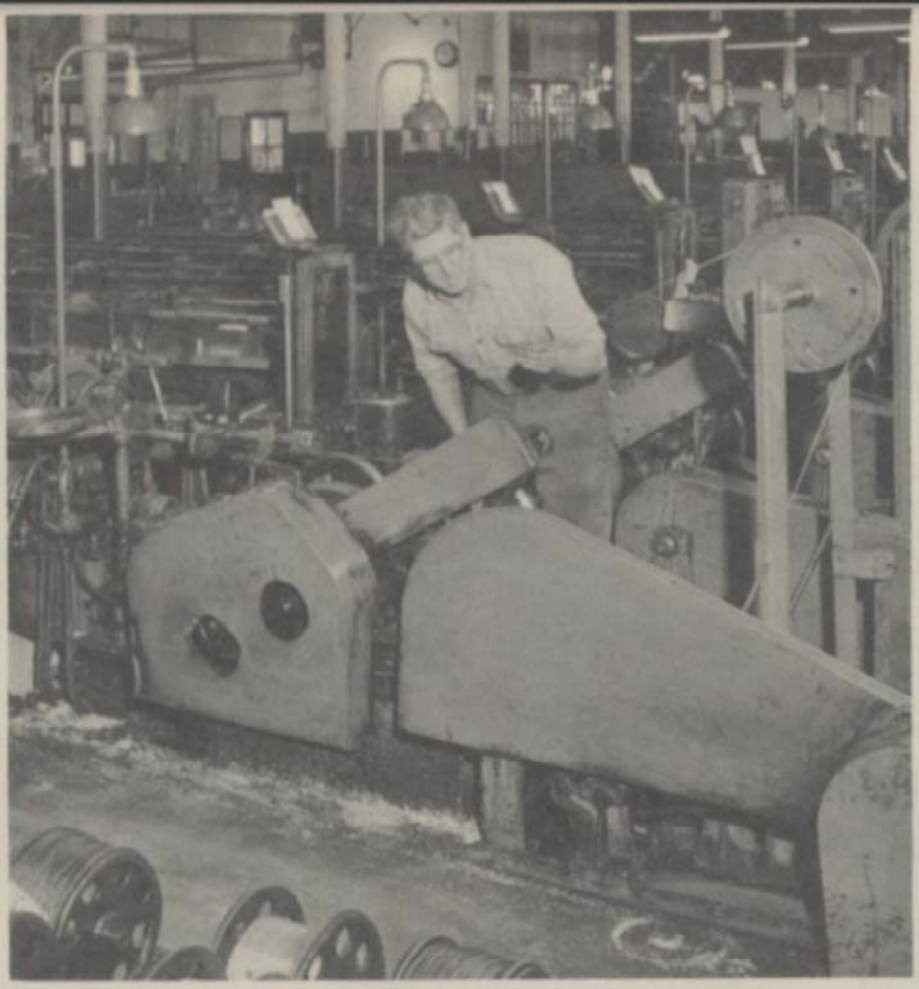


Wire drawing dies, tungsten carbide or industrial diamond, are encased in steel to withstand the great pressure of the elongation process during the wire drawing operation. Here machines recut diamond dies. The diamond die maker is checking the dies being recut to make certain each one is centered correctly for perfect roundness of hole diameter.

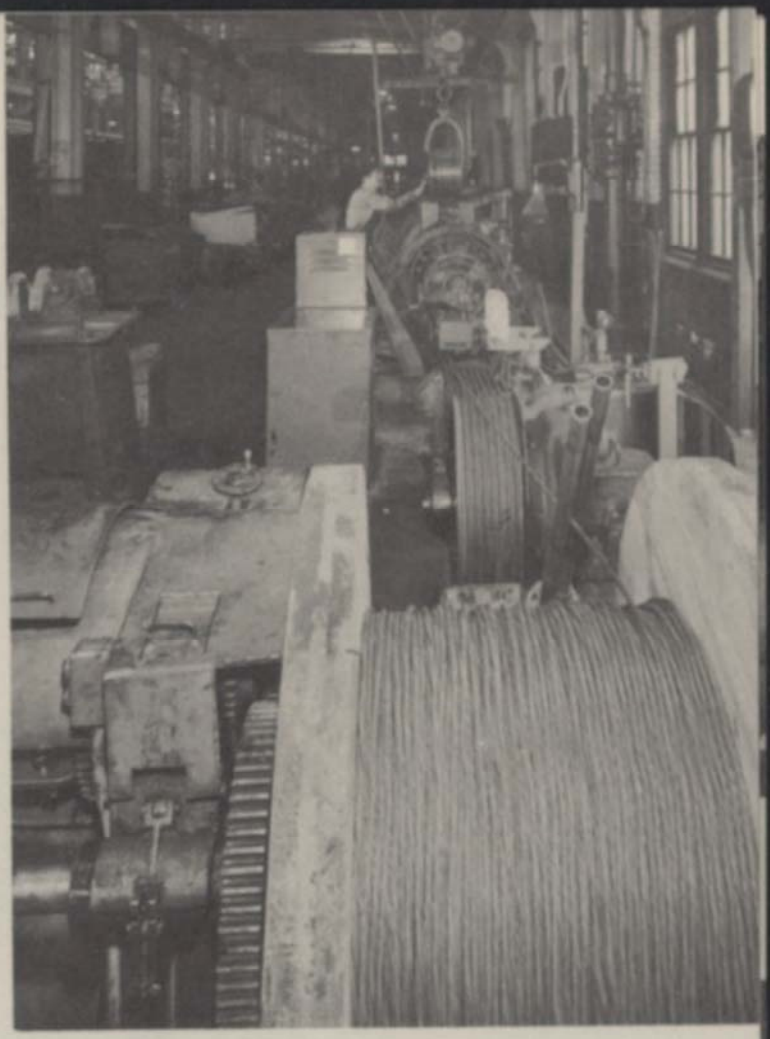
ROPE DEPARTMENT

Wire placed on various size spools depending on the size of wire and spool capacity of the machine which will strand it. Mechanism in foreground is "dead pay-off" (designed at New Haven Works), so named because the coil remains motionless and wire is uncoiled by gooseneck in center. Here, constant vigilance is required to assure wire goes on spools in uniform layers under proper tension.

