FOUNDRYMEN • MACHINISTS • ENGINEERS

R. D. WOOD
COMPANY

1803 · 1953

PUBLIC LEDGER BUILDING

Independence Square, PHILADELPHIA, PA.

R. D. WOOD
COMPANY

1803 · 1953

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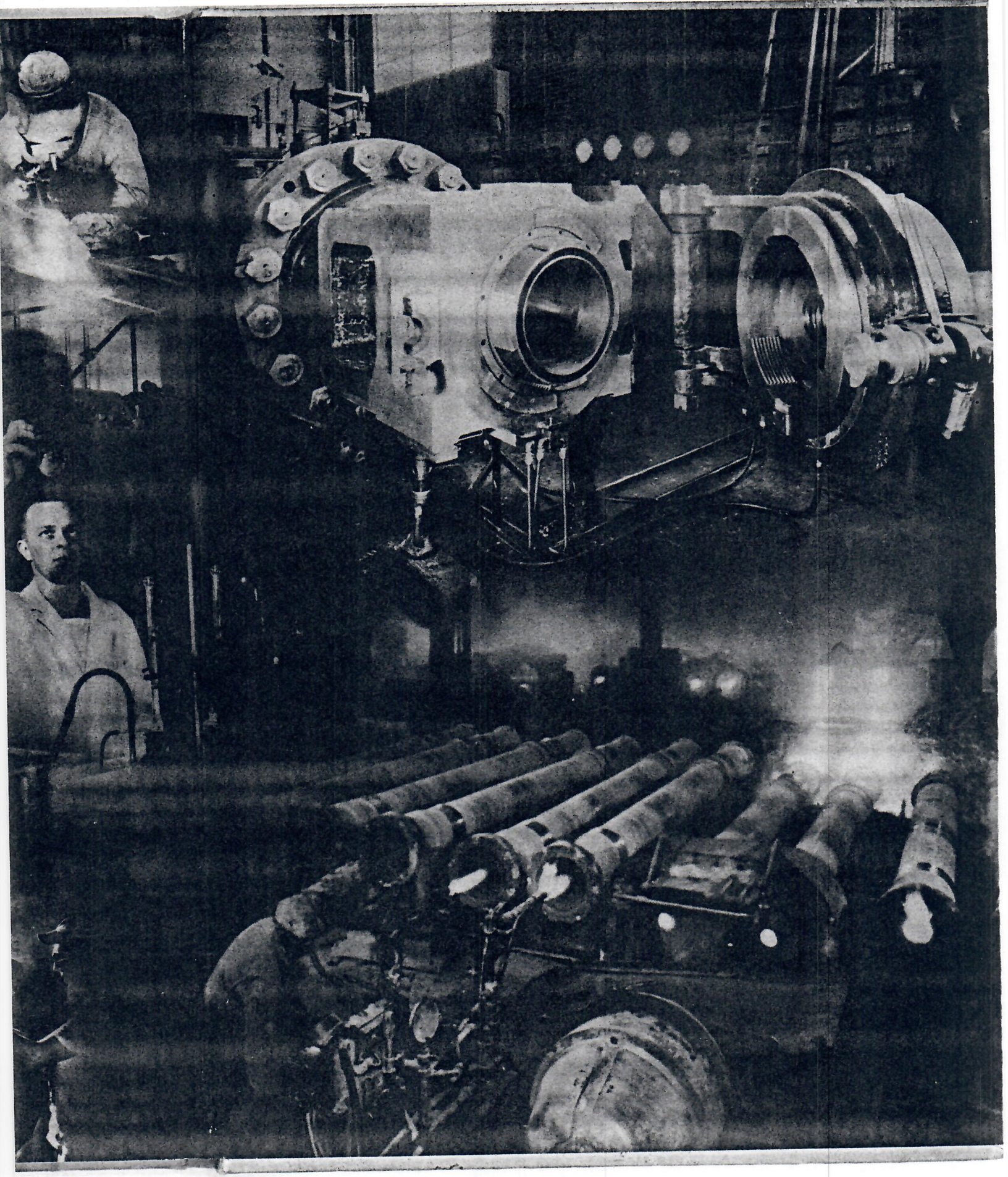

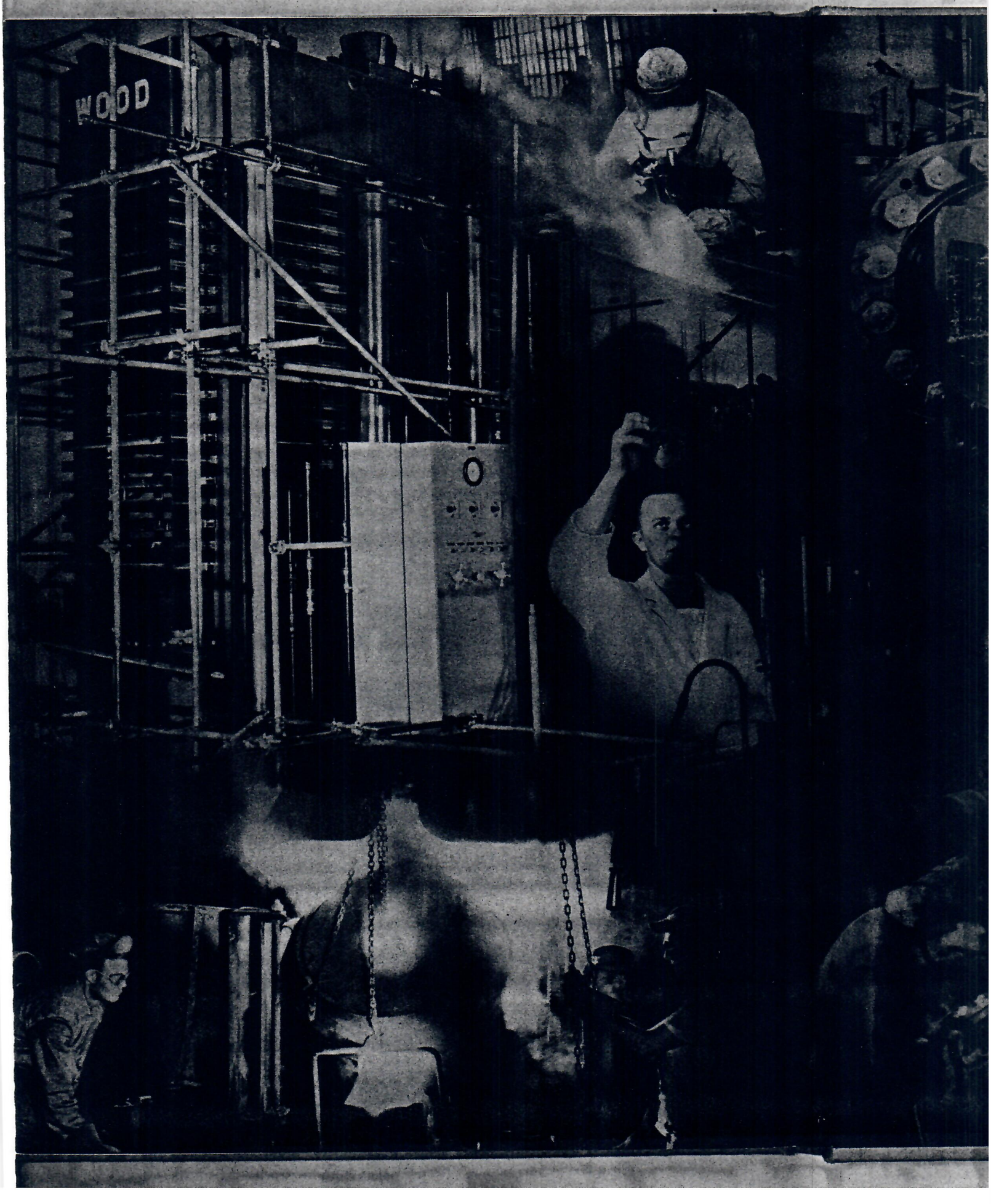
WOOD

DESIGNED AND PRINTED BY
DAVIS, DELANEY, INC.
NEW YORK

RESEARCH AND WRITING
BY BUSINESS BIOGRAPHIES

INTRODUCTION

THIS IS THE STORY of 150 years of the R. D. Wood Company. A century and a half is not a long time as nature measures the age of the earth, but it is a long span in the affairs of mankind as society measures his scientific, spiritual and political progress. More pages of achievement have been written in the past century and a half than in the previous millennium.

The story of cast-iron pipe is a significant chapter in the history of man's progress as a civilized being. The city is the symbol of modern civilization, and tangible evidence of man's reliance upon his fellow man for the benefits of community life.

The city's expansion in area and population is limited primarily by the quality, quantity, and accessibility of its water inventories in reservoirs, and in water table levels of wells and springs. In the post-war development of American communities water supply has been a problem of great consequence, not only for drinking, sanitation and fire protection but also for the increasing needs of industry. The watersheds of the nation, whether they be in the Catskills, Ramapos, Blue Ridge, Ozarks, or Rockies are of superior importance to the security and well being of the nation to our mines, oil wells, forests and farms.

The jugular veins and arterial and venal systems of the community that fetch, distribute and carry away the pure and contaminated waters of a community are made of cast-iron pipe. With its affinity to the soil, its strength against pressures, and surface shocks, and most of all its inbred resistance to rust, cast-iron pipe is worthy of man's trust for decades and even centuries of service. It is the incorruptible and indestructible servant of mankind in vital function within the civic anatomy.

The waterworks engineer has a special affection for cast-iron pipe because it conquers rust, ignores the calendar, and contributes silently and inexpensively to the welfare of the community.

The name of R. D. Wood and cast-iron pipe are synonymous in America. Since the early years of the 19th century to the middle years of the 20th, the furnaces and foundries of R. D. Wood have provided cast-iron pipe for the growing cities of a new empire. The original cast-iron pipe installed in America's largest cities still serves, with many additions, of course, but without replacement for damage, wear or rust. The growth of American cities from the days of dusty crossroads of the pioneers to cities of steel and stone, was made memorable by a first step,—the protection of its water supply. The initial order for cast-iron pipe for scores of cities from coast to coast was given to R. D. Wood,—orders that the founder often received in person from a water commissioner, and in some cases the mayor himself.

There have been many improvements and refinements in community life; better transportation, and infinitely faster communication, but there is no substitute for water supply of a community and nothing better ever made to carry it to the consumer than cast-iron pipe, now serving American cities for one hundred and fifty years.

In the following pages we tell a simple narrative of a need, its fulfillment and something of the genius and personality of the man who gave his name to R. D. Wood & Co.

Philadelphia 1803.

Philadelphia 1903.

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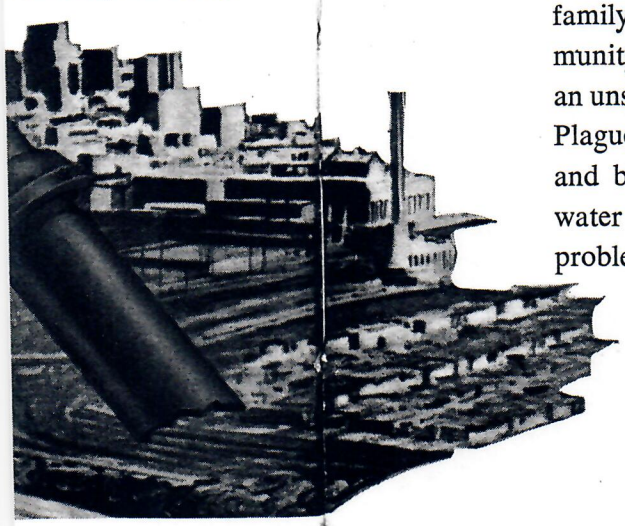
Chapter
ONE

MAN is a gregarious animal, and his instinct to live together with fellow creatures has been an impelling force in his evolution from a roaming and primitive existence to the communal and rooted life of the city dweller. The nomad followed the game trails for food, used caves and wind-breaks for shelter, camped near a spring and in his struggle for survival wasn't much concerned with anything else.

Community life brought with it a mixture of blessings and problems. The need of creature comforts and the protection of the family against disease became a primary responsibility of the community leader. The walled and moated city of the middle ages faced an unseen enemy within more dangerous than the marauder without. Plague and pestilence destroyed far more people than the arrows and blades of the besieging hordes. The continuity of a potable water supply and the proper disposal of sewage was an ever present problem. As the civic units of society ventured from their feudal

Philadelphia 1903.



walls and set the patterns for social intercourse, the problem of water supply, sewage disposal was followed by the need of fire protection, street lighting, and a wide range of community conveniences.

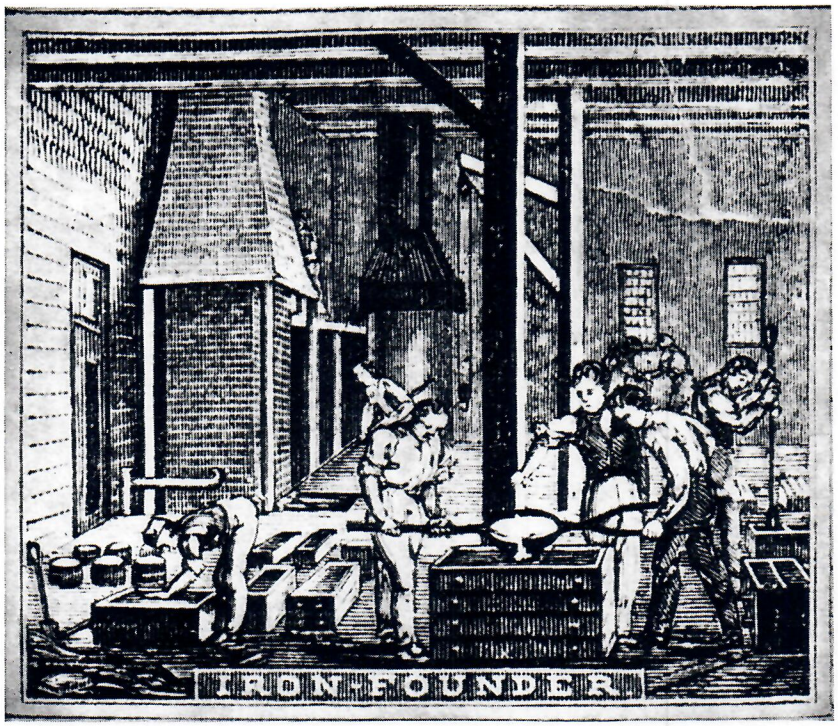
The human body is a complex, resilient, and adaptable piece of mechanism. How it has survived the polluted streams, open cesspools and other sources of filth through the centuries is a marvel to us in an antiseptic and scientific day. However, a high price was paid in human lives in the plagues of Europe. Shortly after the American Revolution, the dirty cisterns of Manhattan Island contributed to a devastating attack of typhoid. Thousands of people left the city in fear. The editors of the papers railed against the unsanitary cisterns which caught the water from roofs fouled by birds, and poorly filtered through sand, gravel or porous stone. More than one contemporary writer stated that New York City was at the end of its growth as a residential community unless potable water could be piped into the city. Quack advice was published to the New Yorkers for purifying the water, and the suggestion that whiskey and rum mixtures not only fortified the rain-barrel water but purified it was welcome news to a liberal-minded segment of the populace. The more sober-minded gentry looked hopefully to the Croton watersheds which brought Manhattan good water in 1842.

Pestilence in the form of cholera, diphtheria and smallpox were recurrent problems in the cities of Europe, but the remedies were slow, and ignorance and superstition were allies of disease. The civic leaders of Europe, men with the searching and often quarrelsome minds of Galen and Paracelsus, floundered around in the quagmire of disease and contamination, setting the foundation for modern medical practice and chemistry, and especially a reliable pharmacopeia. Only the faintest inkling was available of the existence of the germ empires, friendly and unfriendly, until the door was opened by the hand of Louis Pasteur, the French naturalist and scientist.

One of the first steps toward the control of disease came in the late 15th century with the introduction of cast-iron pipe as a defense against pollution of drinking water and the insulation of contaminated fluids of the open sewers and drains. A German source says "It was in the second half of the 15th century that the first iron pipes were cast in the Seigen country." One of the first descriptive accounts of cast-iron moulding tells of the manufacture of pipe at Altenan in Germany at the beginning of the 17th century. The little furnace cast about 25 pipes a week. They were poured in short lengths in horizontal moulds. When longer lengths were attempted the core sagged or bent and the walls of the pipe were uneven. The Mattern-nich cast-iron water supply line at Coblentz was five miles long and took three years to build.

Germany has many old cast-iron water lines still in service. The Burgomeister of Ehrenbreitstein wrote, "The water main was replaced in 1726 by cast-iron pipes, and though this old main crosses the much frequented tramway, and lies partly under the provincial street of Arensburg with its heavy traffic, the main required very seldom any repairs during its long time of service." The Burgo-meister's letter was written in 1933 and said that very few repairs were ever necessary to the main in its long life. The city of Bruhl has a cast-iron water line 230 years old, the city of Bad Homburg has a cast-iron water line 267 years in service, and at Braunfels there is a section of cast-iron pipe connecting an ancient artificial well system that is 291 years in service. The only city mains com-peting in actual age with Braunfels is Versailles, whose cast-iron mains were installed in 1664 by the order of Louis XIV. London's oldest cast-iron pipe was installed late in the 18th century.

There is older evidence, of course, that the Babylonians used clay pipe, laid in sections, and joined by a tapered end fitting into an expanded sleeve end. The excavators at Pompeii found lead pipe laid in the same manner by the socially-minded if not safety-minded



Iron Founding in the 1830s. The first step in America's industrial growth.

Roman residents living at the base of a volcano. Clay and lead pipe gave a limited service to the ancients but it could not stand much external pressure. Internal pressures belong largely to modern civilization, and the science of hydrostatics.

