



T is unlikely that Franklin Peale, proprietor of the Philadelphia Museum, realized a hundred years ago, when he appealed to Matthias W. Baldwin to construct a miniature locomotive to gratify public interest, that the steam locomotive was to revolutionize modes of transportation or that it would become the greatest single factor in the development and use of the vast resources of the entire world, and particularly of the United States.

It is unlikely that Mr. Baldwin realized in the early days that his efforts would be crowned with such far reaching success. Although he fortunately lived to see and enjoy the fruits of his labor, skill, and genius, his associates and each succeeding management of the company bearing his name have carried on to the benefit of the peoples of many countries through the great transportation companies which Baldwin has served.

In the following pages the reader is carried through an interesting, though necessarily brief, review of Baldwin's early activities and present facilities . . . an exhibit of modern motive power, both steam and electric, for every use . . . and an exhibit of appliances and materials, produced by many of America's foremost manufacturers who, like Baldwin, are continually striving to build better that the railways may serve better.

Probably at no time during these hundred years has there been a greater necessity for intelligent and generous co-operation between Boards of Directors of Railways, Railway Executives, and the industry serving them.

The pressing needs of the railways for increased operating efficiency and lower maintenance costs suggest a careful study of the products and facilities of the equipment industry, which has never been in a better position to help solve their problems.

### Baldwin Celebrates Its Hundredth Birthday

Its history is unique among industrial enterprises—
Founder's character still vital in traditions
of the institution

T IS a notable event when any industrial enterprise in America has survived the vicissitudes of a century and lived to celebrate its onehundredth birthday. Founded by Matthias W. Baldwin, when he undertook to build a miniature steam locomotive for the Philadelphia Museum in 1831, The Baldwin Lo-comotive Works has shared the entire life of steam transportation, growing with the railroads, without a break in the continuity of the enterprise or its manage-So marked has been this continuity that men in the service of the corporation today speak familiarly of the work of the founder and his associates, and there are few men in positions of responsibility in the present organization who do not know and take pride in its traditions.

No more striking evidence of the strength of character and soundness of the ideals of the founder need be sought than that 65 years after his death—years during which vast changes have

taken place in the character of American industry—those ideals still influence the conduct of the enterprise.

Matthias Baldwin was an able craftsman, an ingenious inventor and a man who adhered to a chosen course with a fixity of purpose which sometimes amounted to stubbornness.

His ingenuity and skill as a mechanic stood him in good stead during his early ventures in locomotive building. Machine tools were few and crude and few mechanics competent to enter this new field were available. It is said that few blacksmiths could be found who could weld a bar of iron larger than 1¼ in, thick and that cylinders had to be bored with a chisel fixed in a block of wood, turned by hand. For years, therefore, his endeavors were as much concerned with finding new shop



M. VIB acum

methods and practices to keep a head of the requirements of the new industry as in the development of the product itself.

Many of his inventions pertaining to the locomotive were essentially those of the craftsman interested in improving construction and in simplifying production and maintenance. This is well illustrated by four improvements patented in the autumn of 1834, all of which were probably embodied in some of the five locomotives built by Mr. Baldwin that year. These were the half crank, driving-wheel centers with segmental rims, ground steam-pipe joints and a simplified boiler feed pump.

The Half Crank.—
This applied to driving wheels with outside journals and in side cranks. The invention consisted in eliminating the outside crank cheek and securing the outside end of the crank pin directly in the wheel center. It simplified the crank-axle structure and

increased the space between the wheels for the boiler.

Driving-Wheel Centers with Segmental Rims.—The wheel center was of cast iron, but without a rim. Each spoke ended in a flange. To these flanges wooden fellies were attached and the tire secured by bolts to the fellies. This was to cure the effects of unequal expansion of the metal encountered in the wheels when cast with continuous rims.

Ground Steam-Pipe Joints.—The steam-pipe joints of the imported English locomotives which Mr. Baldwin studied were made tight with canvas and red lead. Steam pressures were limited to 60 lb. per sq. in. He invented ground joints and built his locomotives to work at 120 lb. boiler pressure.

Simplified Feed Pump.-This invention consisted in

making the main guide bar hollow, to serve as the pump cylinder. The guide terminated in a vertical valve chamber made in two parts. The suction and delivery pipes were attached to the bottom and top of this chamber, respectively, the joints being all ground, metal to metal. The assembly was held together by a stirrup or yoke and a single set screw, thus permitting quick

and easy access to the valves.

One other of Mr. Baldwin's early inventions should be mentioned at this time because it illustrates the adaptation of locomotive construction to the shop resources of the day. This was the cylindrical pedestal for driving boxes. The pedestal, which was of cast iron, was bored out in a lathe, with the axis of the cylindrical surfaces coinciding with the vertical center line of the pedestal, thus forming two parallel concave jaws. The outside of the box was also turned in the lathe to fit the pedestal. This method was cheap and the quality of the fit was easily controlled.