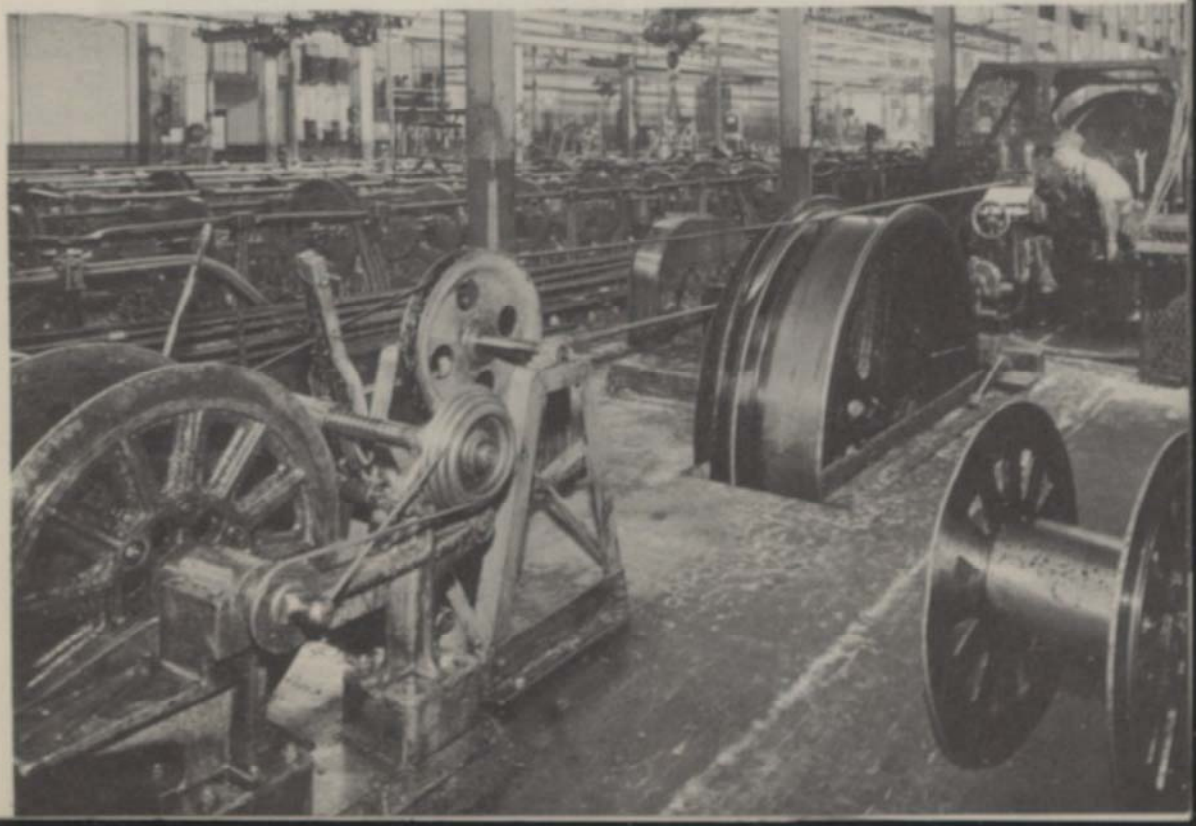
At left (opposite page): Final steps in wire making—inspection and bundling at New Haven. Semi-automatic bundling machines insure tight package of wire which will not tangle and can be put into use quickly by merely cutting the bands.