The first city in the United States to use cast-iron pipe was Philadelphia. English pipe was imported to construct a water line about 1800. This pipe received the benefit of the practical and inventive mind of Thomas Simpson, Water Engineer of the Chelsea Water Co. of London. Simpson designed the first Bell and Spigot joint that has served underground water systems for a century and a half. He was also the first man to seal joints with yarn and lead

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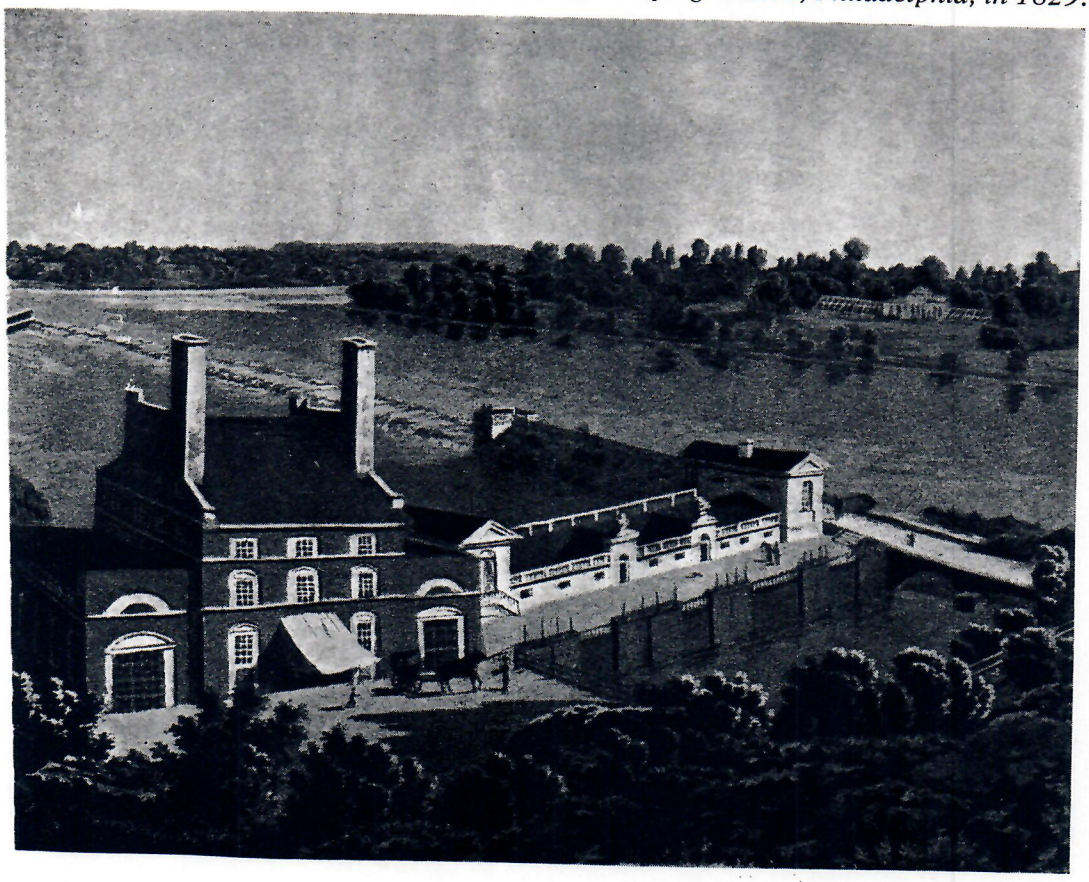
caulking. Simpson and his enterprising foundrymen turned from the horizontal to the vertical pipe casting method, and overcame much of the gravity drag on the core. This enabled the foundries to cast longer and larger lengths of pipe with iron of better quality, with an even distribution of metal in the mould. Some of these original English foundry cast-iron pipes are still in use beneath the busy streets of the Quaker City. When street alterations have made necessary its exposure, and occasional removal for inspection, the pipe has been found in excellent condition.

The Manhattan Company of New York, originally a water company, and now a huge banking system, first used bored wooden pipe to convey the spring waters of the Kolch's drainings to the residents of lower Manhattan Island. The water was pumped from springs surrounding the present site of the State and Federal buildings and piped to the houses and buildings from the Battery north to Chambers Street. Wood pipe had lasting qualities but it was clumsy, expensive, and offered many problems in tapping or setting up hydrants for fire protection. The Manhattan Company was an early user of cast-iron pipe, a necessity as increasing hydrostatic pressures were applied. Baltimore also was an early user of cast-iron pipe for its gas mains. There are more than forty installations in the United States in which cast-iron pipe has been in continuous use for over a century.

The first cast-iron pipe produced and sold in the United States was made in Millville, New Jersey. At first the horizontal casting method with its various limitations of length and quality was used. Later the vertical casting methods of the English foundries were introduced. In our own day, "the pit-cast" or vertical method has given way to the extremely efficient centrifugal spun sand casting method of pipe making, a method in which the gravity pull on the horizontal core is overcome by the centrifugal speed at which the mould spins while receiving its charge of molten iron.

The story of cast-iron pipe and the history of R. D. Wood & Company are inseparable. The company was founded in 1803 by David C. Wood, elder half-brother of Richard D. Wood, who was born in 1781 at Greenwich, N. J. David, who constructed and operated a simple iron furnace in Cumberland, N. J., in 1803 on the Mamimuskin Creek, looked with an appraising eye on the superior advantages of water power and wood fuel in the vicinity of Millville. He came to Millville later in 1803 and with two other men he pur-

One of the early municipal water systems in the United States. Fairmount Pumping Station, Philadelphia, in 1829.



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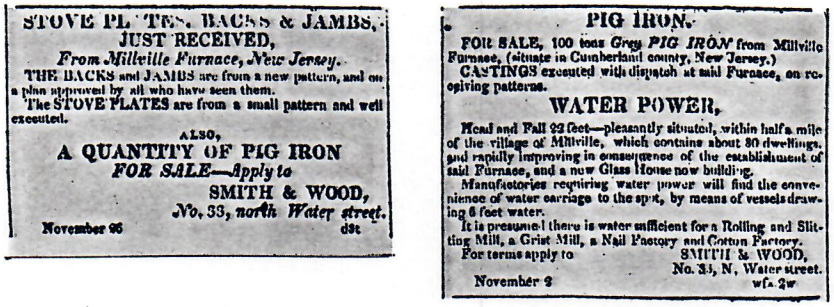
chased 12,000 acres of land with a high potential of water power and charcoal for his furnace. He also purchased the Union Mills, saw mill and dam, two miles from the site of his furnace and extended the water power to the head of navigation on the Maurice River. The Union Mills site was developed about 1740 by David's grandfather, Richard Wood, III, and his partner, Ebenezer Miller, who was the powerful land owner in and real estate promoter of the region. The land was sold to Richard Peters in 1749, and Thomas and Richard Penn in 1793. These were strictly internal deals among the Friends, most of them originally from Philadelphia. David's associates in 1803 were James Lee and Edward Smith. He bought them out in 1816 at a cost of $100,000. The selection of the site of Millville was not only influenced by the power of the Maurice River, and the timber necessary for the manufacture of fuel for the furnace, but equally important because of the proximity of a good supply of bog ore in the marshes on the east side of Delaware Bay. The ironmongers were especially partial to bog ore because of its rust resistant qualities. The Millville furnace of David C. Wood began operations in 1814 with the manufacture of cast-iron pipe and other castings for stove plates.

The Millville plant encouraged the growth of a community of iron workers, and even stimulated other small industries and considerable real estate speculation. An advertisement in a Philadelphia paper dated November 8, 1814, stated that The Millville Furnace was prepared to supply 100 tons of metal and castings. The advertisement sounds as if written by a modern chamber of commerce secretary because it places emphasis on the local trade and industrial virtues of the community, calling attention to Millville's water power, shipping facilities, fuel resources, and a wide range of raw materials, all concentrated in one locality. The advantages of the site for glass making from local sand, are pointed out, as well as the facilities for rolling mills and cotton mills.

The water power of the Maurice River offered an attractive potential to industry, an opportunity that David C. Wood observed and utilized to some extent. It was not until a generation later when Richard D. Wood, his younger brother, enlarged the canal and built the dam across the Maurice River that the energy of the water could be employed to an extent which intrigued the textile manufacturers. However, the story of the cotton and glass industry belongs to another chapter in the history of Millville.

By 1816 David C. Wood had his furnace and foundry going full blast and was doing a thriving business with the city fathers of Philadelphia, supplying pipe for the water works, iron fences for the public squares, and lamp-posts for the street corners. His stove plates were a popular product, and within a few years he was selling 300 to 500 tons of plates annually to a stove manufacturer in the Hudson Valley. David had bought out his partners two years before, but he couldn't get rid of his management problems. He was a good salesman, but often bit off more than he could chew in business commitments. He was property poor, and was in constant need of working capital to meet payrolls and to keep his plant in operation. The proper coordination of ore, fuel and water power supplies eluded his grasp, and as the supply of bog ore dwindled, the problem grew worse and operating costs increased. But David Wood wasn't alone in his predicament. The handwriting was on the wall for the little furnaces on the flats of the tidal Delaware.

As this is a story about iron, and especially about iron, and especially about a cast-iron product, it might be well to turn back the calendar and look at the simple and rugged beginning of iron making in Colonial America. There is a historical reference in 1609 to the making of iron in the vicinity of Jamestown, Virginia, at a little foundry at Falling Creek. There is more tangible evidence of another forge at Saugus, Mass. Tourists may pause at the historic marker and read "IRON WORKS." "The Company of Undertakers



STOVE PLATES, BACKS & JAMBS,
JUST RECEIVED,
From Millville Furnace, New Jersey.
THE BACKS and JAMBS are from a new pattern, and on a plan approved by all who have seen them.
The STOVE PLATES are from a small pattern and well executed.
ALSO,
A QUANTITY OF PIG IRON
FOR SALE—Apply to
SMITH & WOOD,
No. 33, north Water street.
November 26 d3t

PIG IRON.
FOR SALE, 100 tons *Grey PIG IRON* from Millville Furnace, (situate in Cumberland county, New Jersey.)
CASTINGS executed with dispatch at said Furnace, on receiving patterns.
WATER POWER,
Head and Fall 22 feet—pleasantly situated, within half a mile of the village of Millville, which contains about 30 dwellings, and rapidly improving in consequence of the establishment of said Furnace, and a new Glass House now building.
Manufactories requiring water power will find the convenience of water carriage to the spot, by means of vessels drawing 6 feet water.
It is presumed there is water sufficient for a Rolling and Slitting Mill, a Grist Mill, a Nail Factory and Cotton Factory.
For terms apply to
SMITH & WOOD,
No. 33, N. Water street.
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Advertisements of 1814.
Variety was the mainstay of the early foundries.

for the Iron Works," consisting of English gentlemen and colonists, erected a furnace on this site in 1643. Joseph Jenks, their employee, built a forge here in 1647, invented the modern type of scythe, and built Boston's first fire engine. There were many other men like Joseph Jenks, veteran ironmongers of England, Holland, Germany, Sweden and Spain, who came to America and built forges and primitive foundries for the casting of simple tools and utensils. By the end of the 18th century, Congress reported that there were approximately 150 Catalan forges or bloomeries in the State of New Jersey.

Both Northern and Southern New Jersey were dotted with small iron industries by the middle of the 18th century. Rich deposits of bog ore were discovered in many areas in the flatlands and marshes on the west bank of the tidal Delaware. Both hard and soft ore were found in the Ramapo Mountains and the Blue Ridge Foothills in the region between Dover and Belvidere. Many of the foundries in these areas, especially Oxford Furnace, supplied the Continental Army with cannonballs, and those in the northeast region pooled their efforts to cast the huge chain which was stretched across the Hudson River as a barrier to British warships. It was a tremendous undertaking that failed in its purpose, but it was successful as a demonstration of the capacity and cooperation of the early craftsmen in iron.

The Weymouth Furnace, New Jersey. Parts of this early establishment were used in the Jones Brothers Foundry at Florence.

Most of the early forges were the Catalan or Spanish type which produced circular pigs or blooms. Typical production of a forge was five to ten tons a week. The blooms were usually transported to a foundry or mill for re-working, rolling and shaping. It is interesting to note that Swiss and German gunsmiths in Eastern Pennsylvania were able to use colonial iron, heat it, temper it, and roll it in thin spirals around an iron core, and fashion the deadly "squirrel rifles," later misnamed the "Kentucky rifle," weapons far superior to those of European manufacture.

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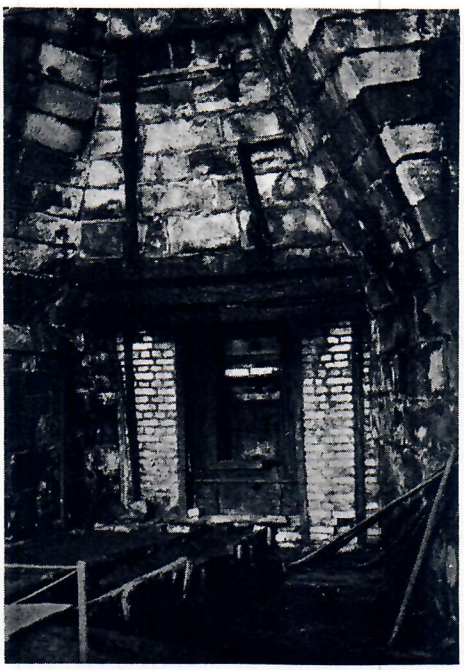
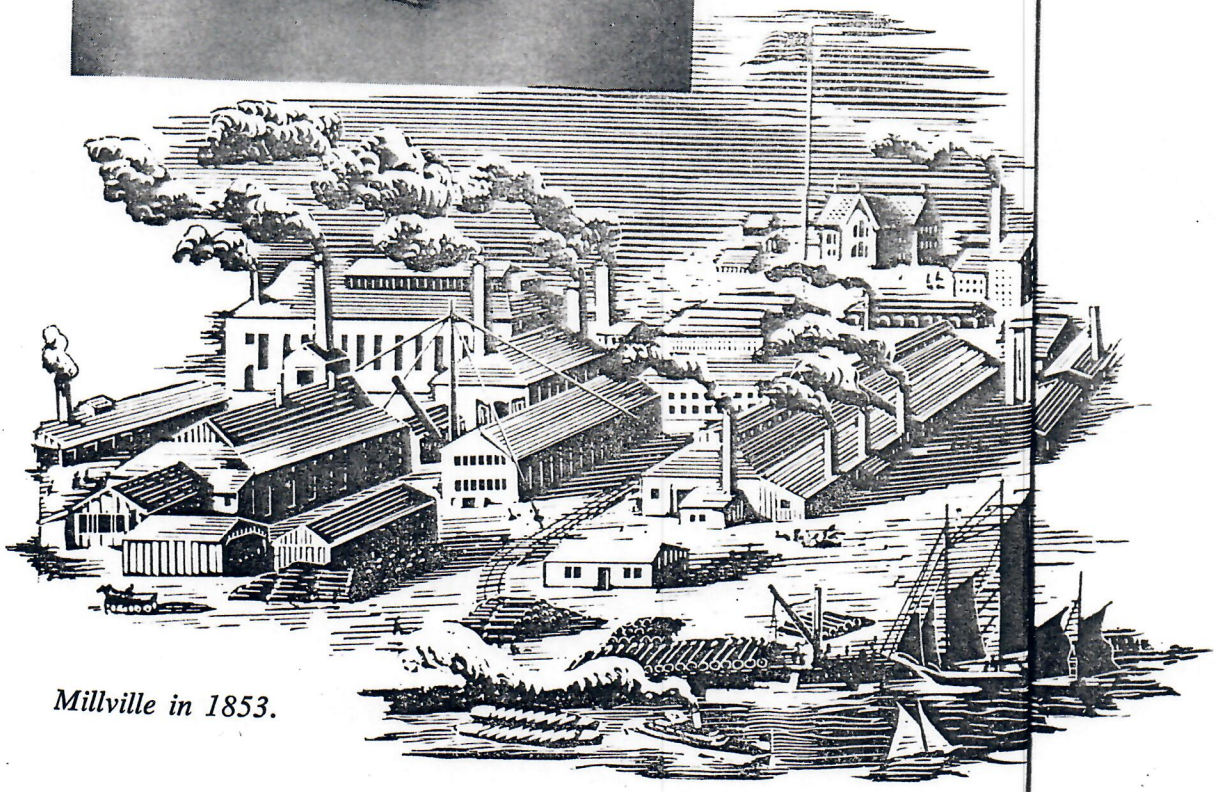
Most of the early New Jersey forges were made of brick and stone with an external wooden frame and roofing. Damage from fire was a constant hazard. As the industry grew, the furnaces expanded in size and improved in method of blasting and casting. Actually, blasting is a process of purification or cleansing by which foreign substances, mostly sulphur, silica, and even traces of rare minerals such as silver and gold, are burned out. By the time the Wood family became interested in its first foundry, the "Catalan bloomeries" were giving way to the cupola furnace of English design. A brick furnace of this period is described as follows: "It is about 24 feet square on the outside, and nearly thirty feet of height within; the middle of the widest part of which is not above eight or ten feet, the top and bottom being brought into a narrower compass, something like the shape of an egg." Within the furnace the workmen placed ore, lime (usually oyster shells in Southern New Jersey, chunks of limestone in the Northern counties), bedded in layers of charcoal. Behind the furnace were bellows, power-driven by water wheels, to add oxygen to the combustion. As the heavier iron sagged to the bottom, the impurities were driven off in gas or collected on top as slag. Once the slag was run off, the metal was diverted in a shallow sand mould called "the sow," and then channeled off into the elongated pigs to cool and harden. The visual metaphor here is quite realistic to the iron-monger who was often a part-time farmer with a pigpen in his yard.



Cupola of the Weymouth Furnace.