Mr. Baldwin's engines established a reputation for "simplicity of construction, small liability to get out of order, economy of repairs, and ease to the road".\* The cost of repairs to some of his locomotives in 1837 is said to have amounted to from 1.2 cents to 1.6 cents

per mile.

One situation in which Mr. Baldwin found himself early in his career as a builder of locomotives illustrates his integrity, the courage with which he adhered to his course and the confidence which these qualities inspired in others. During the financial disturbance of 1836-37 he became so financially involved that he was unable to proceed and called his creditors together for a settlement. He offered them two alternatives: First, that he surrender all his assets, including his home, all of which would have realized about 25 cents on the dollar of their claims; second, that they allow him to go on with the business and that he would pay all claims in full with interest within three years. The creditors accepted the latter alternative. Partly as the result of the general business recession and partly as the result of competition from several other newly established locomotive builders, his output declined from 40 locomotives each in 1836 and 1837 to 23 in 1838, 26 in 1839 and 9 in 1840, and Mr. Baldwin had to secure an extension of two years. At the end of five years, however, he had fulfilled his promise.

#### The Institution Mr. Baldwin Founded

One of the outstanding facts in the history of The Baldwin Locomotive Works is that it was operated as a partnership until 1909, before it was incorporated. Not until 1911, however, did its stock become available to the public, when it was reorganized as a public joint stock company under the laws of Pennsylvania. For practically the entire period during which the railroad system of the United States was being laid out and developed, therefore, The Baldwin Locomotive Works was operated and expanded with the resources of its owner-managers. It is one of the few if not the only established major industrial organization in the United States which passed unchanged through the period of great financial reorganizations and mergers started during the early years of the present century.

Early in his career as a locomotive builder Mr. Baldwin sought the association of others in the management of the enterprise. In 1839 he took George Vail and George W. Hufty into the business and the partnership of Baldwin, Vail & Hufty was formed. In 1842 this partnership was dissolved and Asa Whitney

joined Mr. Baldwin in the firm of Baldwin & Whitney. Mr. Whitney had been superintendent of the Mohawk & Hudson. He withdrew from the firm in 1846 to establish the firm of A. Whitney & Sons, which engaged in the manufacture of car wheels in Philadelphia.

Aside from his railroad experience, Mr. Whitney brought to the firm a thorough business talent. He is said to have systematized many of the details of the management of the business which Mr. Baldwin in his preoccupation with mechanical problems had ignored. It was shortly after Mr. Whitney became a partner that the present method of designating locomotive types by letters and numbers, based on the wheel arrangement, had its origin. For the purpose of representing the different types, sheets with engravings of locomotives were employed. Thus, the sheet showing an engine with one pair of drivers was marked "B"; that with two pairs, "C," etc. From this designation of the drawings it became customary to refer to locomotives with one pair of drivers as "B engines"; those with two pairs of drivers as "C engines," etc. A number prefix was soon added which indicated the weight of the locomotive in gross tons. This system, modified and expanded to indicate further information concerning important characteristics of the design, is still employed by The Baldwin Locomotive Works.

Mr. Baldwin continued his business alone until the firm of M. W. Baldwin & Co. was formed in 1854, with Matthew Baird as the partner. Thus began the period of overlapping partnerships which continued in un-

broken sequence until 1909.

Mr. Baird had been a foreman in the works since 1836 and it was he who carried on the business following Mr. Baldwin's death in September, 1866. The following year the firm of M. Baird & Co. was formed with George Burnham and Charles T. Parry as partners. Both had been employees of Mr. Baldwin from his pioneer years as a locomotive builder. Mr. Burnham, whose connection with the works began in 1836, continued in the firm until the final partnership of Burnham, Williams & Co., was dissolved in 1909 to make way for the corporation.

Space does not permit a complete record of the changes in the firm, but two of these are worthy of special comment. In 1873 the other partners bought out Matthew Baird (a transaction said to have involved over a million dollars) and organized the firm of Burnham, Parry, Williams & Co. In addition to Messrs. Burnham and Parry, the partners in the new firm were Edward H. Williams, William P. Henszey, Edward

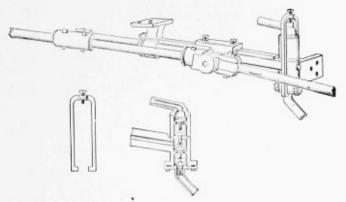
Longstreth and John H. Converse,

The successful conduct and upbuilding of the business was probably due more to the personal contributions by these men and their successors of their ability and personal energy than to their initial financial investment in it. Mr. Burnham had for some time been in charge of the financial affairs of the business. Mr. Parry had been general superintendent, in charge of the operation of the works. Mr. Williams, who had been brought into the business as a partner in 1870, contributed a broad experience as a railroad officer and a wide acquaintance among railroad men, which fitted him to handle sales. Mr. Henszey, who was mechanical engineer and had been an employee since 1859, was largely responsible for the standardization of locomotive details, and had perfected a system for manufacturing interchangeable parts for locomotives of the same class. He had also designed many unusual types of locomotives to meet difficult service requirements. Mr. Longstreth had succeeded Mr. Parry as general superintendent. Mr. Converse, who became a partner in 1878, had been associated with

<sup>\*</sup> From a letter written by L. A. Sykes, engineer of the New Jersey Transportation Company on July 12, 1838.