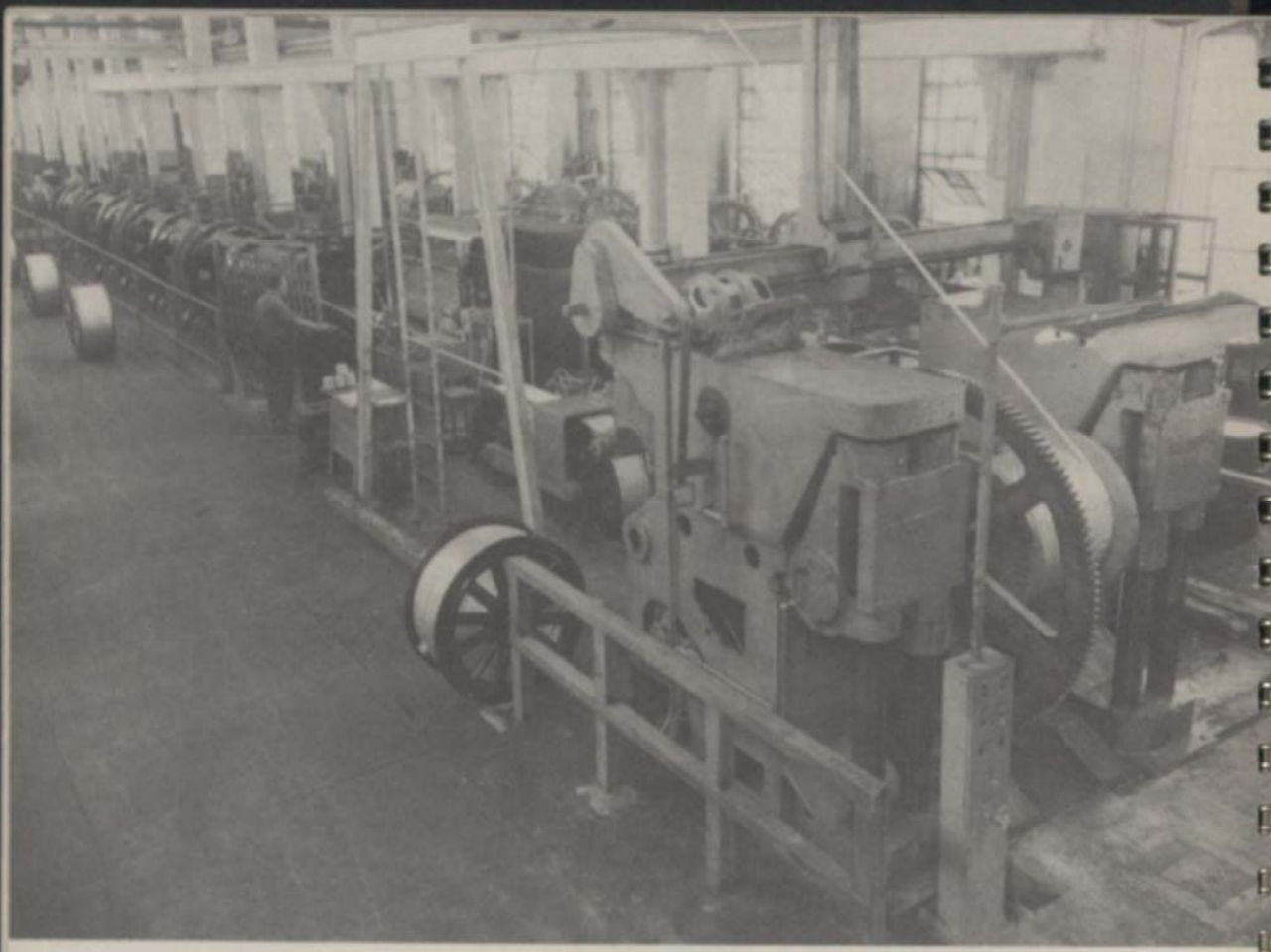


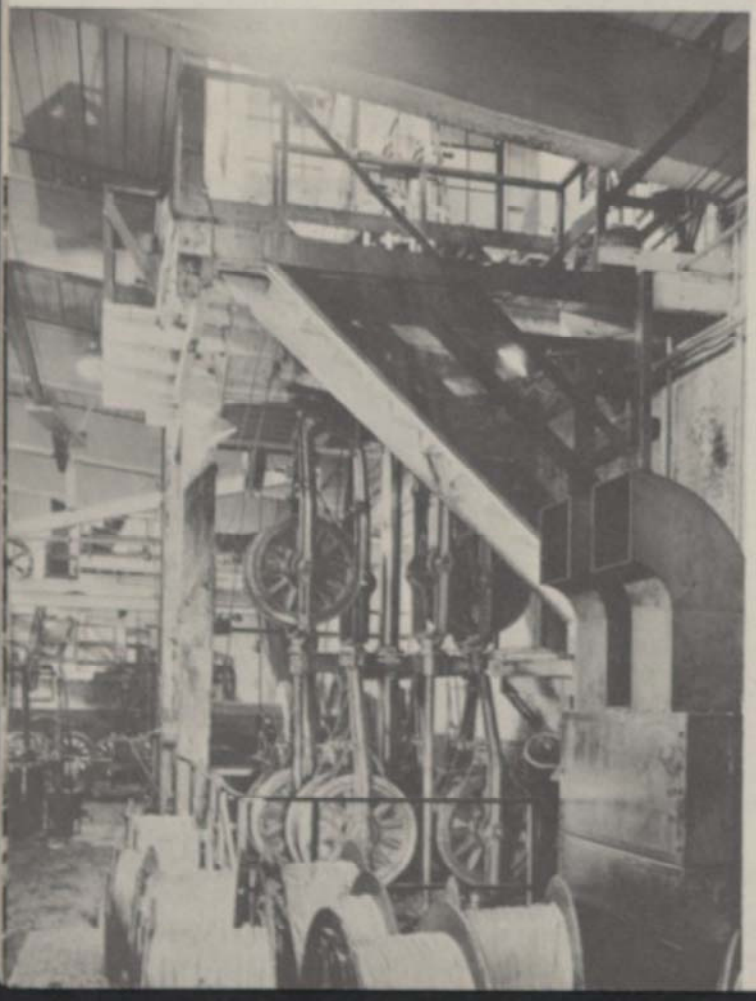
After spooling comes the stranding operation—twisting a number of wires around a center wire. Here, operator is inspecting one of the smaller stranders that revolves at very high speed. These machines produced millions of feet of aircraft control cable in World War II.



Here operator is about to load a 500 pound spool of wire into a strander. Spools are suspended in cradles, one behind the other. Wires are strung through a long tube. Strand is then formed by twisting these wires. The major portion of strand produced, as shown below, is further processed into wire rope. Some machines run in tandem are capable of twisting 48 wires around a center wire to form a 49-wire strand.