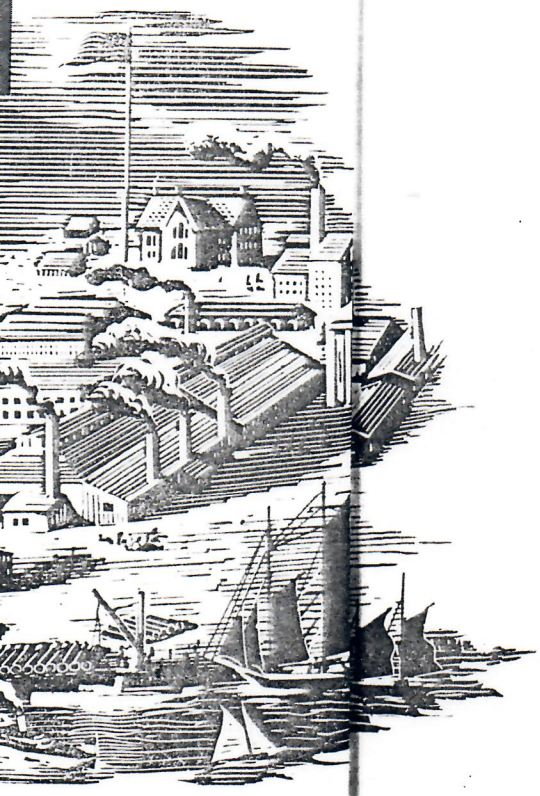
R. D. Wood.



Millville in 1853.

Chapter TWO

R. D. Wood.



D. C. WOOD and R. D. Wood both lived through an important transition period in iron-making. A modernized furnace was built at Millville in 1834 in order to meet the demands for pipe casting. For the early iron foundry, three things were necessary: a plentiful supply of iron, a self-replenishing supply of fuel, and a dependable source of water power.

The bog ore, which is decomposed of hard ore, gave out first, timberlands for charcoal thinned out rapidly, and as larger furnaces were built, larger wheels and greater water pressure were necessary.

As Richard Wood was drawn more and more into the financial and management problems of his brother's plant at Millville, he hustled around New Jersey and Pennsylvania studying the manufacturing and marketing problems. Millville was near the Philadelphia market, and water transportation was nearby. However, the maw of a furnace was almost insatiable in its demand for fuel. An iron furnace annually consumed the charcoal supplied from a thousand acres of woodland. Here was a simple problem in mathematics. It

took nature twenty years to replenish the wood in new trees. Therefore a furnace required 20,000 acres of timberland to provide a continuing supply of fuel. It is the patent truth that most of these furnaces perished beneath the weight of debt on the land they impoverished.

Richard D. Wood was a successful merchant, ship operator, and capitalist with a yen to enter the banking field. The Wood family were Quakers, direct descendants of Richard Wood of Bristol, England who came to Philadelphia in 1682, and served on the first grand jury for the province. David C. Wood was born in 1780, Richard D. Wood in 1799. The difference in ages was no wider than the difference in physical appearance, demeanor, and business talents. We learn much of family history through the informative and objective narrative of Richard's diary, a tome of several hundred thousand words which highlights his business and family affairs almost to the day of his death. The elder David was ambitious with a long eye to profitable investments in his furnaces, mills and real estate, but he

The Wood residence at Greenwich, New Jersey.

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was an inept manager of his own affairs, crotchety in temperament, and mercurial in disposition and decision. His younger brother Richard was self-disciplined to a marked degree. He managed and apportioned his time and talents with the same care that he invested his carefully acquired capital. He was a shrewd trader, loved to win a hard bargain, but observed the spirit as well as the letter of a contractual obligation.

At this point it might be well to go back to 1812 when Richard was 13 years of age. The War of 1812 gave the young nation a serious economic shock and set-back. As the war came to an end the return of specie payment put a pin-prick in the sudden inflation of prices, and rapid depreciation of values ruined many merchants. Richard went to work in the general store operated by his father and uncle. In between his clerking duties he read, studied, and fortified his mind with usable business information and current political and economic opinion. By the time Richard reached 18, he had won the confidence of his father and uncle and he went to Philadelphia to buy goods for them.

This duty aroused in him the latent instinct of the merchant, and he determined to get a store of his own. He confided his ambition to a relative of his mother, David Bacon, a man of some means, and not averse to putting some capital in a reasonably safe venture.

"Where would you conduct such a store, Richard," his uncle asked, "surely not here in competition with your father and uncle?"

Richard protested, "Of course not. I want to go to Salem where there is need for a good store."

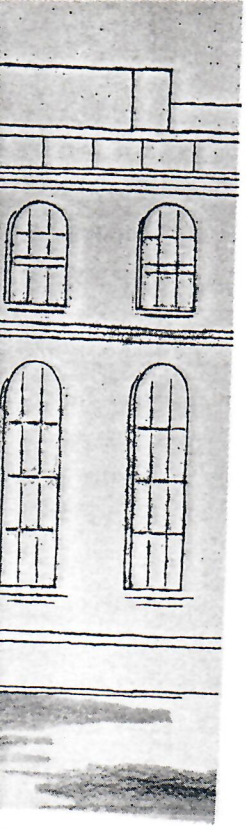
David Bacon weighed the matter, and Richard added convincing argument and evidence.

"Salem is the richest and largest town of west Jersey." David Bacon agreed but required that Richard provide a minority interest of the capital, knowing that any man thinks twice when spending his own dollars.

Wholesaling and importing dry goods was R. D. Wood's first Philadelphia venture.

Said Richard Wood in his diary: "An old man, servant of my grandfather, who lived with my father, and who had saved the earnings of a long life, lent with my father's indorsement, what he could muster. An old neighbor of the name of Stiles, whom I used to amuse by playing checkers with him, furnished part of the balance." Then he rented a store on the main street of Salem, premises that were once occupied by his uncle, James Wood, a half century earlier.

Off he went to Philadelphia to buy merchandise with his capital carefully guarded on his person. After making his selection of merchandise, he decided to return by river boat, and hired a sailing vessel owned by a Captain Miller from his birthplace of Greenwich. After an hour or two, the Captain gave his passenger the rude intelligence that the boat was leaking badly, and they were in imminent danger of sinking. The bad news was partly offset by the fortunate position of a hidden mud flat on which the porous hull grounded and



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plugged its holes. A parcel of sugar and other perishables was damaged by the water, but help came and most of the other items were salvaged with small damage. Richard's elder partner was distressed by the bad news, but Richard published the story far and wide, that the entire stock of water damaged goods would be sold at once at bargain prices. When David Bacon got through counting the salvage sale, he found that the partners had made a respectable profit.

Richard's youthful ability as merchandiser and manager is attested to by another brother, Dr. George B. Wood. After two years in Salem, Richard opened a store on Market Street in Philadelphia under the name of Wood, Abbott and Wood, the second Wood being his cousin Samuel. Speaking of his earlier training in his father's store, the doctor said, "He could not have had a business education better adapted to future success than here. It included an intimate, practical knowledge of the properties, value, price, etc. of all kinds of merchandise, the habit of close attention to all the minutiae of business. . . . He came to Philadelphia at a time peculiarly propitious for the beginner. Mercantile houses had just begun to recover from that almost universal collapse following the excessive expansions, and the wild speculations that succeeded the peace of 1815." Dr. Wood goes on to tell how his merchant brother saw the old established houses fail, and that Richard was representative of the new crop of businessmen who, with high hopes and small capital, went out to make their fortunes. There were more who lost than won, but Dr. Wood recounts that his brother picked able partners and profited by their judgment and experience. The young merchant was also a believer in fast turnover for a quick profit, and one of the first measures adopted by his house was to let it be known that they would sell everything for cash at five per cent advance on the purchase money. Many contemporaries called Richard D. Wood "foolhardy" and others told him to his face "No firm could support itself on so small a profit," but Richard did make

a profit for himself and his partners, and his fame as a trader and operator spread into all the eastern markets.

Richard D. Wood liked people. He spent a great deal of leisure time in a drummer's hotel on Fourth near Market, a hostelry patronized by the western merchants who came in for their semi-annual or annual buying expeditions. Wood loved to match wits with the westerners in the evenings, but in the daytime he matched prices with competitors and won a sizable share of the western trade. When the buyers were in town, Richard slept in the store and was ready bright and early for the first customer at the door. During the late 40's there are frequent mentions of Richard's visits to cities of the west "to recover outstanding debts and find new customers." He took risks and there are several entries which indicate occasional credit losses from unwarranted confidence. He tells us in 1852 that two of his men wrote "gloomy accounts of our debts in the west." After hours, Richard would often go to the Athenaeum to indulge his passion for reading. As to the quality and range of his reading, he is reticent, but the diary on September 10, 1848, had a sudden entry in which he mentions his interest in "Jane Eyre," a novel which caused him to make a note of recrimination about reading on Sunday. If he ever heard of Charlotte Bronte after that, there is no clue in the journal.

The 1837 demand of President Jackson for specie payment for western lands let the air out of the speculative balloon on western real estate and precipitated a general recession in commercial life. His refusal to issue a charter to the Bank of the United States added to the financial chaos. The lack of specie constricted and limited business activity in Philadelphia, and in all of the larger coastal cities. During this period, Richard Wood and his brother, the doctor, continued their support of David with their personal credit.

By 1845 Richard Wood's stature in the world of commerce and finance had grown to the dimension which warranted public

attention in the book "Wealth and Biography of the Wealthy Citizens of Philadelphia" which listed him as follows—"WOOD, RICHARD D.—$50,000—made his own money; came to Philadelphia a poor boy; a good Whig." The comment on his earning capacity was correct, the statement of his poverty in youth was true, but the estimate of his net worth was undoubtedly too low. He could have liquidated his holdings at several times the estimate made in 1845, when his brother's financial difficulties brought Richard, with some reluctance, to Millville. In the same year, he was made a director of the Schuylkill Navigation Company, largely through his campaign to enlarge the capacity of the canal. The tow-path mule and iron horse were getting into a life and death struggle, and Wood urged the project as an offset to the competition of the Philadelphia and Reading Railroad which was completed to Mount Carbon in 1842. Wood served the Canal Company until 1863. Both companies merged in 1870, the year after Wood's death.

In the meantime things went from bad to worse for David, and in 1851 Richard acquired the furnace property through bankruptcy

The Florence pit cast shop about 1907.

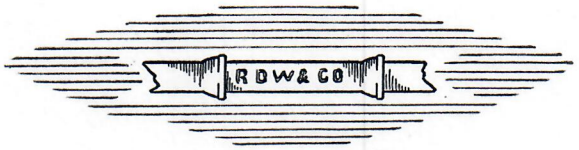
proceedings and sheriff's sales. All creditors were paid off. He states on April 19th, "I purchased about 6,700 acres for $3,995," the remaining parcel of land from the foundry and furnace.

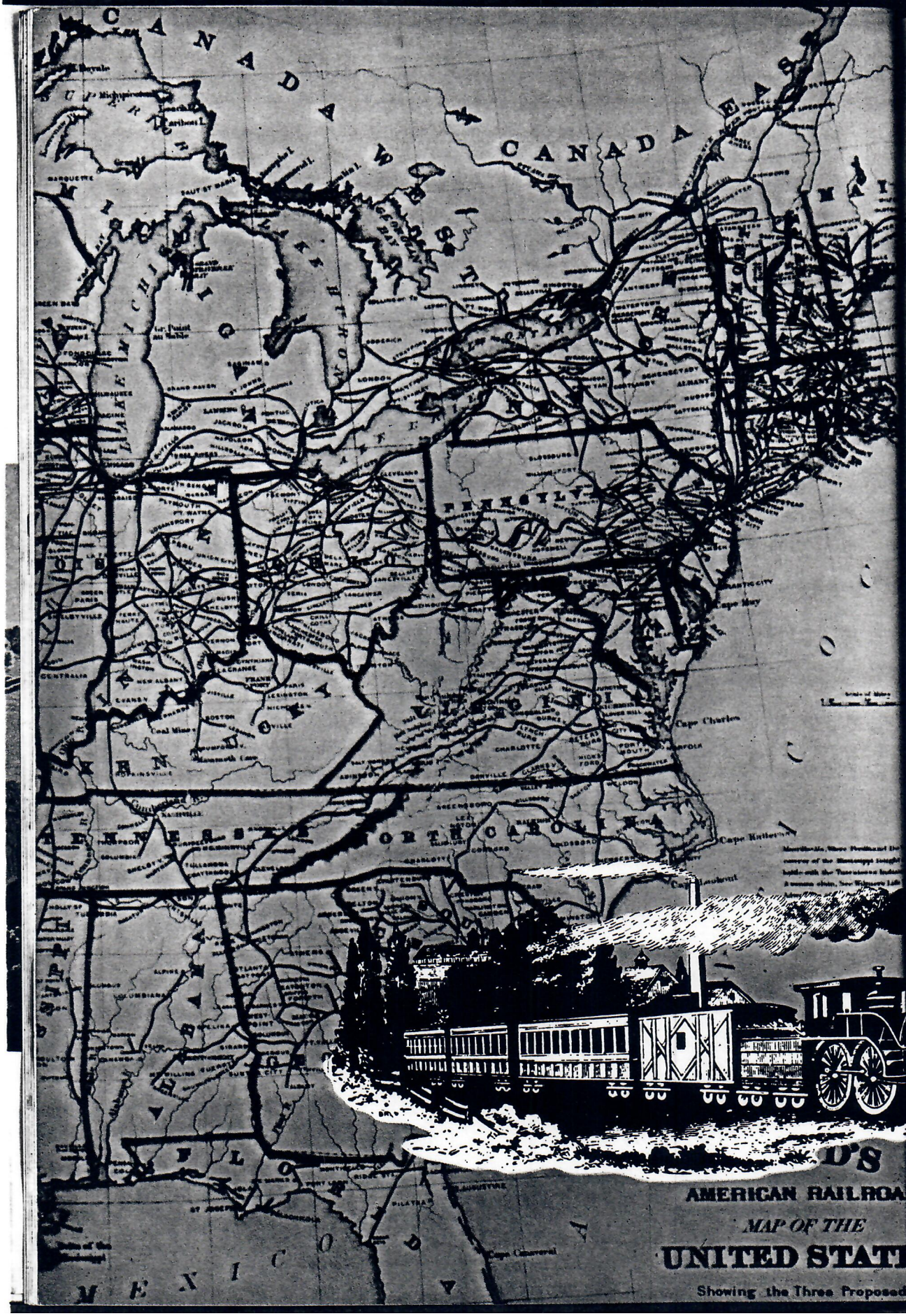
Meanwhile we learn that Richard has been giving more and more attention to learning the science of cast-iron pipe making, and the problem of finding a market for the Millville product. In February he was interviewing the Commissioners of the district of Penn Township about supplying them with pipe. In April he was at the foundry, reporting on the work in progress. "They made three 16-inch pipes, four 10-inch, six 6-inch, fourteen 3-inch, making twenty-seven in all."

The Millville furnace, which had an annual capacity of about 600 tons of iron, found increasing difficulty in competing with Northern New Jersey and Pennsylvania furnaces which were near the anthracite fuel supply and had ample ore resources in the surrounding hills. The digging of canals and the coming of the railroads to the mines offset any advantages that the Millville blast furnace might have in accessibility to deep water and city markets. Richard Wood was quick to convert a difficulty to an asset. He invested in various mines, furnaces, canals and railroads from which he was assured a steady supply of iron for his pipe foundry. The Millville furnace ceased production in 1849, but the Millville foundry was enlarged the following year, with an annual smelting and moulding output of four to five thousand tons. Richard Wood combined vision and realism to meet the economics of the day. In this year further improvements were made at the foundry to permit the vertical casting of 12-inch pipe. This was the standard method of pipe casting until the introduction of the centrifugal sand-spun horizontal casting method 72 years later.

The feeble canal ditch which ran 2½ miles along the swamp from the Maurice River at Union Mills furnished only 50 horsepower, and was a source of aggravation to R. D. Wood. In 1851

he began the digging of the new canal which was 48 feet wide and four and one-half feet deep. This multiplied his power, but the demands for waterwheel energy expanded rapidly, and he visioned a dam across the Maurice, a dream achieved seventeen years later. However, in 1854, with the increased power available, a cotton mill started two years earlier was put into operation at a cost of a quarter of a million dollars. It had 18,000 spindles, 430 looms, employed 350 people, and had a monthly capacity of 160,000 yards of cotton cloth. Within a few years the cotton mill was enlarged to 700 looms, 32,000 spindles, and a monthly capacity of 525,000 yards of cotton cloth. In 1860 a bleachery and dye house was constructed for finishing operations. Hundreds of people were coming to Millville, foundry men, mill hands, weavers, as well as skilled glassmakers for the pioneer glass works which employed the superior sand of the Maurice River for the manufacture of window panes.





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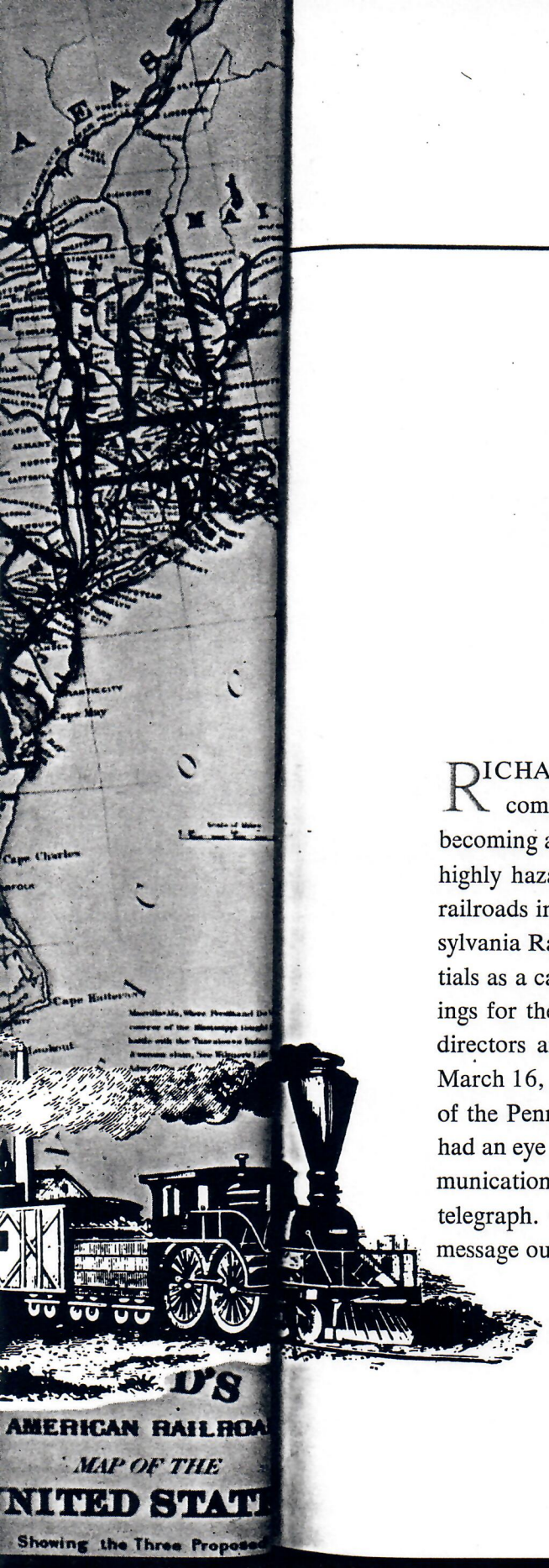

Chapter
THREE

RICHARD D. WOOD was a busy man, working for his canal company one day, the railroads the next. The railroads were becoming a maze of short lines, interlocking, overlapping, and often highly hazardous as investments. But Wood sold stock for several railroads in which he was willing to risk his own capital. The Pennsylvania Railroad never had a more vigorous promoter of its potentials as a carrier of passengers and goods, or as a producer of earnings for the investor. Wood was influential in the selection of first directors and in the election of the first president of the road on March 16, 1847. Wood was a member of the first board of directors of the Pennsylvania Railroad but resigned in November, 1848. He had an eye to all of the epochal improvements in transport and communication, and was an early enthusiast for the use of the Morse telegraph. On January 27, 1854, he sent the first paid telegraph message out of Millville.

His vision and energy were at work all of the time, even when his body began to feel the wear and tear of a busy life. Not everything he touched made large profits, but no venture ever suffered from his judgment. He appraised opportunities, localities, and people with a penetrating and objective mind. He was loyal to his family and friends but never at the price of folly. He had dignity but was never too proud to sell his wares, whether they be groceries, dry-goods, iron pipe, lamp-posts, iron rails, fruit from his farm, or land for building. He admitted to the joy of trading, and confessed to the thrill of making a profit, whether it was a dime or a dollar.

Many of his successes were other men's failures. The Millville Furnace, the Cambria Iron Works, the Florence Mills and Camden Mills were all the faltering ventures of men of high vision who lacked the command of their talents, or were unwilling to invest the mental and physical sweat that goes with successful management. R. D. Wood drove himself at fast pace, and if the partners and officers of the enterprises in which he took the reins grumbled at his whip-cracking, they were well aware that he didn't spare himself. One day he was inspecting an ore hill, the next a construction project, the next he was calling on city engineers for pipe orders, the next he was heading west for Omaha or Louisville to get merchandise orders for the stores in Philadelphia. In later years he spent months offering pipe to gas companies or iron to railroads.

As an example of his personal industry, his diary entries in the early fifties tell of plans to enlarge the canal for the furnace at Millville, an effort toward the salvage of the Trevorton, Mahanoy & Susquehanna R. R., and an early meeting with the officers of the Cambria Iron Company, which was in need of added capital, an urgent meeting of directors and executives of the Insurance Company of North America, which had suffered a heavy set-back when the *S. S. Arctic* was rammed by the French steamer *Vista* in a fog off Cape Race and sank. No dividends were paid that year. The

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S. S. Arctic belonged to the Collins Line, and the wife and two children of E. K. Collins perished with 300 other passengers. New York City went in mourning from Bowling Green to 14th Street. Collins and Wood met on several occasions prior to the loss as Wood had an urge to get into trans-Atlantic shipping. Collins was an early operator of iron steamships in America, and his *S. S. Baltic* set a speed record of 13.34 knots in 1851.

History glows through the diary entries. Wood is in Washington and has a luncheon date with President Pierce, and he intends

Scrip issued in 1849. Before the Federal Reserve System, money scarcity could be a local problem.

to "tell him off" on several subjects—frankly but firmly. The southern political skies are clouding up. Business suddenly fades away in 1856, and by 1857 the country is in the throes of a panic worse than 1837. In all of these eventful months, R. D. Wood flits from problem to problem with the speed and agility of a humming-bird sampling the nectar of flowers. The North America Bank helped him meet a

crisis on October 7. By December the money stringency had eased, and the New York banks resumed specie payments. Writing of this period he says, "The remembrance of this year will continue with me. It has been full of commercial losses and difficulties, owing to an immense contraction in the currency in the last half of the year, and in the first half from having to meet engagements that were entered into without sufficient consideration." The loss of the schooner *Martha* in 1857 enroute to Brooklyn with a full load of pipe valued at $5,000 was a serious blow. The upturn in the cotton market gave him cause to rejoice, and he reports increasing entries about the cotton mill operations in Millville which reflect the improvements in power at the mills, especially the new Geyelin water turbine. On May 1 of 1858 he reports his decision to increase the size of the looms from 30 to 39 inches.

By 1860 the economic situation improved but the political tension heightened. He is pleased to hear of the nomination of Lincoln in his May 18 entry. He visited Bedford, Pa., on August 25, and met President Buchanan who was visiting the town. They chatted pleasantly, and perhaps with less earnestness than marked his luncheon meeting with President Pierce. On October 3, he sent a check to H. C. Carey as a contribution to election expenses. Carey, the son of Matthew Carey, the celebrated publisher during the American revolution, was a political economist who believed in "paper money" as opposed to the "hard money" school. Some of Carey's ideas are reflected in the present Federal Reserve System.

On November 6, we find this comment, "Went with son to poll and voted for Lincoln for President of the United States." By the end of the year, however, he complains of the panicky attitude of businessmen, and the lack of business acumen of the men in government. Businessmen are paying fifteen per cent per annum for money, an intolerable situation, yet R. D. Wood wasn't altogether pessimistic. He concluded a long statement with "Men fear to rely upon

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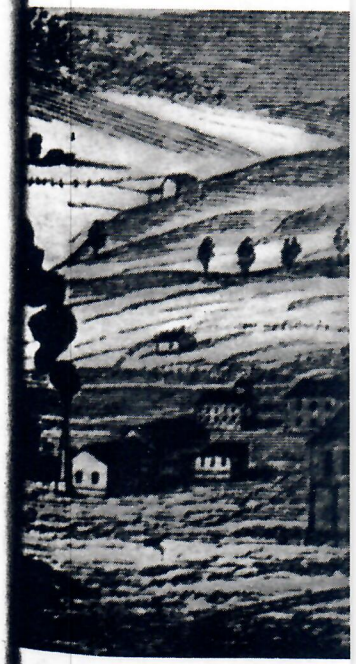
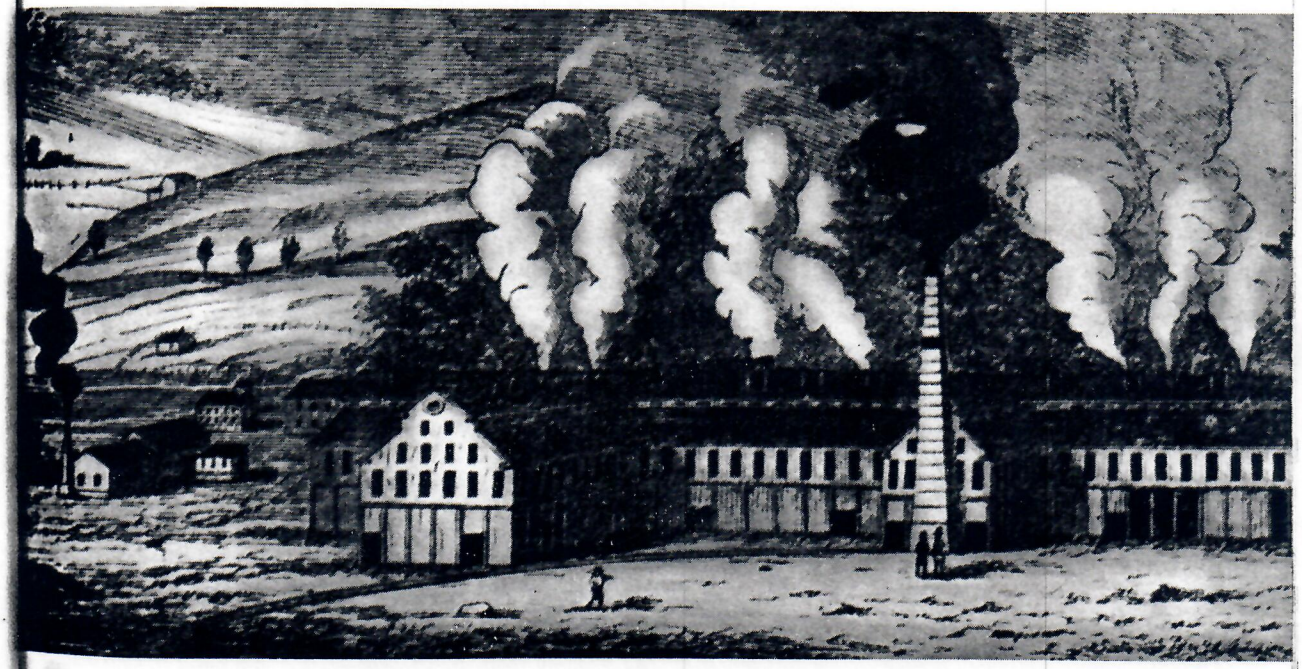


themselves, hoping that Providence will yet save them and the country."

The Civil War gave a delayed stimulus to the commerce of the nation. At first, the shock of conflict, of brother against brother, brought a cessation to trade, but by 1862 the needs of the Union armies for transportation, uniforms and other equipment stoked up the mills of the nation to a high level of productivity. The Cotton Mill was busy, and the price of cotton was rising rapidly. The twin spectres of speculation and inflation were visible to R. D. Wood and other financiers.

Daniel J. Morrell, associate of Richard D. Wood and member of Congress, conferred with President Lincoln and the cabinet on contracts for railroad iron.

Cambria Iron Works (now a Division of Bethlehem Steel) as R. D. Wood first saw it.



Due to the complicated pattern of R. D. Wood's financial and commercial life, it is difficult to maintain any chronological order to his business progress. To follow him is to zigzag through the decades, and the mere mention of the name of Morrell makes it necessary to go back to 1852 when the Cambria Iron Works was organized at Johnstown, Pennsylvania, with Richard D. Wood offering his blessing and an investment of $10,000 in the venture. However, the company got off to a bad start, and Wood soon abandoned his paternal role on the sidelines to jump into the management problems with some pertinent advice.

One of Wood's intimates was David Reeves, a man of foresight, energy and know-how in metallurgy. Reeves was a generous consultant on techniques at Millville, and Wood responded with financial guidance for Reeves and some of his associates at Cambria. In 1854 Reeves invited a cocky young ironmaker by the name of John Fritz to take charge of the Cambria plant, and on one occasion sent him to Philadelphia on a money-borrowing errand to Wood's friend and fellow investor, E. Y. Townsend. Impressed by Fritz, Wood's original investment of $10,000 increased to $40,000, as he banked heavily on the abilities of the 30-year-old superintendent of the Cambria plant at Johnstown.

Shortly afterward Fritz introduced his three-high-roll-train, a revolutionary change in the processing of iron ingots. The principal outlet of Cambria iron was to the railroads, which required a large tonnage for rails and plates.

Fritz was a man of strong opinions, and never side-stepped a challenge. When the stockholders of Cambria opposed the investment of capital in his invention, he met them in an open meeting and won the day. With Fritz improving the quantity and quality of Cambria output, Richard Wood went out on the road and used all of his talents as a salesman as well as his influence as a railroad capitalist to sell Cambria iron. When the financial debacle of 1857

paralyzed the country and the railroads were unable to pay their bills, R. D. Wood organized the Wood, Morrell & Company to take over the assets of Cambria and sell its wares, installing Charles S. Wood, his brother, as president. Daniel J. Morrell was a merchant turned financier, and a politician who served two terms in Congress as a Representative from Pennsylvania. He and Fritz respected each other's talents, but were not bosom companions. Fritz admitted that "Morrell was a good manager even if he didn't know anything about iron making." Morrell, however, lived on to be elected President of the American Iron and Steel Association, and was a sponsor of the Centennial Exposition at Philadelphia in 1876.

Fritz fought off the ravages of time until he reached the venerable age of 91, and died in 1913, a name to conjure with in the company of Frick, Gary, Carnegie and Schwab. Morrell was more intimate with another great name in metallurgy. One of his associates at Cambria was William Kelly, who was born in Pittsburgh in 1811. Kelly's experiments in steel-making preceded the Englishman, Bessemer, by five years. When he tested his first successful converter, the neighbors called it "Kelly's Fireworks." William Kelly and his brother, John, owned the Suwanee Iron Works in Kentucky. They failed in the panic of 1857, and Morrell turned over part of the Cambria yard for Kelly's continued experiments in steel-making. It was at Cambria, Kelly built his eighth converter which is now a museum piece at the Cambria plant. In 1863 Morrell organized the Kelly Pneumatic Process Co. and was a holder of several Kelly patents.

With the aid of Wood, Morrell & Company, Cambria weathered the financial storm and two serious fires, one of which destroyed the rolling mills. John Fritz, satisfied that Cambria was on a firm footing from the plant engineer's viewpoint, looked for other fields to conquer. He transferred his activities to the Bethlehem Steel Company, and as general manager was assigned to a plant construction proj-

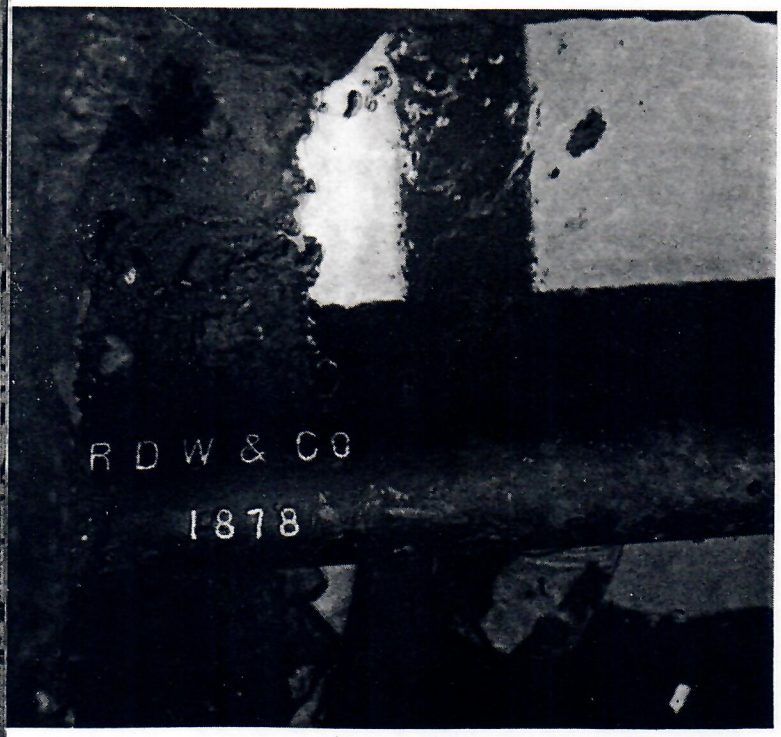
ect. In 1862 Cambria was reorganized with C. S. Wood as president. The firm of Wood, Morrell & Company continued in the iron business as sales agents. The Cambria Iron Works began to operate its Bessemer Converter in 1869, the year of R. D. Wood's death. After the death of Charles S. Wood in 1873, E. Y. Townsend became president.

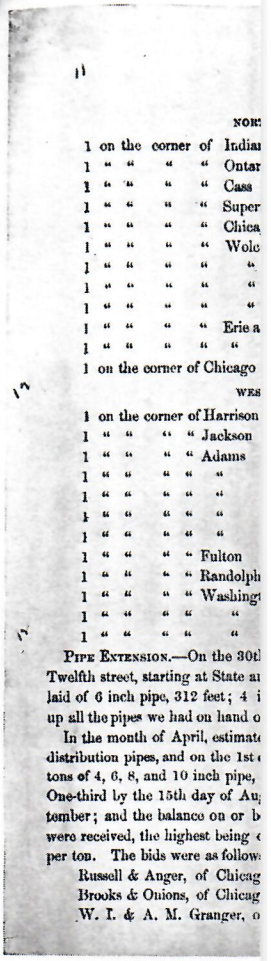
The entries in Wood's diaries during the late fifties reflect the variety of his interests. In 1859 he was fascinated by the products of the new glass factory at Millville, and is especially proud of the Maurice River sand which is used in home window glass, car coach windows, sheet glass for show windows and other industrial purposes.

In 1862 he sold some of his Schuylkill Navigation Company securities at a handsome profit. He had invested in this company out of local pride, and with the hope that combination canals and railroads would fetch coal at a low cost of the Philadelphia market. In 1863 there is a notation of current interest, "I paid $6,100 in income tax." He writes with a hint of pride that it is probably the "largest payment in the district."

During the same year he paid a visit to the plant of J. B. Lippincott, the Philadel-

Seventy-five-year-old pipe still in service.