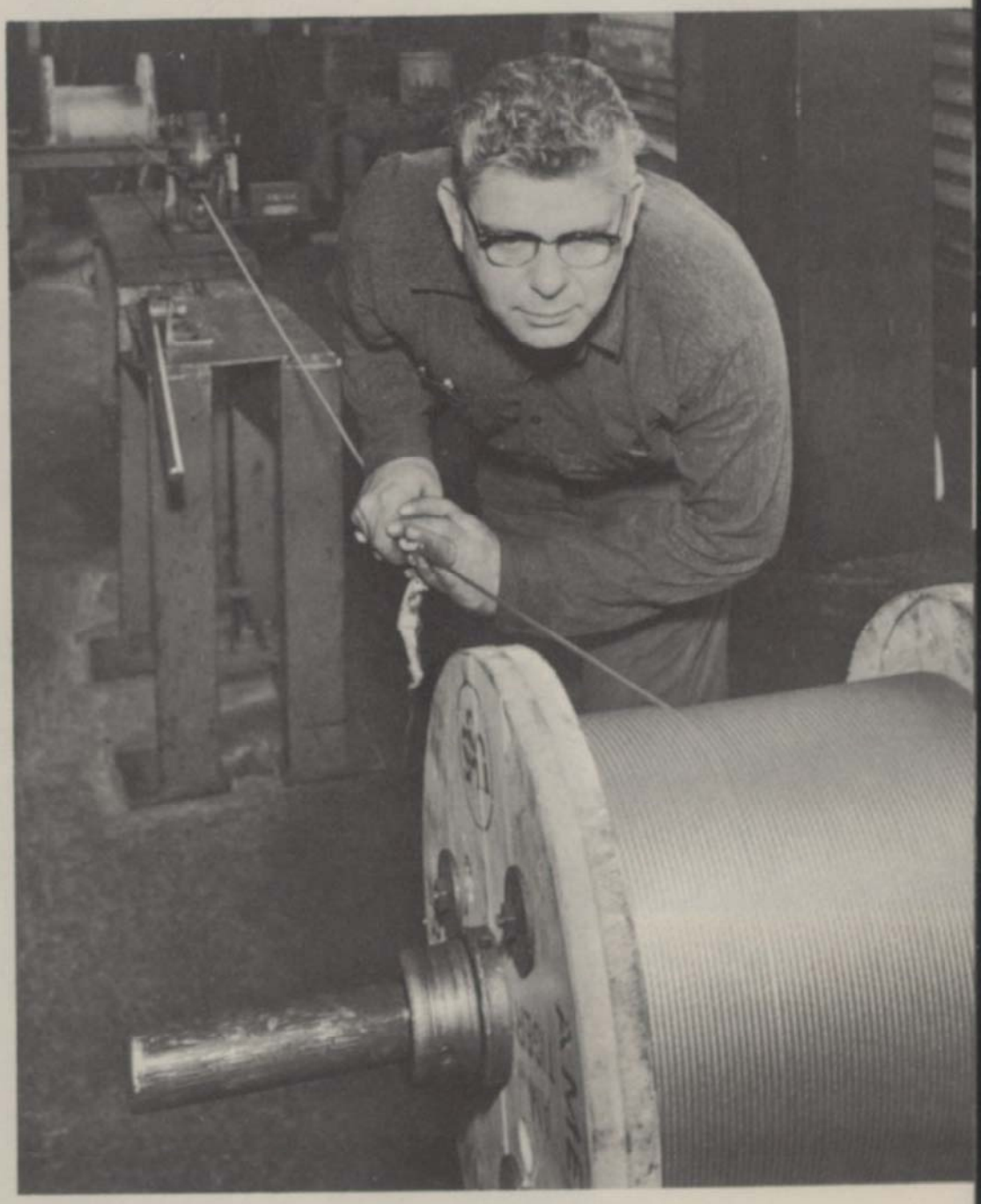


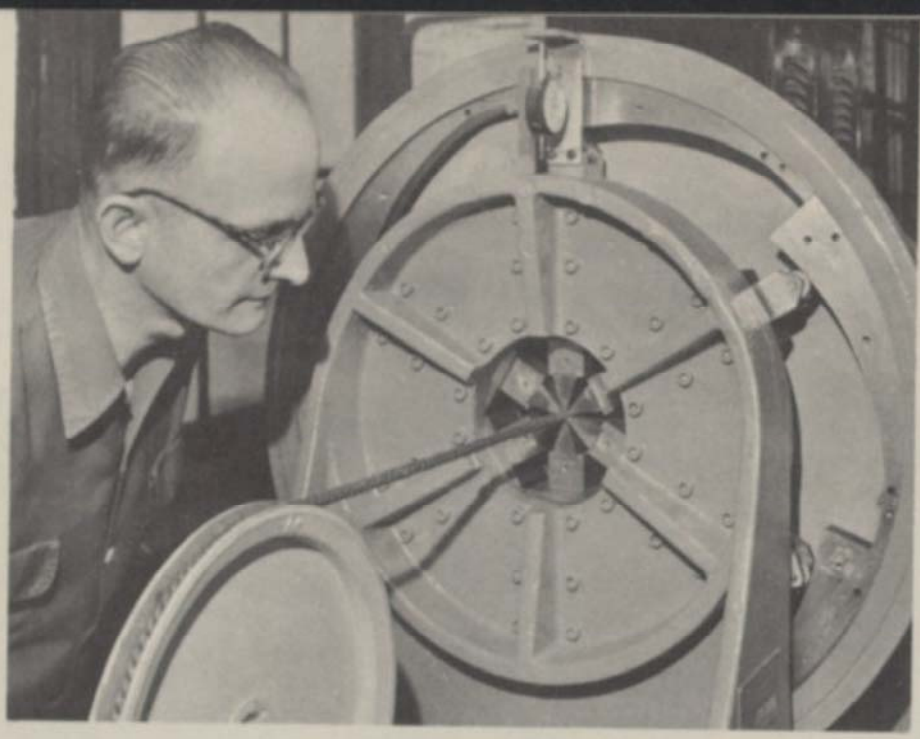




Here are two types of machines that lay the wire strands into wire rope in accordance with exacting standard practice specifications set up by rope engineers. These rigid standards assure quality that must pass tests for breaking strength, bending fatigue, resistance to wear, twisting characteristics. In the *foreground*, vertical layer; *background*, horizontal type.

Foot by foot visual inspection to detect any possible irregularity. Rope is being payed-off the master reel seen in the rear, traveling through footage counter and inspected as it winds on reel, *foreground*.





Jute, Java, Sisal, Hemp, Cotton Fibre centers undergo rigid inspection in the fibre center testing. Six jaws representing the outer steel strands of a wire rope can be interchanged for testing various sizes. This machine subjects the material to the type of treatment it will receive when it becomes the center of actual wire rope. Because the center is the heart of rope, this inspection is vital.

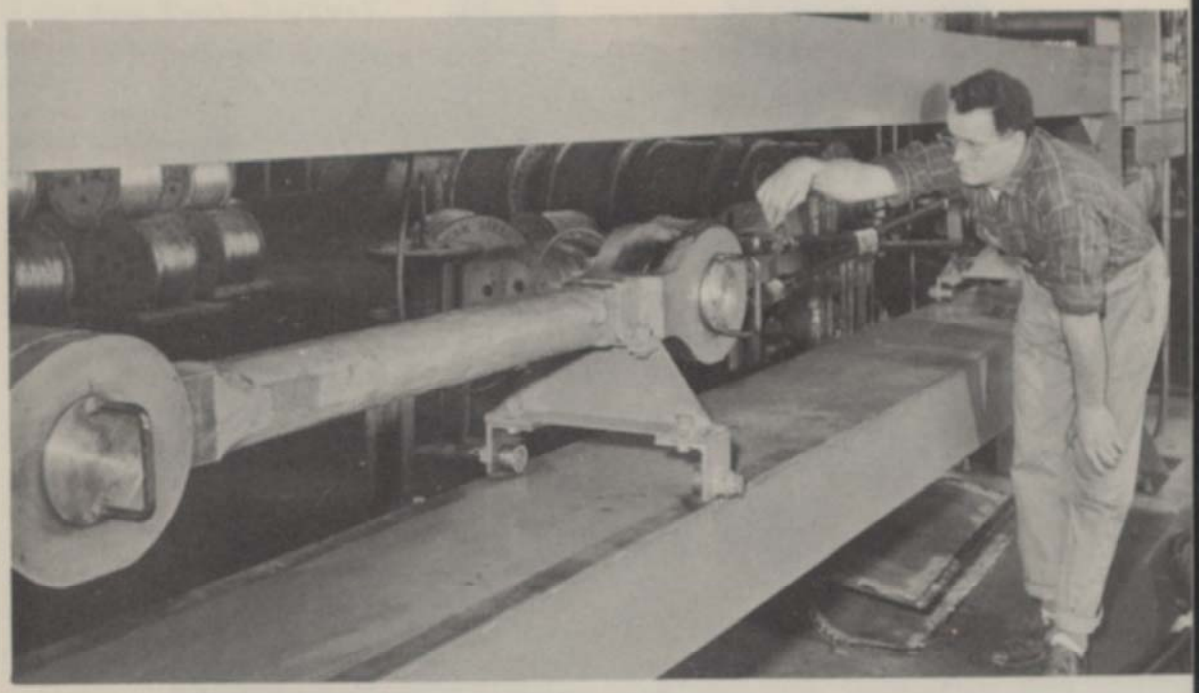
FINISHING & ROPE PRODUCTS DEPARTMENT

Above: Highly skilled splicers fashion fatigue resisting splice. Here they are splicing a boom support to be used on one of the gigantic shovels which will dig high-grade iron ore from one of the United States Steel Corp. mining operations.

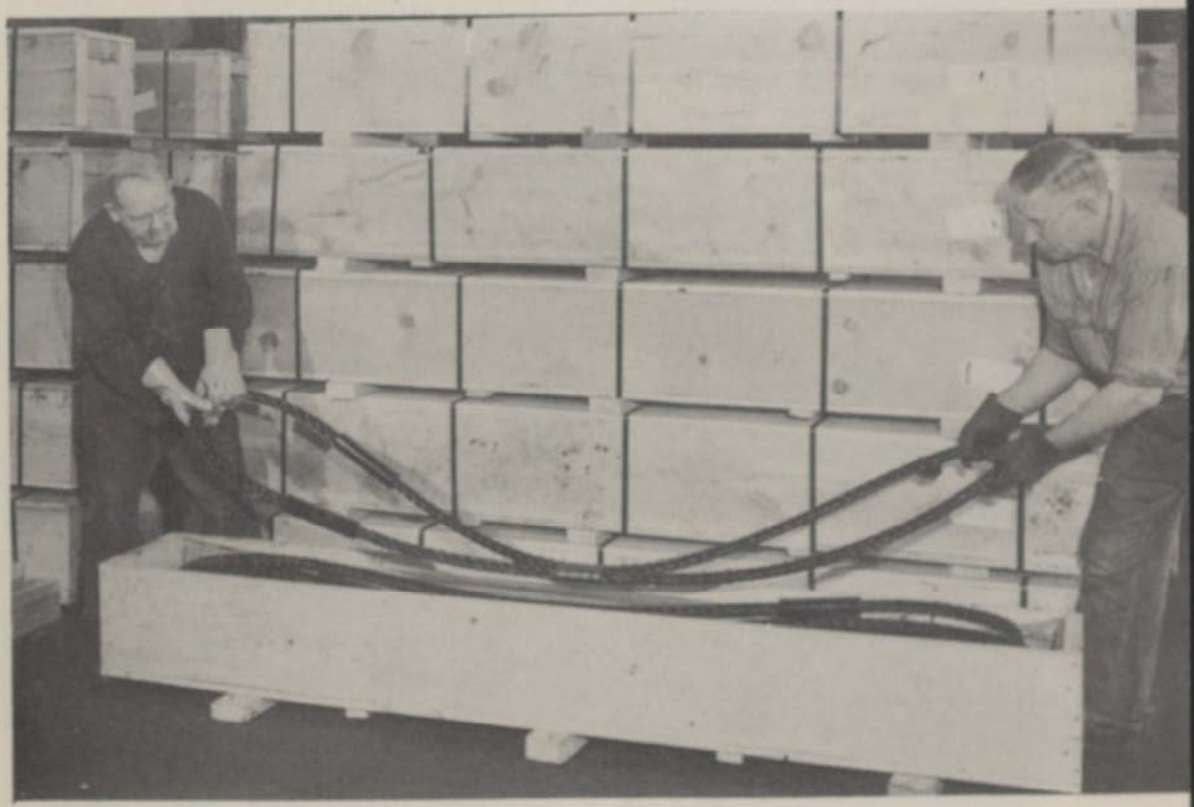
Opposite page: Workers pouring molten zinc into a specially designed end fitting for wire rope. When cooled, the solidified zinc will hold a fitting to the rope at greater strength than the rope itself.