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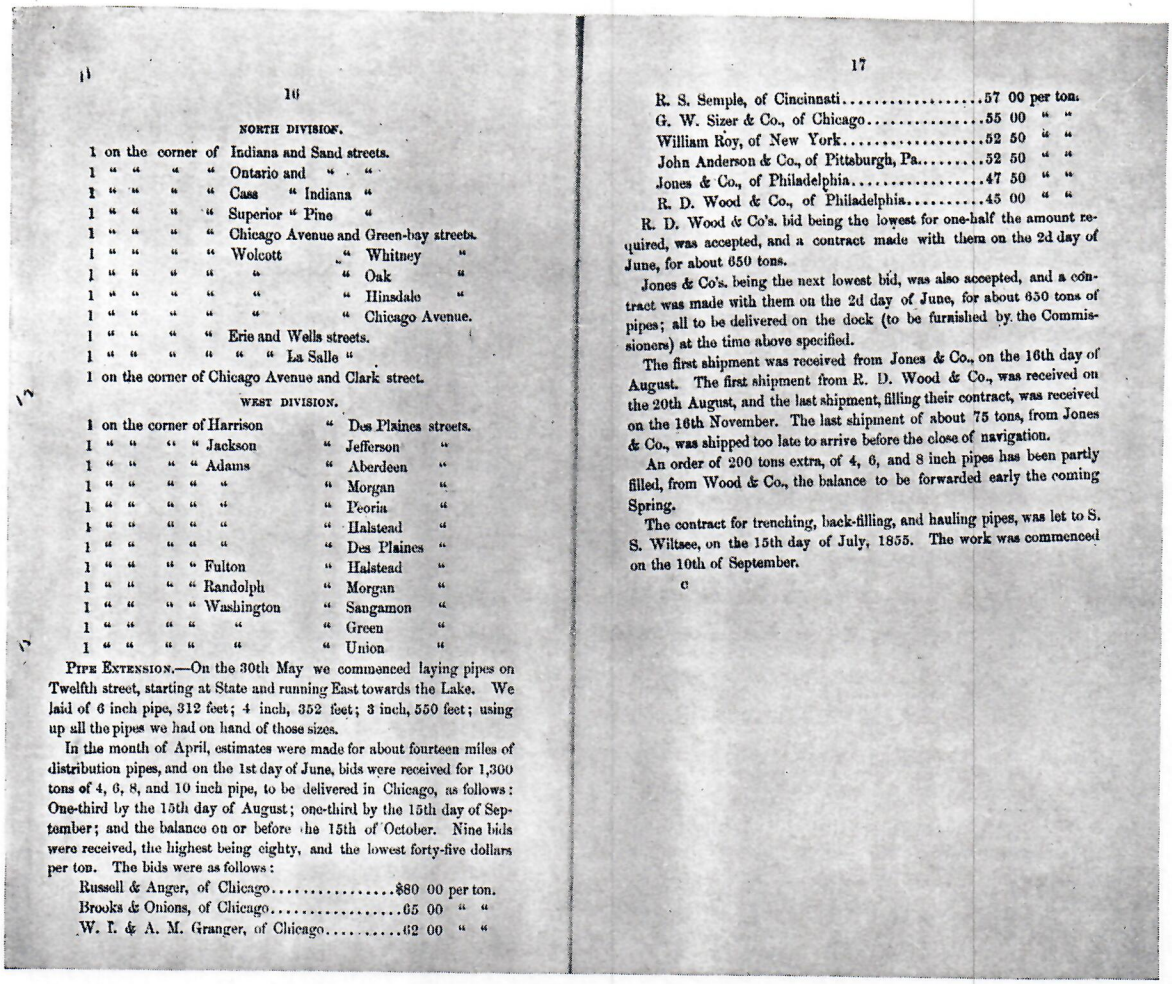

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NORTH DIVISION.

1 on the corner of Indiana and Sand streets.
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1 on the corner of Chicago Avenue and Clark street.

WEST DIVISION.

1 on the corner of Harrison " Des Plaines streets.
1 " " " " Jackson " Jefferson "
1 " " " " Adams " Aberdeen "
1 " " " " " " Morgan "
1 " " " " " " Peoria "
1 " " " " " " Halstead "
1 " " " " " " Des Plaines "
1 " " " " Fulton " Halstead "
1 " " " " Randolph " Morgan "
1 " " " " Washington " Sangamon "
1 " " " " " " Green "
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PIPE EXTENSION.—On the 30th May we commenced laying pipes on Twelfth street, starting at State and running East towards the Lake. We laid of 6 inch pipe, 312 feet; 4 inch, 352 feet; 3 inch, 550 feet; using up all the pipes we had on hand of those sizes.

In the month of April, estimates were made for about fourteen miles of distribution pipes, and on the 1st day of June, bids were received for 1,300 tons of 4, 6, 8, and 10 inch pipe, to be delivered in Chicago, as follows: One-third by the 15th day of August; one-third by the 15th day of September; and the balance on or before the 15th of October. Nine bids were received, the highest being eighty, and the lowest forty-five dollars per ton. The bids were as follows:

Russell & Anger, of Chicago.....$80 00 per ton.
Brooks & Onions, of Chicago.....65 00 " "
W. P. & A. M. Granger, of Chicago.....62 00 " "

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R. S. Semple, of Cincinnati.....57 00 per ton.
G. W. Sizer & Co., of Chicago.....55 00 " "
William Roy, of New York.....52 50 " "
John Anderson & Co., of Pittsburgh, Pa.....52 50 " "
Jones & Co., of Philadelphia.....47 50 " "
R. D. Wood & Co., of Philadelphia.....45 00 " "

R. D. Wood & Co's. bid being the lowest for one-half the amount required, was accepted, and a contract made with them on the 2d day of June, for about 650 tons.

Jones & Co's. being the next lowest bid, was also accepted, and a contract was made with them on the 2d day of June, for about 650 tons of pipes; all to be delivered on the dock (to be furnished by the Commissioners) at the time above specified.

The first shipment was received from Jones & Co., on the 16th day of August. The first shipment from R. D. Wood & Co., was received on the 20th August, and the last shipment, filling their contract, was received on the 16th November. The last shipment of about 75 tons, from Jones & Co., was shipped too late to arrive before the close of navigation.

An order of 200 tons extra, of 4, 6, and 8 inch pipes has been partly filled, from Wood & Co., the balance to be forwarded early the coming Spring.

The contract for trenching, back-filling, and hauling pipes, was let to S. S. Wiltsee, on the 15th day of July, 1855. The work was commenced on the 10th of September.

C

Summary of the Chicago Water Commissioners Report of 1855.

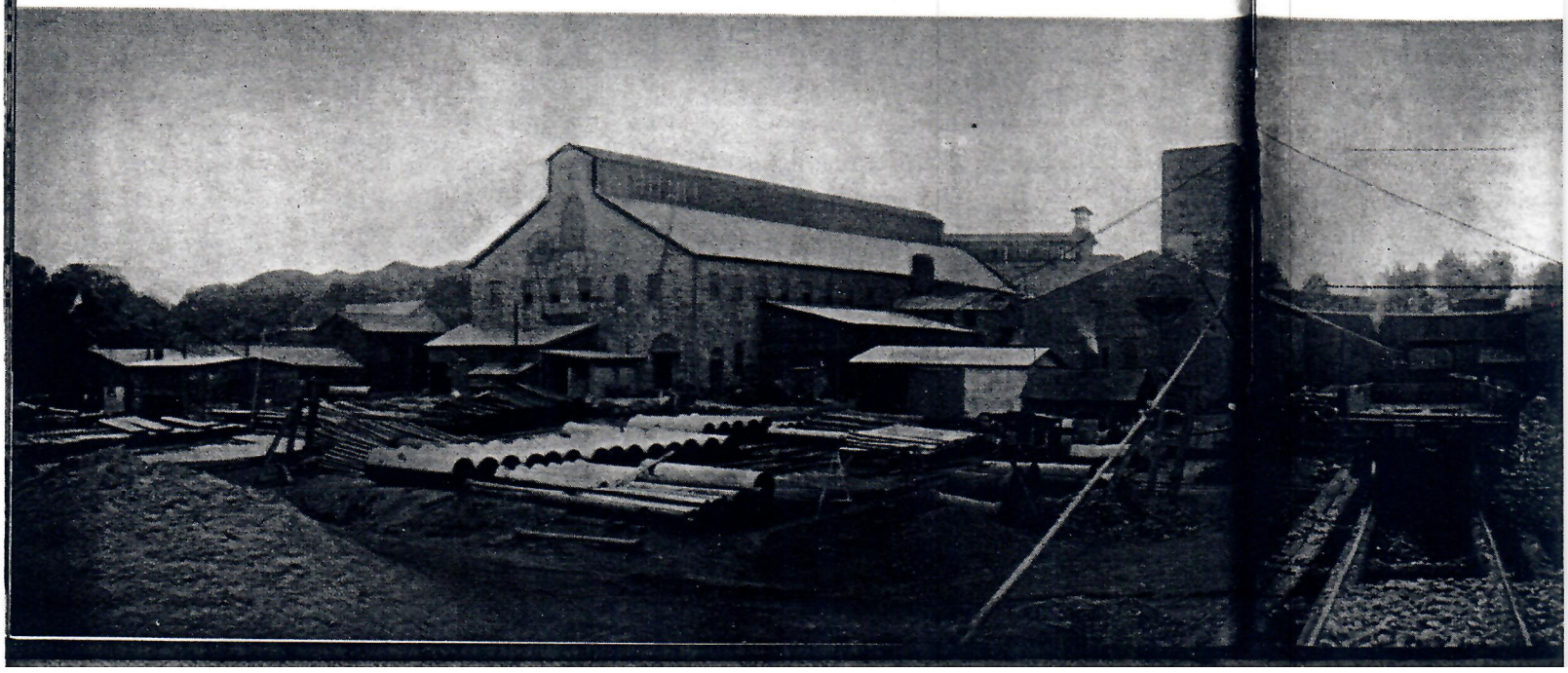
phia publisher, and is impressed by the details of book manufacture. The prospect of the sale of cotton goods for cloth book covers is also a matter of pleasant speculation. Toward the end of the year he discussed the possibility of a steamship line from Liverpool to Philadelphia, tying in the Pennsylvania Railroad with a dockside terminus. Early in 1864 he is buying coal lands in the anthracite region in behalf of Schuylkill Navigation Company whose securities are still rising in value. In the midst of laconic comments on business, there is an added sentence, "saw President Lincoln at the Sanitary Fair on Arch Street."

R. D. Wood spent most of 1865 in Egypt, and when he came back the war was over. He gave immediate attention to the construction of a dam across the Maurice River. He was also intrigued by the new design of a water wheel by Emile Geyelin, and balanced carefully the genius of the wheel builder and his lack of talent in handling his financial affairs. Now conscious of age, he seemed increasingly tolerant of the frailties of his fellow men. On the last day of December R. D. Wood signed a special partnership agreement for three years. The Philadelphia Bank cheerfully went along with a $100,000 loan, personal and unsecured, confident of Wood's ability to turn the money at a profit for himself, his partners, and the bank.

Early in 1867 Wood was invited to help in the revival program for the damaged southern economy, and he gave immediate attention to Virginia as a source of high grade iron ore. He and his old friend, Morrell, purchased substantial acreage for ore digging. During the negotiation period, ex-Governor William Bigler of Pennsylvania called on him to ask his aid in getting the Pennsylvania Railroad to extend a line to Clearfield.

Shortly after the war ended Richard Jones called on Wood to talk about the purchase of his foundry at Florence, N. J., then

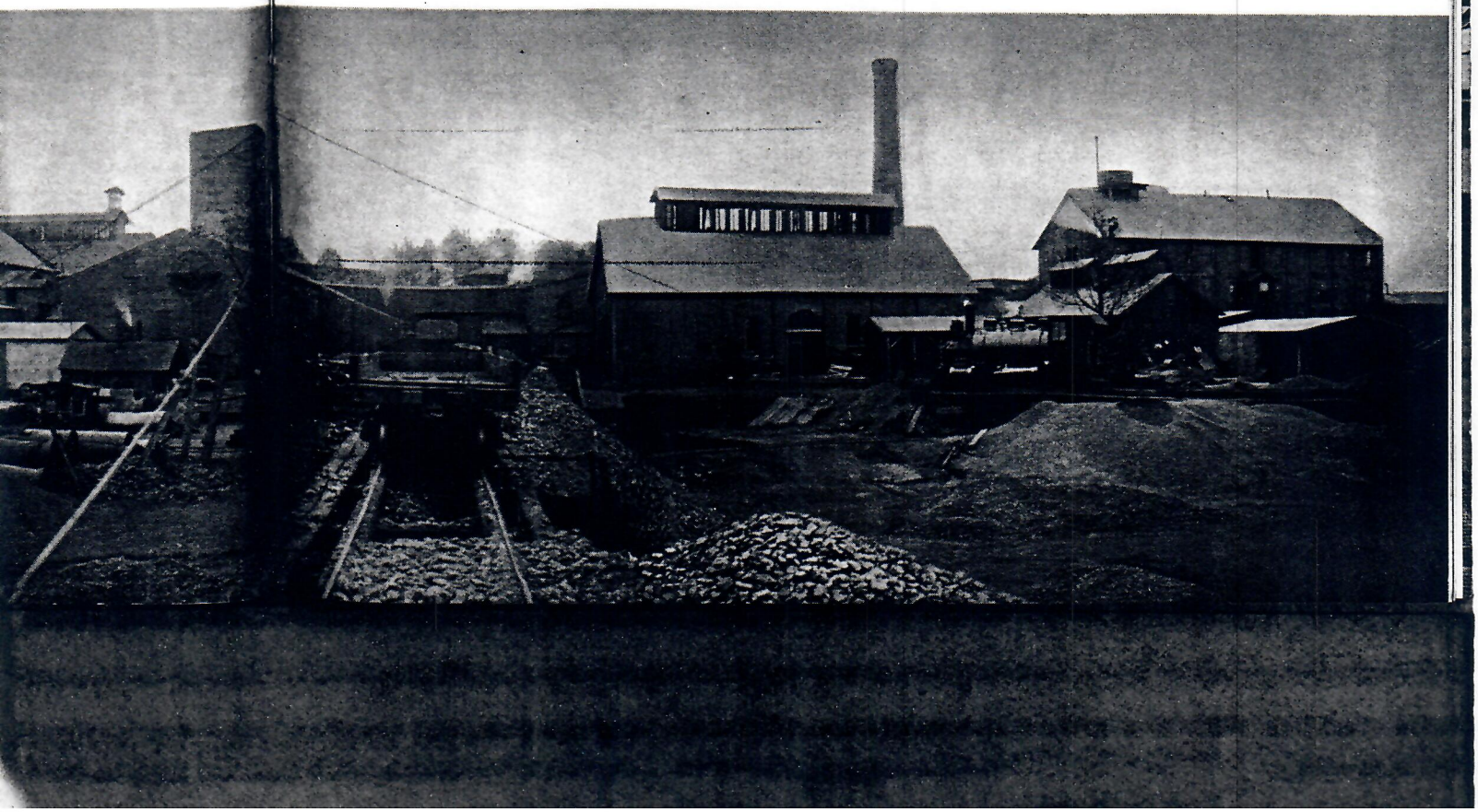
Florence in the 1890's.

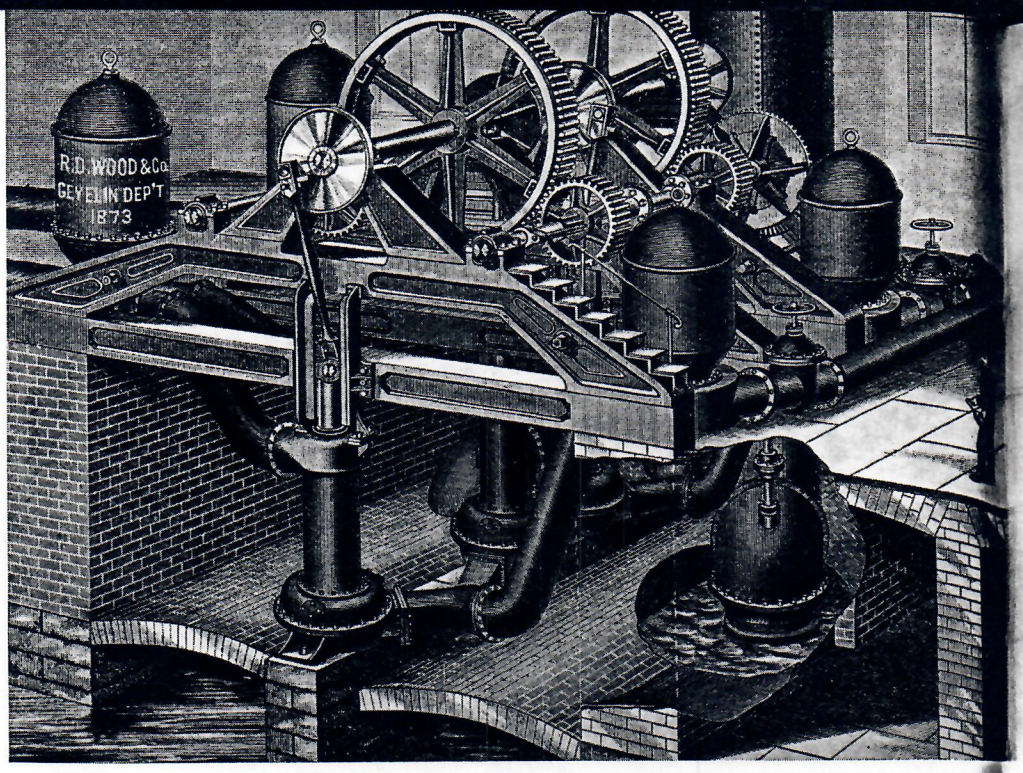


advertised for sale by the sheriff. Richard Jones had encountered some of the difficulties which beset David Wood at the Millville furnace and foundry. They were both land poor and victims of the fatal combination of circumstances which spelled doom for the bog iron industry of southern New Jersey. The bog ore deposits were petering out and pig iron was cheaper and easier to obtain for North Jersey and Pennsylvania furnaces. The cost of cutting wood and converting it to charcoal was also greater than the expense of hauling anthracite coal from Pennsylvania.

Richard Jones and his brother Samuel were previous owners of the Hanover Furnace near Browns Mills in Burlington County, and when they purchased the site on the Delaware River at Florence in 1853, they moved a portion of the equipment to the new location. Many of the skilled iron workers came with the Jones Brothers to the superior facilities erected on the 65 acre location at Florence. The Jones Brothers, and especially Richard, were pioneer men in metals research. Richard was an organizer of the New Jersey Exploration and Mining Company in 1850, later known as the New Jersey Zinc Company.

After an heroic but unsuccessful attempt to make ends meet at Florence, Richard Jones tried to salvage what he could from the





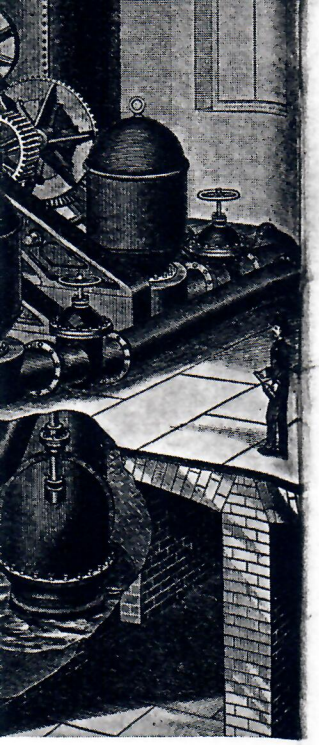
The Geyelin turbine of 1873, an important contribution to the economy of water power usage.

dwindling assets of the foundry and furnace. R. D. Wood was receptive and sympathetic at the opening interview, but his enthusiasm cooled after an inspection of the premises. Wood estimated that it would take at least ten thousand dollars to repair the foundry.

Later on, a Colonel Patterson bought the property for a quick profit and tried to interest Wood in salvaging and remodeling the foundry. Wood eventually bought the foundry, after several months of polite haggling, at the price of $42,000, a substantial drop from Patterson's first quote of $60,000.

Nothing new ever escaped the curious eye of R. D. Wood. As a director of the North American Insurance Company, he heard about a gadget for extinguishing fires. He inspected the apparatus, costing $45, which used carbonic acid gas to snuff out flame. Writes Mr. Wood almost glumly, "If effective as represented, there will be little need of Insurance Companies."

For a man aging and ill, Wood was continually on the move,



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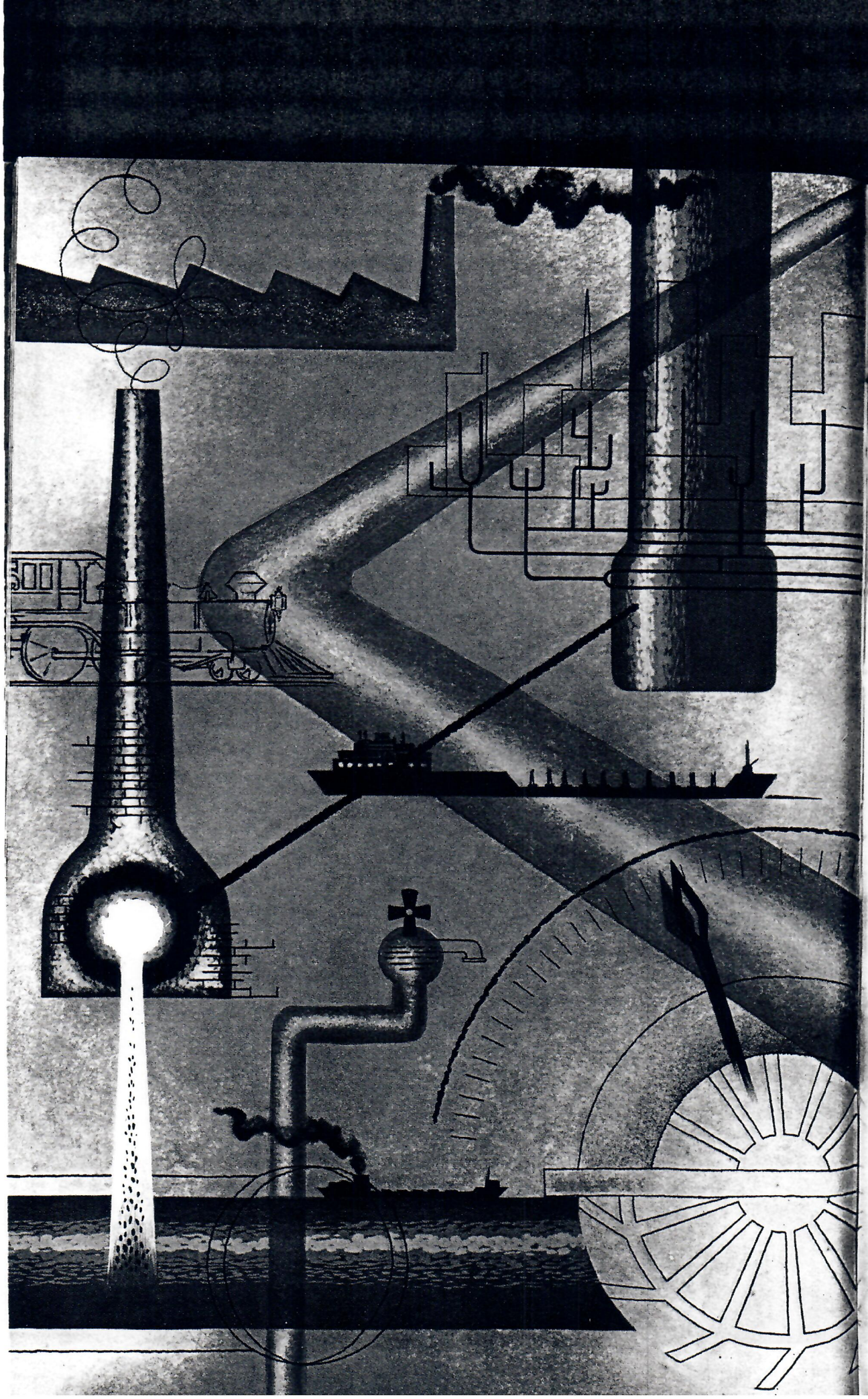
inspecting mines and ore properties, one month in Virginia, the next in Northern New Jersey. In 1867 he went to a cast-iron pipe maker's convention, one of the earliest on record, as he was keenly interested in the stability of the cast-iron pipe trade, orderly marketing of the product, and the acceptance of a set of standards by manufacturers.

The great event of these years was the completion of the dam across the Maurice River. The embankment 2,000 feet long started in 1866 when Wood was granted permission to dam the river by Act of Legislature. It covered a thousand acres and contained 100,000 cubic yards of fill. The dam, or waste weir, was 500 feet wide, and its masonry consisted of red sandstone and cement. The wall tapered in thickness from 11 feet at the base to 4 feet at the top. When first submitted to the pressure of the water, the unexpected happened. The huge stone wall moved forward and tilted, and within 48 hours the wall was four feet out of line. The rapid diversion of the water lessened the pressure, but it took several months to repair and put in working order with new supports and sluice gate controls. R. D. Wood was chagrined at the damage to the weir after he had invested more than a hundred thousand dollars in the project. He recaptured his humor and enthusiasm when he saw the wheels turning for half-dozen industries along the impounded waters, wheels that aided in the making and bleaching of cotton, the manufacture of glass, and the operation of a cast-iron pipe foundry. His last entry in the journal concerned the dam, and his last physical effort was a journey from Philadelphia to Millville where he walked to the dam's edge, his eyes alive with the pleasure of achievement, but his face contorted in the pain of a fatal malady. About a month later, April 1, 1869, Richard Davis Wood died and left behind him a vast treasure of impersonal achievements, infinitely more important in benefits to the community and the nation than his acquisition of a large fortune for himself and his family.



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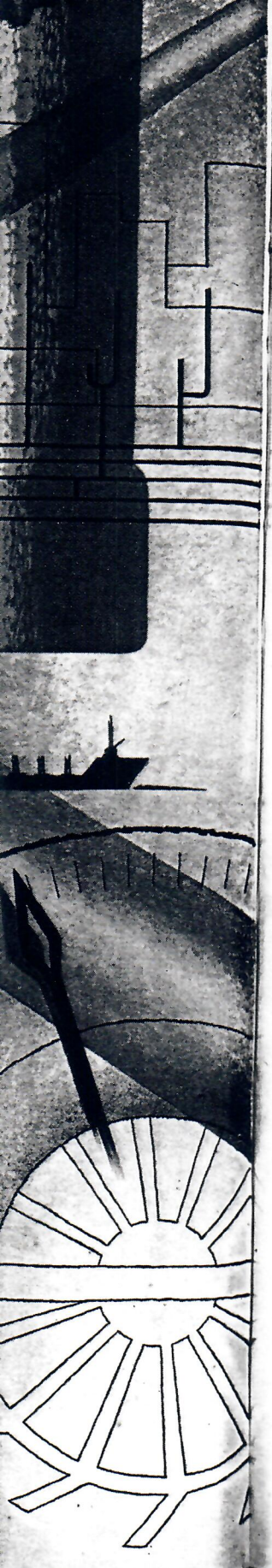

Chapter
FOUR

THE ramifications of these financial interests hung like a spider-web over the economy of the nation, touching its industries, railroads, mines, and mercantile establishments with its auxiliary benefits of banking, insurance and shipping. R. D. Wood had the catalytic touch which incited action but left him free to spin his web of finances in wider, interlocking patterns. The metaphor would be ill-chosen, if permitted to convey the impression that there was a lack of activity in his vast empire of industrial and commercial interests. On the contrary, the threads of his web were charged with an electric energy that reached into every branch of engineering, manufacturing and sales.

When Richard D. Wood died he attempted to bequeath to his sons individual enterprises and responsibilities, and while the sons inherited some of the father's talents, none had all of them, nor could such a phenomenon be expected. One by one the subsidiary

and auxiliary interests of R. D. Wood fade out of the picture under new ownership and direction. George Wood Sons & Company still maintain the Wood tradition in Millville and operate the Millville Manufacturing Company, a concern well-known in the cotton textile industry. However, the sons concentrated on the primary industry of cast-iron pipe manufacture, and the casting and fabrication of water turbines. Necessary to this task were the coal and iron mines, railroad and shipping facilities, and a convenient labor market. Richard, the eldest son, maintained a personal interest in Philadelphia's mercantile and banking affairs. Edward, though admitted to the Pennsylvania bar, preferred business to jurisprudence, and gave his time to R. D. Wood & Company. Randolph specialized in the shipbuilding interests of his father. George continued his management of the cotton mills at Millville as well as giving time to railroading and insurance. Walter Wood, unlike his father in personality, inherited much of R. D. Wood's genius for management. He is described as urbane, well-groomed, with a carriage that marked him as distinguished. He achieved results by suggestion, indirection, and tact as opposed to his sire's frontal and dynamic approach.

While Richard D. Wood had a genius for management and finance, his son, the genteel, worldly-wise Walter, gave his talents to product research, invention, improved manufacturing methods. He applied an intellectual energy to meeting demands of modern industry and went abroad to interview foreign inventors, plant engineers, and spent much time with metallurgists and chemists. He was as much at home in the laboratory as he was in the office or factory. In 1889 he received a British patent for "improvements in the manufacture of illuminating or heating gases." Among his diversified interests which had a strong influence on the company's later catalog of products were his early and effective experiments in the development of traveling and hydraulic cranes, turret lathes, gasometers and a host of other items of immediate and future interest to industry.

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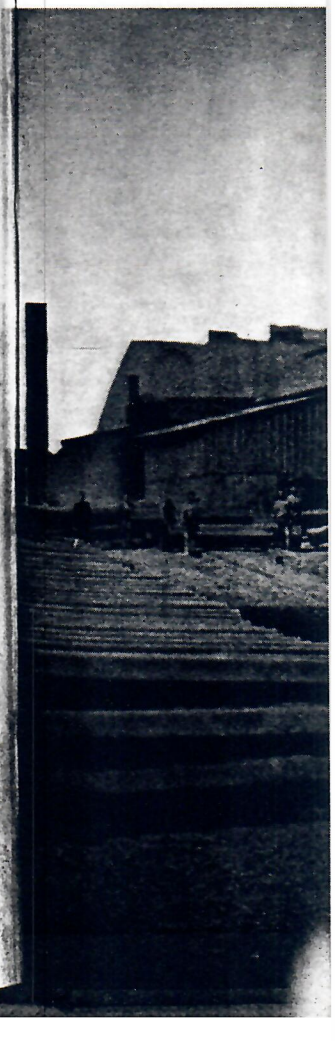
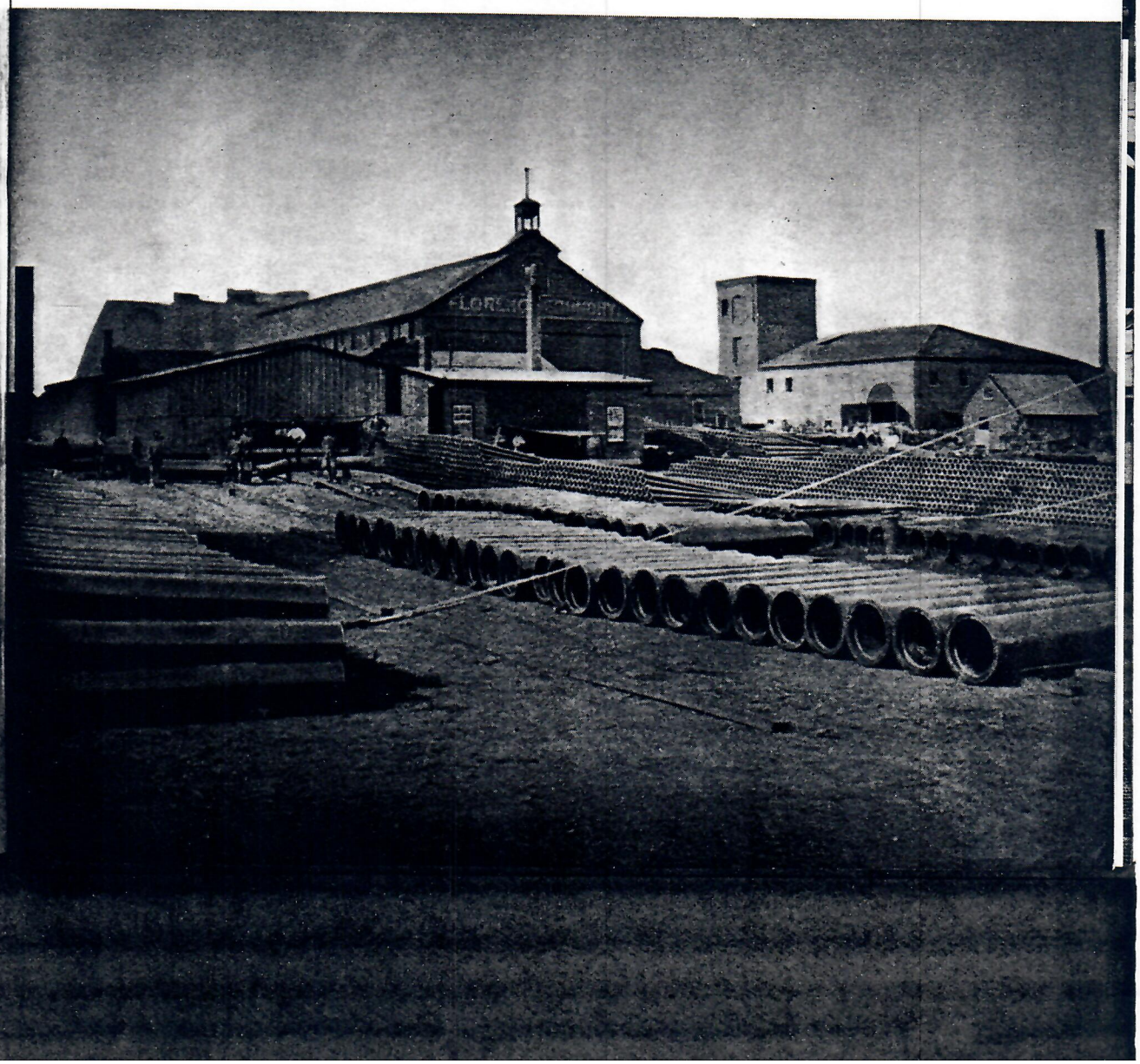


After the death of his father, Walter, with the immediate aid of his brothers, and especially Stuart, the youngest, who came into the enterprise in 1874, gave his attention to revitalizing the Florence Iron Works. Stuart later supervised and managed large holdings of timber and coal lands in Logan, Webster, Randolph, Nicholas and Greenbrier Counties in West Virginia. Stuart rose to prominence in management circles and was Vice President of the American Economic Association during 1889 and 1890. The actual partners in R. D. Wood & Company after the death of the founder in 1869 were Richard, Edward R., Randolph and Walter. Then Randolph withdrew from the firm and he was replaced by Stuart.

In 1883 R. D. Wood & Company purchased the pioneer foundries of J. W. Starr & Sons of Camden, New Jersey, and the company was reorganized as the Camden Iron Works. The final

Florence and its renowned pipe in 1900.