Loading guard rail for shipment to our customers. Thousands of miles of guard rail cable for the protection of motorists are along the highways of the North American continent. From the New Haven Works goes constantly this reliable product that means highway safety.

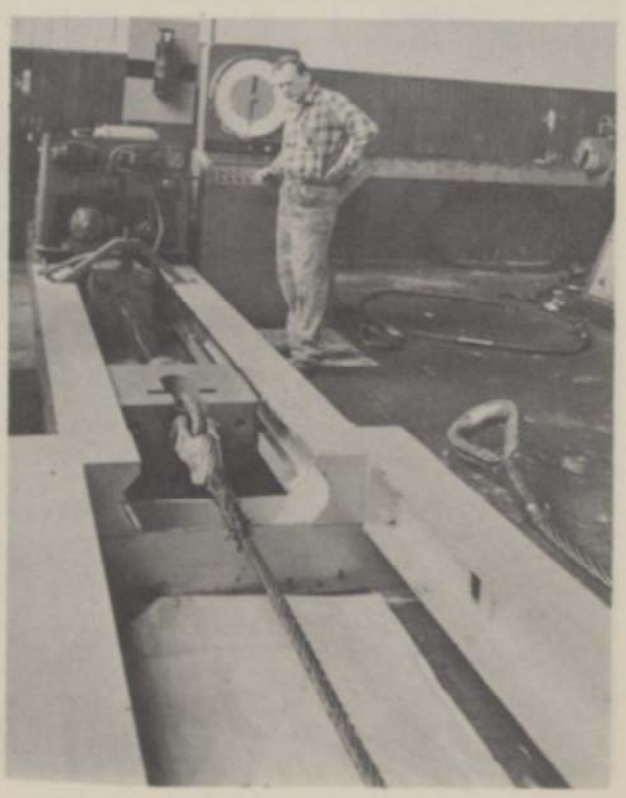
Below: Making tags for products to be shipped. Graphotype machine shown imprints metal tags. Metal tags are used in order to withstand time and weather as the product is shipped to points all over the world. These tags record size, length, grade, construction.



The lives of pilots are at stake when these slings are used in launching planes from the decks of carriers. Here is shown the rigid test by skilled men and special equipment and the certified sling being packed for shipment.

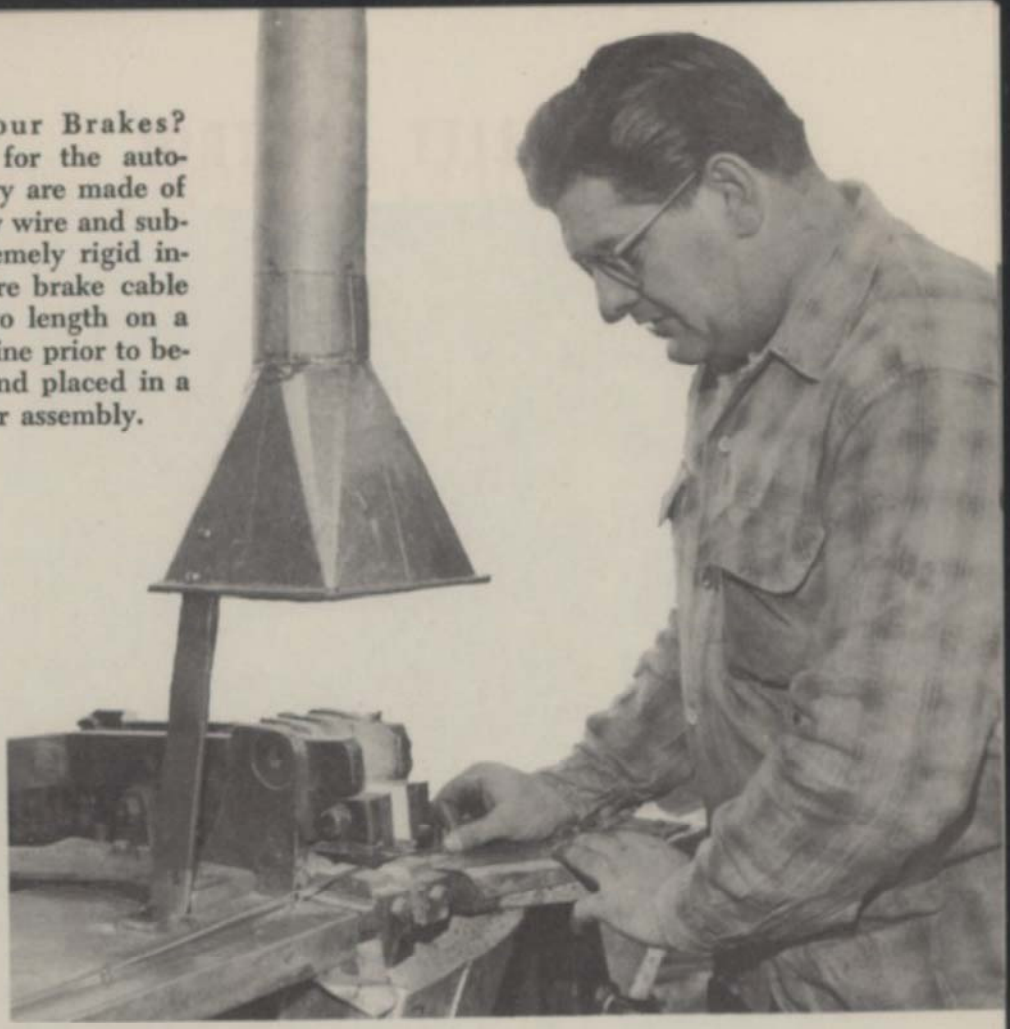


"The Tendons of Industry" —wire rope slings used to pick up and carry heavy loads are fashioned with steel ferrules forming the loops. Here a ferrule is being subjected to 1000 tons pressure in one of the New Haven hydraulic presses.