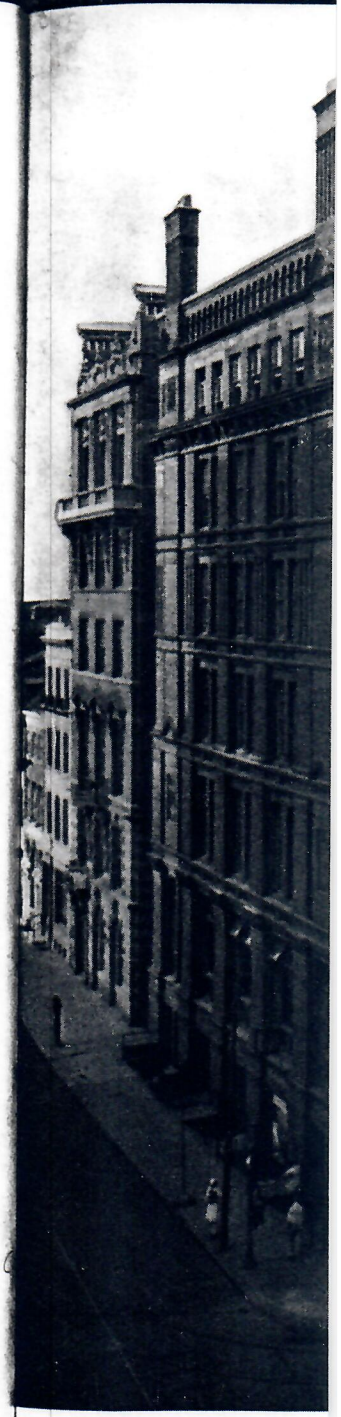


quarter of the 19th century was a period of rapid expansion of facilities at Florence and Camden as products were developed along a homogenous plan—all items of necessity in the water and gas systems of the mushrooming cities of a new nation. In 1886, R. D. Wood & Company with plants at Florence and Camden, New Jersey, and offices in Philadelphia advertised its foundry and machine shop products as—

1. Cast-iron gas and water pipes
2. Plain lamp-posts
3. Gas machinery equipment
4. Geyelin's Jonval Turbines
5. Geyelin's Duplex Turbines
6. Matthews Fire Hydrants
7. Eddy's stop valve for water and gas
8. Meter lamp-posts
9. Graham's anti-freezing lamp-posts
10. Hydraulic machinery
11. Heavy machine castings, gearing and shafting.

There were other items too. R. D. Wood & Company was beginning to reflect the growing complexity of American industrial, commercial and social life. Many of these were going overseas too, as the reputation of the company was carried abroad, especially to community officials eager to improve, enlarge and protect their potable water supply. By 1890 the plants at Florence, Camden and Millville employed 1,300 men, and the furnaces had a casting capacity of 600 tons a day.

On October 15, 1859, R. D. Wood noted in his diary "Met E. Geyelin to settle about the new waterwheel." The comment is prophetic in importance in the history of the company. Emile



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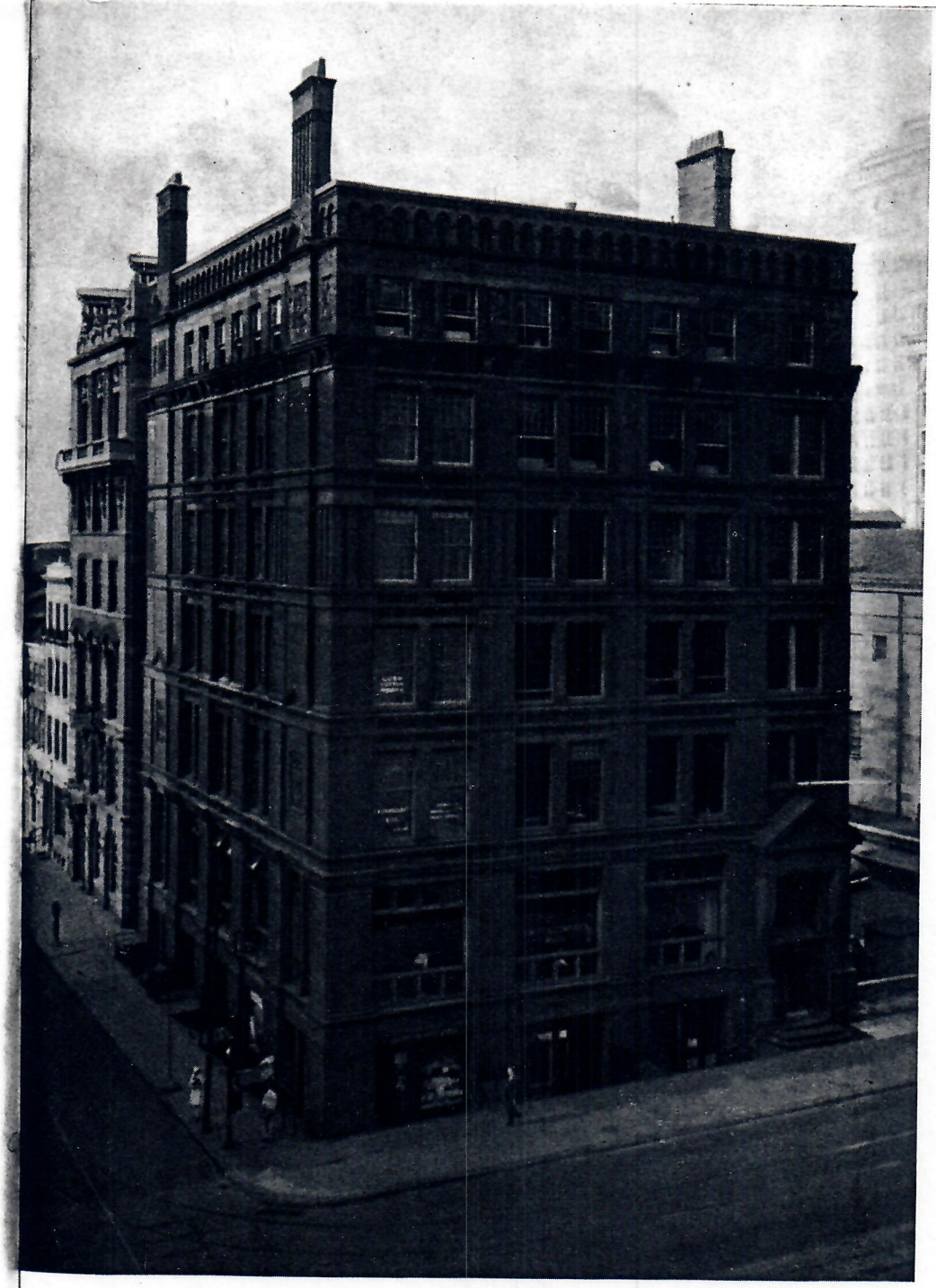

The R. D. Wood Company's building, the first of Philadelphia's skyscrapers. About 1881.

Geyelin was a French engineer who came to this country to promote the building and sale of the Jonval waterwheel, which had proven superior to the overshot waterwheel in general use along the streams of the United States and Canada. Geyelin constructed one of his first wheels for the powder works of the du Pont family. Not long afterward he set up a wheel for R. D. Wood on the Maurice River at Millville. The wheel was tested by the Franklin Institute and given an efficiency rating of 78.3 per cent. R. D. Wood's diaries make several entries that illustrate the plus and minus qualities of the French mechanical engineer, who could solve any problem of high or low water at a mill site, but couldn't manage the simple arithmetic of his finances. Wood, none too patient with his other associates, bided his time and temper with Geyelin because he knew the Frenchman could provide a cure for the waterwheel handicaps of American industry. Wood foresaw a huge new industry in which the cumbersome, lumbering, water-wasting wheels would be eliminated by scientific turbines that used every impulse of the water to turn shafts, and create useful energy. One of the earlier Geyelin turbines replaced the large undershot "breast wheel" of the Fairmount station in Philadelphia. Other cities which purchased Geyelin wheels were Augusta, Georgia; Watertown, N. Y.; Willimantic, Conn: and Richmond, Virginia.

Actually, there were four types of Geyelin wheels, designed to local terrain and seasonal supply of the water available. The Geyelin wheels delivered a high water power potential, and were easily adaptable and adjustable to the rise or fall of the head of water.

Other products for the community water works supplied in the '80s were centrifugal pumps for raising water to filter beds. One of these was installed at the Torresdale plant of the Philadelphia Water Department. One of the large single units of steam pumping machinery was erected at the California Station of the Cincinnati, Ohio, water works. This had a capacity of 125,000,000 gallons of

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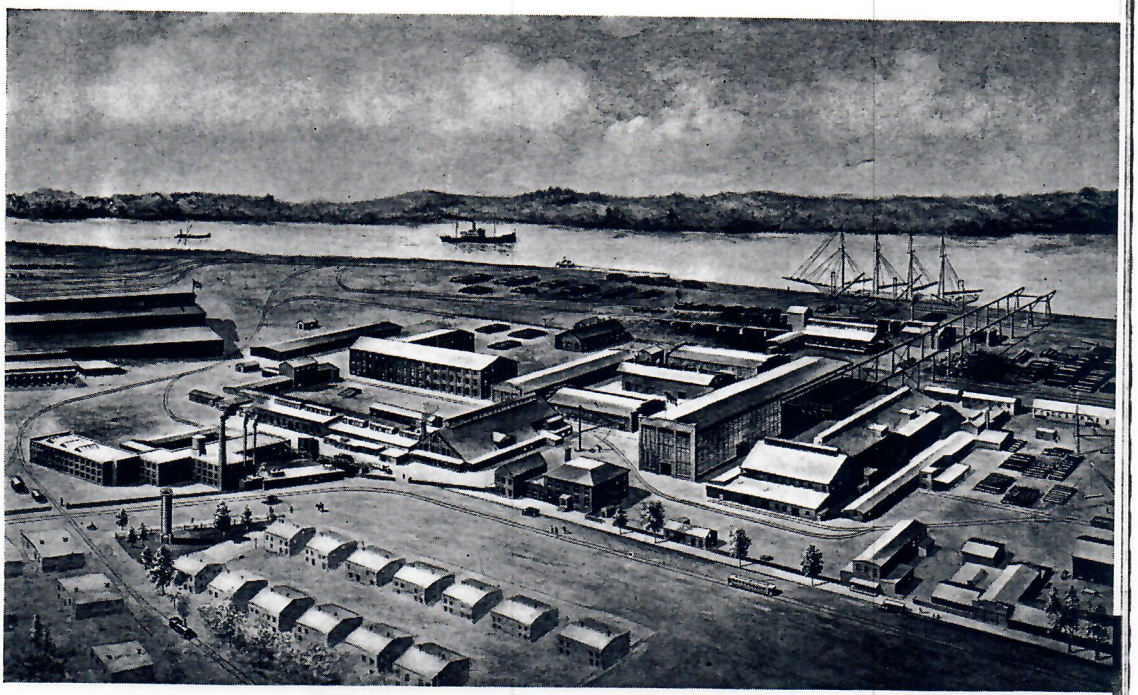

The Florence plant in 1920.

water daily, and the installation received nationwide publicity when the equipment was put to the test. In 1894 a series of three Geyelin Jonval turbines was installed at Niagara Falls. The turbines spun under the force of a 140-foot drop and developed 1100 H. P. each.

The increasing use of domestic gas not only increased the demand for cast-iron pipe for conduits, but led to the building of many huge gas holders, tanks that float on the upward pressure of gas, rising and falling with the consumption by industrial plants and household ranges. In 1890 the company built a gas holder for the Chicago Gaslight and Coke Co., 128 feet high, and with a storage capacity of over three million cubic feet of gas. Its size and three telescopic lifts made it one of the great mechanical wonders of Chicago.

The various mills and foundries of R. D. Wood & Company at Millville were disposed of by 1900. The original textile mill of the Maurice River still functions under different management and ownership, but the impression left by R. D. Wood on Millville is indelible. The Canal and dam are monuments to his vision and energy to the self-sufficient community on the Maurice River. While there was a deep sentimental attachment to the foundry at Millville, it could not compete with the deep-water facilities and rail terminal available at Florence and Camden. Millville represented a long and fruitful chapter in the progress of R. D. Wood & Company, and that chapter ended with the 19th century.

With the opening of the 20th century, everything increased in size, including the opportunity to serve the newer needs of industry. The introduction of electric power, with a rapid sequence of inventions employing or converting energy, led to greater demands on the foundries of R. D. Wood & Company. Cast-iron pipe grew greater in diameter, water pressure and gas pressure increased, and specification for the mechanical engineer and metallurgists called for greater and faster research and testing methods.

At the death of Stuart Wood in 1914, Walter Wood assumed control of the business he managed for forty-four years. Charles R. Wood, father of Theodore V. Wood, managed the hydrant and valve department, later becoming Vice-President and a member of the Board of Directors. Edward R. Wood, Jr., manager of the machinery sales department, resigned in 1916 to manage the West Virginia timber and coal properties of the Wood family.

In 1918, the Florence Iron Works was incorporated under the laws of the State of New Jersey as the Florence Pipe Foundry & Machine Company. Six years later the Camden Iron Works was liquidated, and all production activities concentrated at the Florence plant. On the death of Walter Wood in 1934 at Washington, D. C., in his 85th year, the R. D. Wood Company was chartered under the

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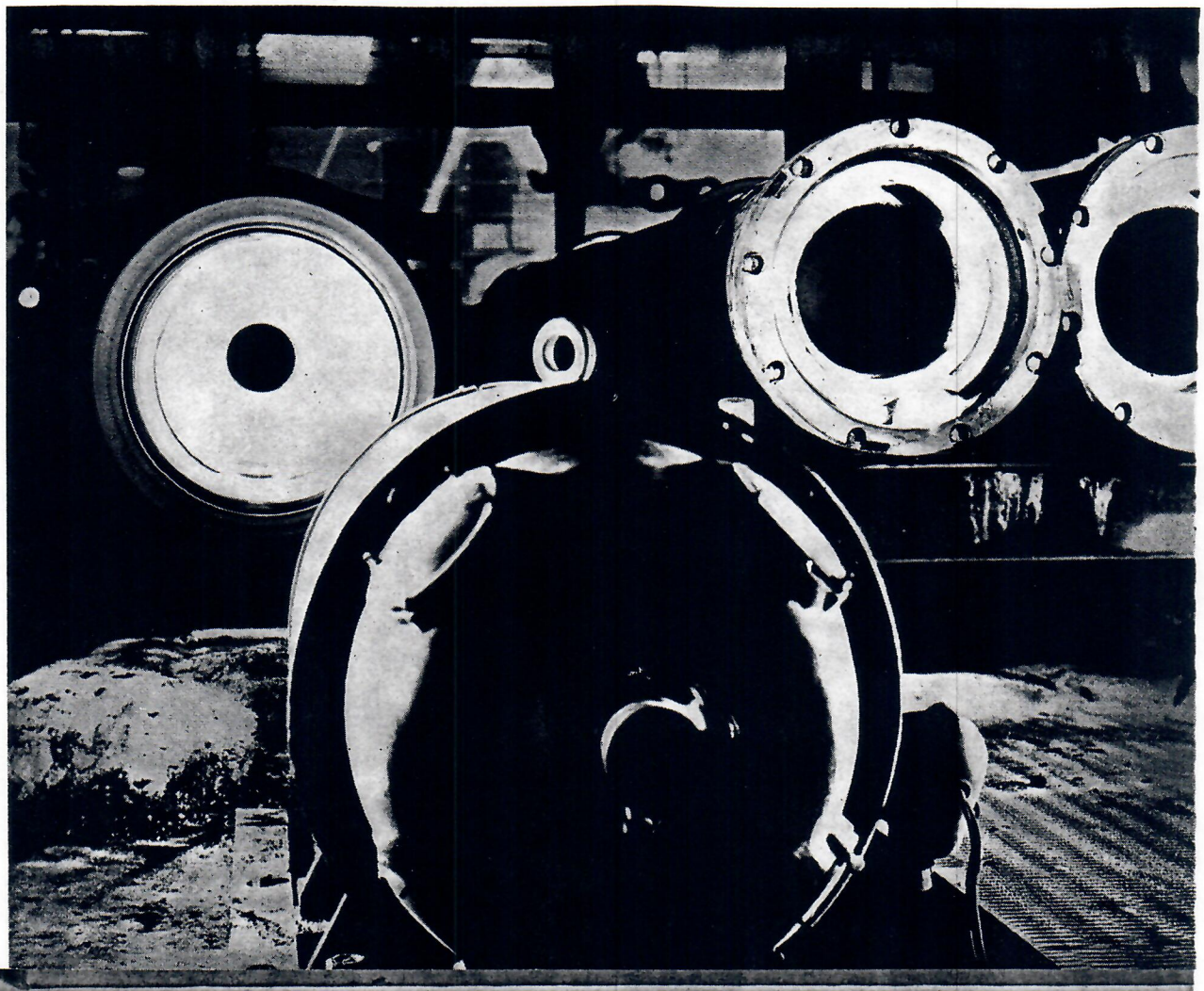
laws of Pennsylvania to preserve the good-will and historic significance attached to the name of R. D. Wood. The company is a wholly owned subsidiary of the Florence Pipe Foundry & Machine Company and is operated as a selling agent for the parent corporation.

When necessity demanded a stronger and more uniform cast-iron pipe, American ingenuity provided the answer in 1925. Earlier descriptions have been offered on the horizontal and vertical methods of pipe casting from the rudimentary horizontal German methods of the 16th century to the more or less satisfactory vertical method in vogue to the early 20th century. With the continued growth of pipe diameter, the pressure of the wall thicknesses increased pro-

Centrifugal casting of SAND-SPUN pipe.



portionately, and any flaw in the iron resulted in a costly leak or blow-out.

With the introduction of the centrifugal pipe casting method, science moved in first with a series of standard material specifications and rigid control tests. These tests applied to sand, clay, blacking, coke, scrap, pig iron, core oil, fuel oil, and every item employed in the routine of casting. For instance, there are five grades of sand used, each for a separate purpose—three for moulding and two for head cores. The sand is tested for moisture, porosity, strength against heat of molten iron, and fineness, which contributes to the smooth surface of the pipe.

The charge of iron is sampled before the cast, and its qualities analyzed. When the pipe is cast, it is inspected for wall thickness, and then tested against water pressure to 500 pounds per square inch. At the turn of the century a pressure resistance of 100 pounds per square inch was considered sufficient for the normal stress. The tests include a variety of external and internal strains to simulate the wear and tear on cast-iron pipe under a modern city street.