Here the sling is being proof tested as a certification to the customer that it will withstand heavier loading than it will ever be called upon to carry.

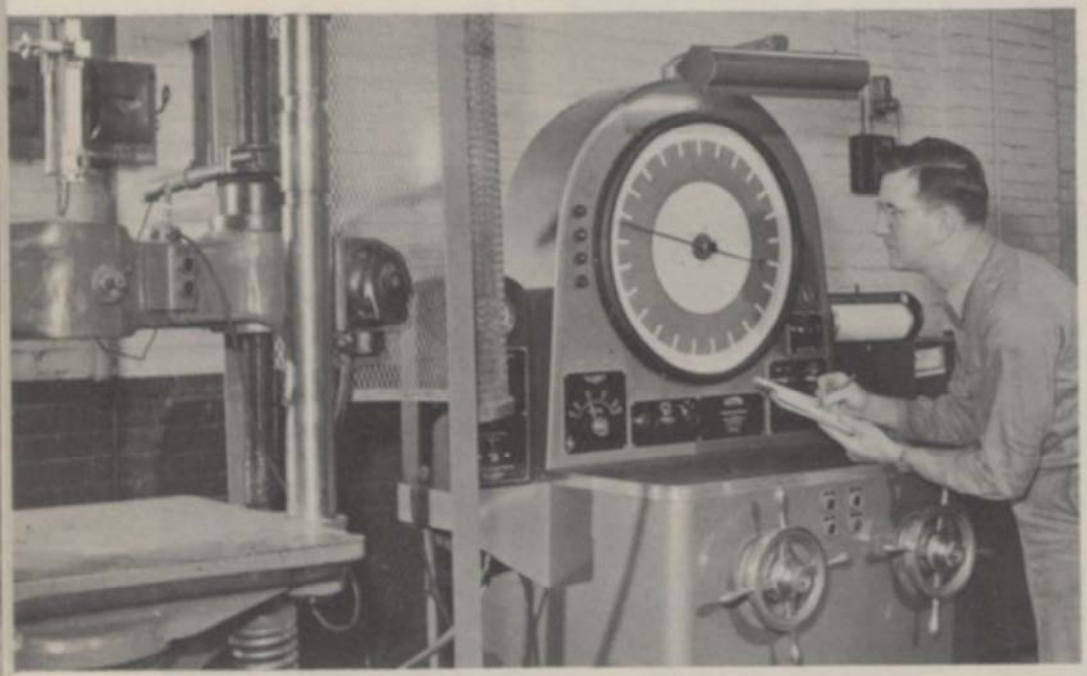
How Are Your Brakes? Brake cables for the automotive industry are made of highest quality wire and subjected to extremely rigid inspection. Here brake cable is being cut to length on a burn-off machine prior to being shipped and placed in a final motor car assembly.



Wire Rope Warehouse. Over 2500 tons of finished product are stored for ready shipment to all parts of the world by rail, truck, air or sea.

QUALITY CONTROL

One phase of quality is control testing which determines the strength of wire. The tensile testing machine pulls a sample of wire until it breaks and the breaking strength is recorded. Metallurgical process observers, trained in the techniques of testing wire, accumulate test data to be used as a basis for the quality control.



DEVELOPMENT LABORATORY

By research and carefully selected studies, the Development Laboratory achieves factual data for operating and engineering personnel, not only as it pertains to materials, methods, practices and costs, but also in respect to the behavior of wire ropes under various service conditions. Here are bending life test machines, bending equipment for testing continuous spliced lengths of ropes, elongation and breaking strength equipment and fibre core testing equipment.

ENGINEERING AND MAINTENANCE DEPARTMENT

THE functions of the Engineering and Maintenance Division may be most clearly defined as those concerned with project development, construction, maintenance, utilities, improvement and replacing of manufacturing facilities, and the maintenance of plant property.

Facilities for handling this complex operation consist of an Engineering Department and assigned maintenance and a central shop. The assigned maintenance group is made up of independent groups located within the various operating divisions which are capable of handling current repairs and maintenance jobs. The central maintenance group consists of a number of shops capable of handling all major repairs and maintenance and construction jobs which may arise. The service division is responsible for all transporting and unloading of materials within the plant.

The steam used is made by four Hornsby Boilers 406 h.p. each and delivered at 150 pounds pressure.

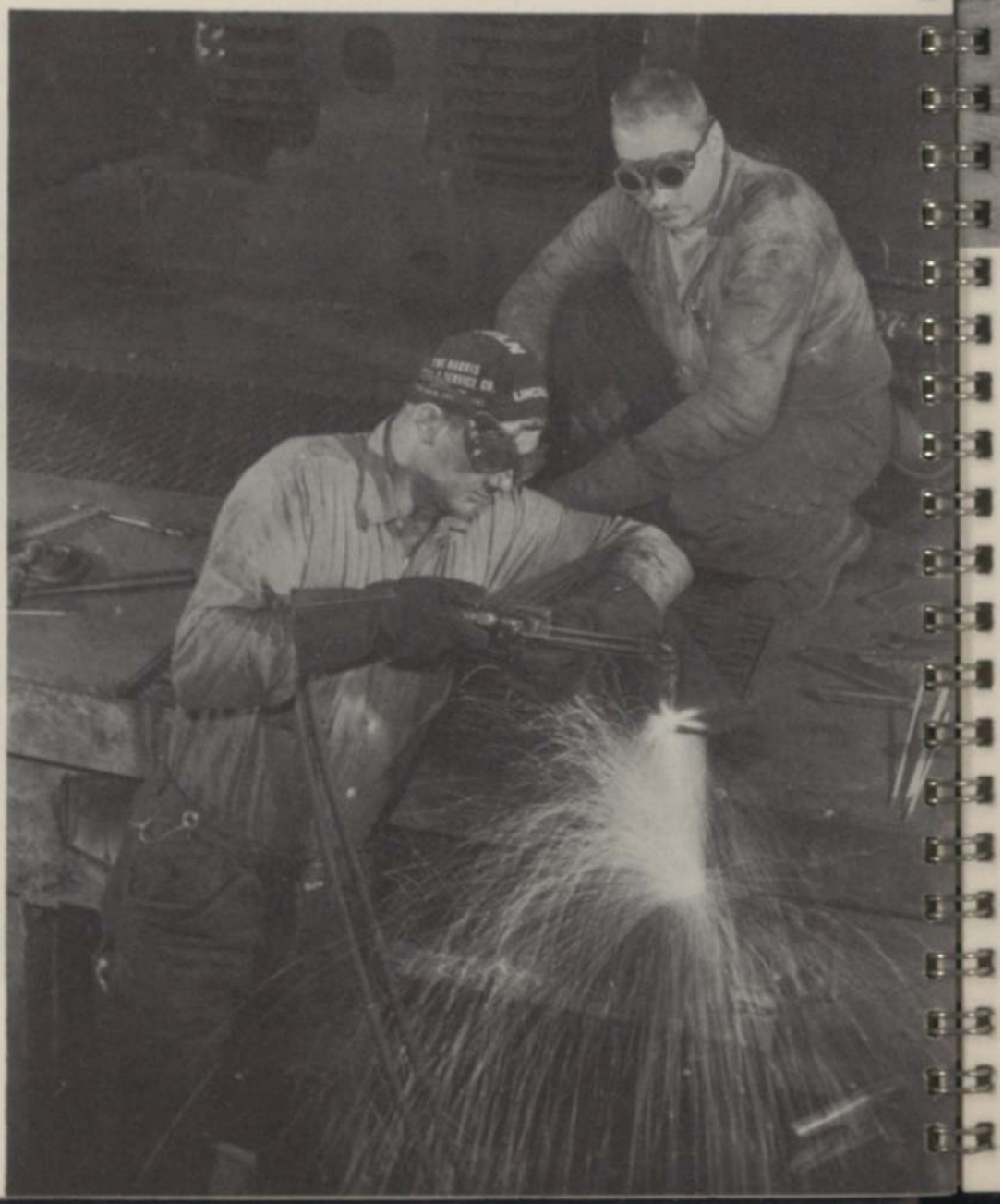
Fuel used in the boilers is "Bunker C" oil with natural gas being used in the summer months. All fuel for operations in the operating division is natural gas.

Electricity is supplied by outside sources delivered to the plant at 14,200 volts and transformed to our uses to 550 volts to 110 volts.

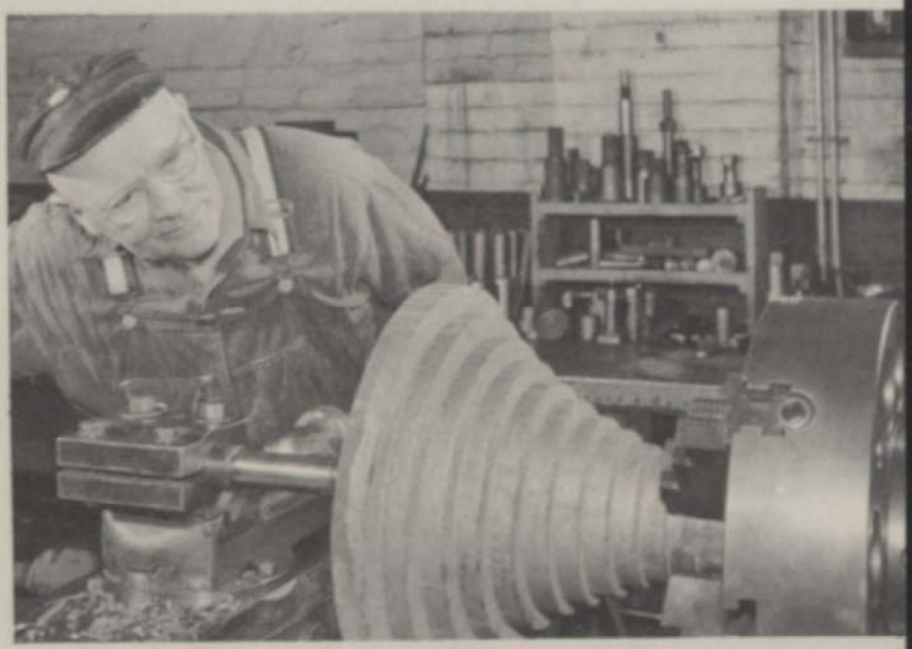
For some processes, the blacksmith's forge is still the most effective. Here a smith is making pins for wire drawing blocks.

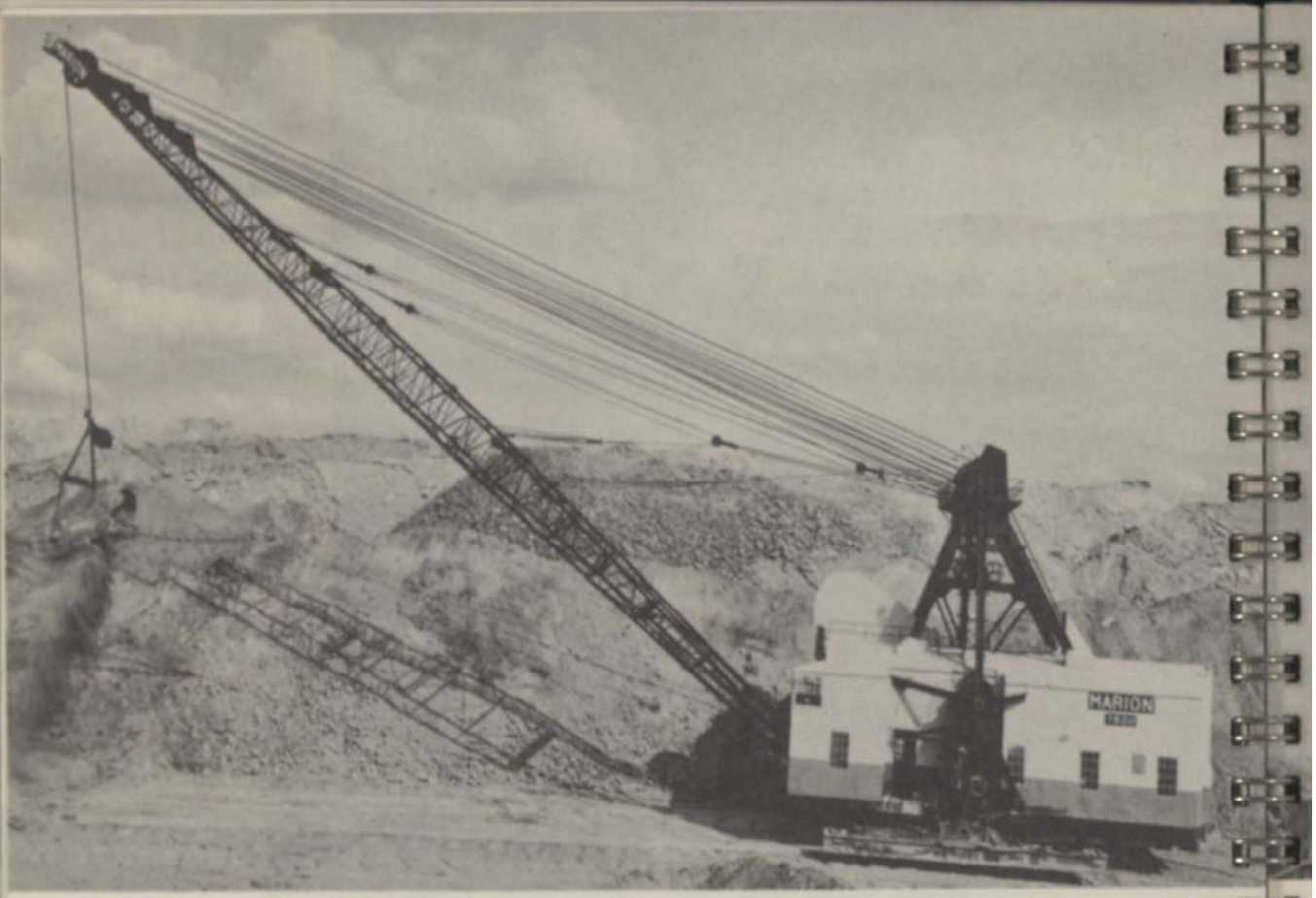
Opposite page: The Engineering and Maintenance Department plays an important role in maintaining the facilities for the manufacture of wire and wire rope. Here, skilled carpenters are shown at work.