Under the sand-spun method, the mould turns horizontally as the molten iron is forced against the sand, clinging by both a capillary and centrifugal action. The force of the spinning or rotating distributes the iron evenly, increases the metal density, and forces out hidden imperfections such as air bubbles or foreign matter. The sandspun method has had many refinements since it was introduced, but the principle is unaltered.

Heavy machinery castings are produced in the foundry at Florence. On a visit to the plant one observes machinery in the first stages of manufacture, giant presses for the rubber, steel, plywood and aluminum industries, housings for marine generators in battleships, rolls, cylinders, and mandrels for printing presses.

Many of these units were part of large government defense orders, often the first step in setting up an industry to meet the pro-

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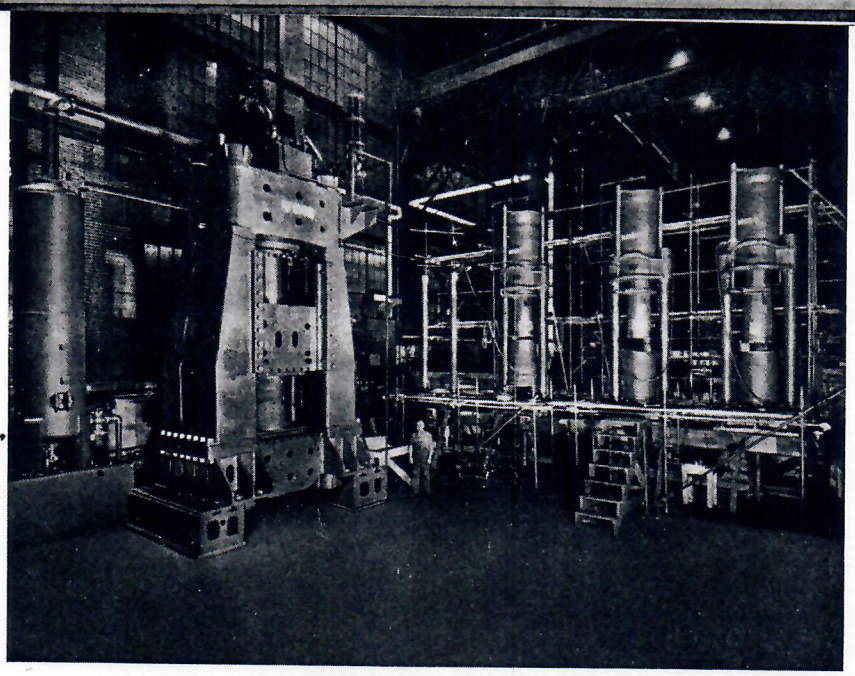
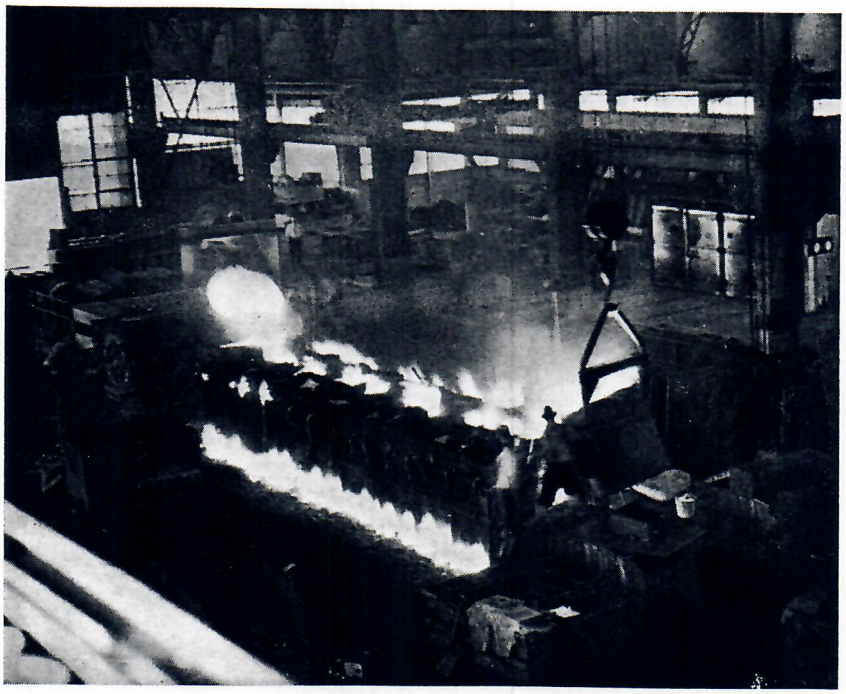


Erection Division, Machinery Department, Florence.

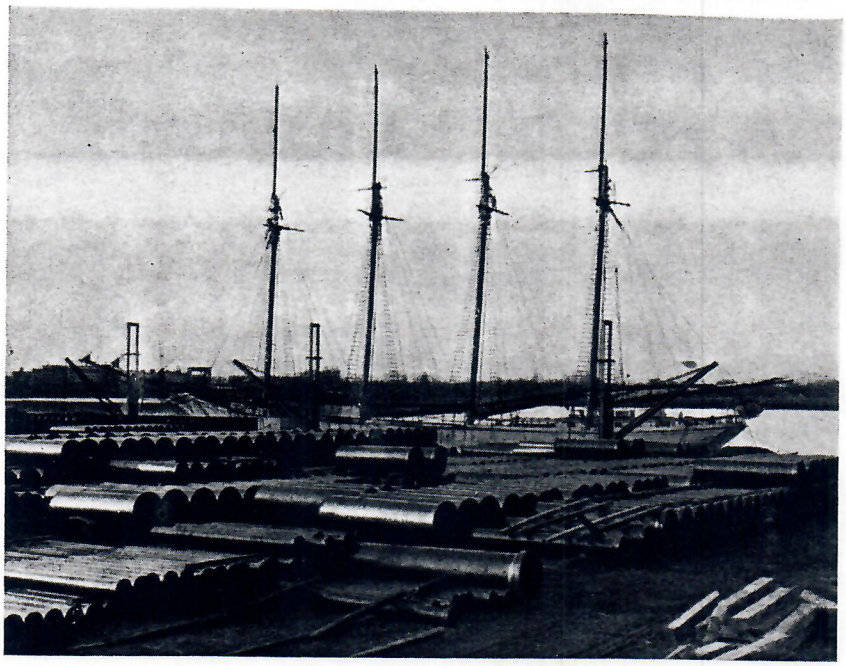


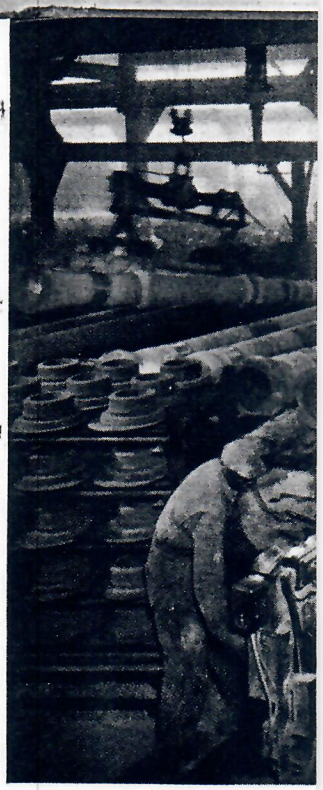
Special Casting Division at Florence.

gram for mobile arms equipment and accessories at home and abroad. Not all of the items are iron. The Florence plant has cast many non-ferrous items for the special needs of modern industry, some of them of an experimental nature, and a few of them on the hush-hush list of new devices and techniques.

The R. D. Wood tradition of craftsmanship permeates the whole staff of the Florence foundries and machine shops. The sense of responsibility for precision work begins at the drawing board and never ceases until the equipment is in operation. The pattern maker, the foundry man, the machinist, the welder, lathe operator and installation specialists all recognize the significance of their jobs. Most of them are R. D. Wood career men with decades of service at Florence.

Company Schooner Loading Pipe about 1900.





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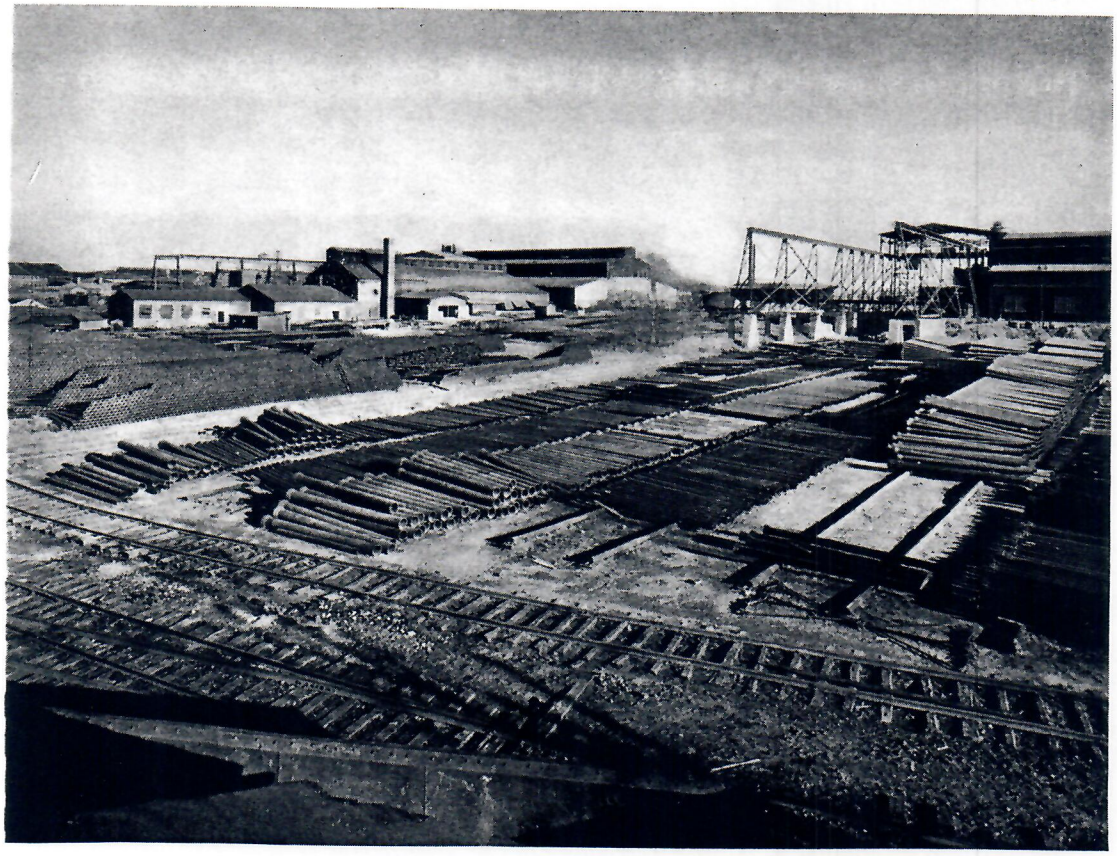
The casting of SAND-SPUN pipe by the centrifugal process.

Florence products, especially cast-iron pipe, circle the globe. As early as 1898 large shipments of pipe went to Karachi, now the great port and capital of Pakistan, and the drinking water of the city of Odessa on the Black Sea flows through pipes cast near Delaware tide water. Sixty-eight tons of cast-iron pipe went to Sigluf Joerdur, Iceland, in 317 lengths of six-inch pipe in 1940. At this northern outpost, pipes are just as likely to carry high pressure steam and boiling water, coming up from volcanic fissures. Back in 1900, 5,000 lengths of pipe, varying from six to twenty inches were shipped to Soerabaja in Java. A shipment of 134 lengths of four, six and eight inch pipe was sent to Durban, Union of South Africa, in 1941. These are a few random samples of Florence cast-iron pipe that is in daily use in the Arctic, Temperate and Torrid zones of the globe, functioning under varying pressures and a wide range of circumstances and applications.

Since the death of Walter Wood in 1934, the company has met two decades of rapidly shifting conditions on the economic front. The situation in industry during the depression years called upon a new management to exert its ingenuity to find new customers and arouse dormant markets. Competition made it necessary to seek improved techniques in engineering and production to cut costs. Limited capital required the most careful judgment and decision in the repair, salvage and replacement of equipment.

SAND-SPUN pipe shipping yard.



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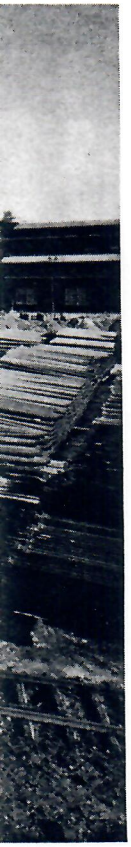

With the benefit of depression discipline on management, the company was prepared to meet the swift change in the industrial needs of the nation in the defense program of 1940. The plant economies, better engineering methods, new product design, improved machine tools and experienced personnel placed the company in a position to adapt its facilities to defense orders and deliver them to the Government and other participating prime and subcontractors without delay. In addition its officers, with long years of experience were able to act in advisory capacities for many departments of the Government.

Now, after a hundred and fifty years, the R. D. Wood Company sees its founders' visions of service taking shape for the benefit of all the people of the world. The adventuring spirit, heart and instinct of Richard D. Wood can look with pleasure at the achievements that continue to take place under his name and inspiration. He can look with pride on the men who have maintained the standards of quality that have characterized the company's products for a century and a half.

Levittown, Pa. A modern city supplied with water through SAND-SPUN pipe, and protected by R. D. Wood Matthews hydrants.

SAND-
ydrants.

ON THE DEATH of Walter Wood in 1934, R. D. Wood Company was chartered under the laws of Pennsylvania, to preserve the goodwill and historic significance attached to the name of R. D. Wood.

With the organization of the R. D. Wood Company on May 24, 1934, Mr. Spencer P. Hazard was elected President, Mr. Edwin J. Lame, Vice President and Mr. E. Roy Russell, Treasurer and Secretary. Later in that year Mr. John J. Troster was elected Assistant Treasurer.

The company was continued under the above officers until January 7, 1937, at which time Mr. E. Roy Russell was appointed Vice President, and later in 1940 Executive Vice President.

On June 5, 1947, Mr. Spencer P. Hazard was elected Chairman of the Board; Mr. Edwin J. Lame, Vice Chairman of the Board, and Mr. E. Roy Russell, President.

Theodore V. Wood, Vice President and General Sales Manager.

John J. Troster, Secretary, Treasurer and Vice President.

There were no changes in the officers from that time until 1953, except with the death of Mr. Edwin J. Lame in 1949—his office was never refilled.

Mr. Raymond C. Carrick became a member of the Board on March 2, 1950.

As of today, the Officers and Board of Directors are as follows:

	JOINED THE COMPANY
SPENCER P. HAZARD, *Chairman of the Board*	1899
E. ROY RUSSELL, *President*	1902
THEODORE V. WOOD, *Vice President and General Sales Manager*	1922
JOHN J. TROSTER, *Vice President, Secretary and Treasurer*	1915
RAYMOND C. CARRICK	1911

R. D. WOOD Company

Abrasive Wheel Presses
Accumulators, Hydraulic and Hydro-Pneumatic
Asbestos, Shingle and Molded Products Presses
Automatic Gas Producers

Bakelite Molding Presses
Baling Presses
Barrel Presses, Steel
Battery Box Presses
Beam and Rail Benders
Belt Presses
Bending Presses, Plate
Board Presses
Brick Presses
Bulldozers
Bushing Presses

Cable, Lead Covering Presses
Carbon-Dioxide, Solid Cake Presses
Centrifugal Cast Rolls
Check Valves
Cogging Presses
Coining Presses
Cork Presses
Crimping Presses
Curb Presses
Cut-In Specials

Die Sinking Presses
Dishing Presses
Double-Acting Presses
Drawing Presses

Embossing Presses
Extrusion Presses, Metal and Plastics

Felt Presses
Fibre Presses
Fittings, Bell & Spigot, Cast Iron
Flanged Fittings
Flanged Pipe
Flanging Presses, Plate
Floor Stands
Forcing Presses, Vertical and Horizontal
Forging Presses
Forming Presses

Gate Valves
Grinding Wheel Presses

Hardboard Presses
Hydrostatic Testing Presses

Indicator Posts
Intensifiers, Hydraulic

Joggling Presses

Laminating Presses
Linoleum Presses

"Matthews" Fire Hydrants
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Polishing Presses
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Rush and Pull Benc

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Rayon Steeping Pre
"R. D. Wood" Fire
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PRODUCTS

Molding Presses for Rubber, Bakelite and All Plastic Materials

Pipe, Bell & Spigot, "SAND SPUN" Centrifugally Cast Pressure Pipe
Pipe Bending Machines
Pipe Testing Machines
Plain End Pipe
Planishing Presses
Plate Bending Machines
Plate Punches
Plate Stretchers
Polishing Presses
Pumps, Hydraulic
Push and Pull Benches

Raised End Pipe
Rayon Steeping Presses
"R. D. Wood" Fire Hydrants
Reduced Fittings
Riveters
Rubber Curing, Vulcanizing and Molding Presses
Rubber Heel and Sole Presses
Rubber Printing Plate Presses

Salt Block Presses
"SAND SPUN" Centrifugal Cast-Iron Pipe
Scarfing Presses
Sectional Flanging Presses
Shears, Plate, Billet, Bar and Structural Shapes
Shell, Forging, Drawing, Piercing and Testing Presses
Shock Alleviators for Hydraulic Pipe Lines
Spring Band Forming Presses
Spring Banding, Stripping, Assembling and Testing Presses
Standardized Mechanical Joint "SAND SPUN" Cast-Iron Pipe
Standard Fittings
Steam Platen Presses
Steam Platens, Rolled Steel, Drilled
Steel Casting Straightening Presses
Straightening Presses

Tire Forcing Presses
Tube Testing Machines

Upsetting Presses

Valve Boxes
Valves and Fittings for Hydraulic Pipe Lines
Veneer Presses
Vulcanizing and Rubber Molding Presses

Wall Board Presses
Wheel Presses