Welders fabricating frame work for the installation of a plant air compressor.

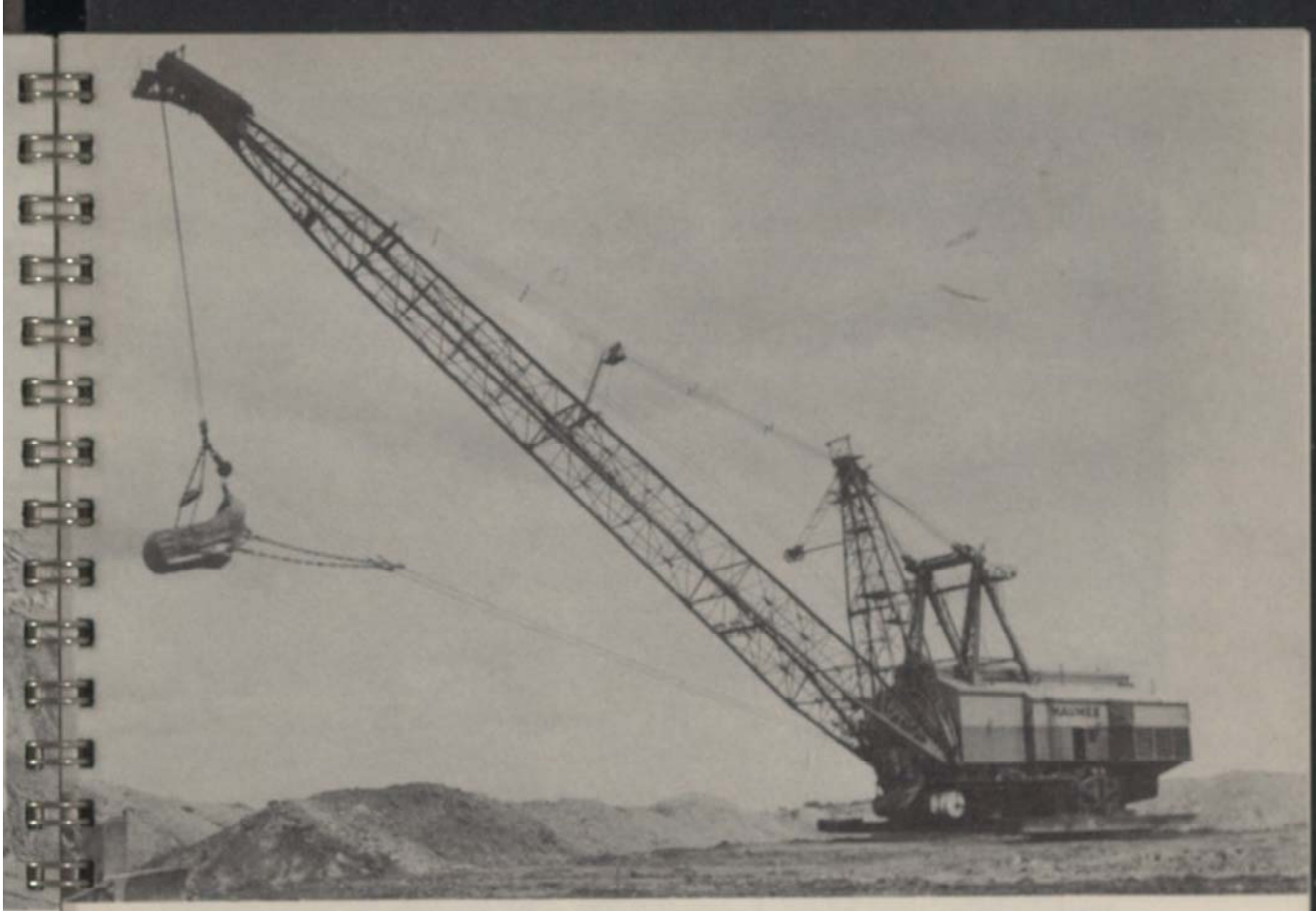


Below: In central shop, machinist turns continuous wire drawing cone.





Power shovels require wire ropes that can take rugged work.



Electric punched card accounting machines for all types of accounting, statistical and computable work are here. Some of the applications produced mechanically are preparation of payroll journals and checks, collection and recording of deductions, calculation of taxes, payroll labor distribution, sales statistics, analysis of costs, calculation of payroll earnings, recording production and other special reports used by management in the daily operation of the mill.

Order Entry System. By teletype and Integrated Data Processing, using punched tape, orders are received from sales offices. The time elapsed from the moment of entry by the sales department to the receipt of order in the mill is approximately ten minutes.

Mutual problems are resolved through the conscientious efforts of officers of Local Union, United Steelworkers of America, and representatives of Industrial Relations department.

Trained personnel interview applicants and provide counselling service for employees.

Medical program is directed by works physician and trained nurses.

Polite but sharp-eyed guards note the identity of all employees whenever they are entering and leaving plant.

WIRE IS EVERYWHERE

THE beginning of the wire industry is lost in the mists of antiquity. It is known that about 1500 B. C. when the Israelites under Moses were wandering in the wilderness of Sinai in search for the Promised Land, their working equipment included facilities for making wire, for the Bible tells us—"And they did beat the gold into thin plates, and cut it into wires . . ." EXODUS XXXIX–3.

The old wire mill saying that "nothing is so handy as a piece of wire" is borne out by fact, especially when it is realized that wire serves man everywhere. The uses of wire are interminable. Milady depends on it to keep her crowning glory in place. It holds our homes together. It makes possible bridges suspended over long distances, and is an important part of the most powerful machines. It is a part of all forms of transportation. We depend on it to transmit power and light and for communicating to our neighbors and to great distances. In fact, it has been said, and truly, that nowhere in this civilized world life goes on without the help of wire.

Club house near main gate where employees play games of skill and fun while waiting to report for work or at the end of their work day.

DEVELOPMENT OF WIRE ROPE

In January, 1830, a patent was granted for the first wire rope. In reality it was a reinforced hemp rope in which wires of brass or iron or copper were intermingled with the hemp fiber. Fourteen years previous, a suspension bridge with main cables of wire was built in Cala Water, Scotland, and the next year another bridge was built across the Tweed. These bridges employed main cables in which the wires were laid parallel and bundled together with serving wire. However, it was not until 1840 that much progress was made in the art of making wire rope, and a year later the first suspension bridge in America was hung across the Schuykill River near Philadelphia.

The earliest type of wire rope was probably composed of three strands of about seven wires, all the same size. Later, hemp center six-strand rope became the accepted standard. In the early days, strands of more than seven or eight wires were usually constructed with two or more layers of wires laid concentrically about a common center wire in two or more operations, one twisting operation being necessary for every concentric layer of wire. Later on, what is known as interlocking construction was invented.