Mr. Williams in a clerical capacity during the latter's railroad days and was brought in by Mr. Williams in 1870 to organize and improve the office work and accounting.

This brief survey of the partnership of 1873, suggests that, while men were brought into the management from outside to meet special conditions, most of the

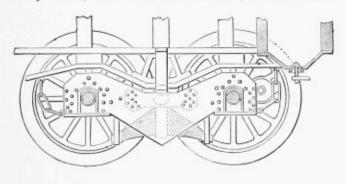


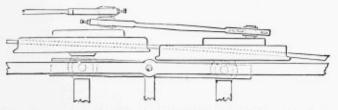
The Boiler Feed Pump-The Parts of the Valve Chamber and the Pipe Connections, Made Tight by Ground Joints, Are Secured by a Single Set Screw

partners had served years of apprenticeship in the business before assuming responsibility for a part in its management.

It was during this partnership, in 1875, that the firm acquired a controlling interest in the Standard Steel Works which had been incorporated in that year by the creditors of the former proprietor, William Butcher.

In 1896 three new members were admitted to the partnership. These were Samuel M. Vauclain, Alba B. Johnson and George Burnham, Jr.\* Messrs, Vauclain and Johnson, and William L. Austin, who became a





Elevation and Half Plan of Baldwin's Flexible-Beam Truck for Six- and Eight-Wheels-Connected Locomotives

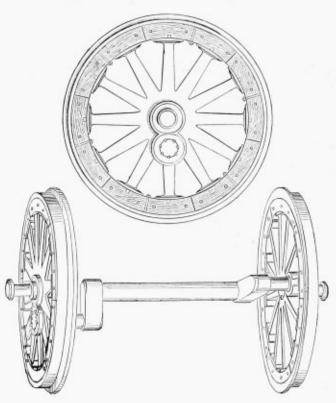
member of the firm in 1886, are all widely known among the present generation of railroad men.

#### The Corporation

In 1899, prior to the death of Edward H. Williams, there were eight partners. During the next decade the number had been reduced by death or withdrawal to five, one of whom was past 90 years of age. The financial burden thus placed on the remaining active members led to the incorporation in 1909. The following year \$10,000,000 of first mortgage bonds were issued, the first public financing in the history of the institution. In 1911 the present corporation was organized, with William L. Austin as chairman of the board, Alba B. Johnson, president, Samuel M. Vauclain, vice-president, and William de Krafft, secretary and treasurer.

In 1919 Mr. Johnson resigned from the presidency. He had been continuously connected with the institution from 1879 when he became an assistant to John H. Converse.

Mr. Johnson was succeeded as president by Mr. Vauclain, whose career typifies the character of the management which had prevailed throughout the history of The Baldwin Locomotive Works. Entering the service of the works in 1883 after having served there as an inspector for the Pennsylvania Railroad, Mr. Vauclain was made general superintendent early in 1886 in the



The Rimless Wheel Center and Half Crank Patented by Mr. Baldwin in 1834

reorganization following the retirement of Edward Longstreth as one of the partners. Ten years later he became a partner and served as a director of the first corporation. When the present corporation was organized in 1911, Mr. Vauclain was elected vice-president and a member of the board of directors, and he became senior vice-president later in that year. During the war he directed a number of subsidiaries of The Baldwin Locomotive Works which were organized to produce arms and ammunition for the Allied governments and later for the United States government. He also rendered the nation a notable service during the war as chairman of the War Industries Board. After the war, Mr. Vauclain took an active part in the successful efforts of The Baldwin Locomotive Works to secure orders for export business. On March 28, 1929. he was elected chairman of the board of directors and was succeeded as president by George H. Houston.

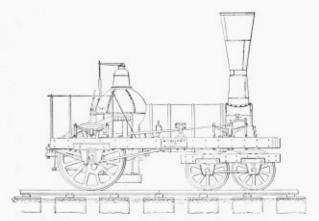
During his long service with The Baldwin Locomotive

<sup>\*</sup> Mr. Burnham withdrew from the firm in 1906. He is now deceased.

Works not only was he actively engaged in dealing with the problems of development and expansion of the manufacturing facilities, but he was the father of numerous developments in locomotive construction, for a number of which patents were granted to him. The pride of craftsmanship which was an outstanding characteristic of the founder of the institution and which showed itself in finding ways to do new and difficult jobs, was evident in a marked degree in Mr. Vauclain's career in taking orders for seemingly impossibly quick deliveries and finding ways to make them. He never lacked courage to take bold measures, either in dealing with the problems of production or in providing locomotives to meet unusual operating conditions. That not all of these measures proved wholly successful or find a permanent place in the art of locomotive construction should in no way becloud the fact that Mr. Vauclain, with his strong personality and individualism, representing the old school of owner-management, was a large factor in the success of The Baldwin Locomotive Works for many years. For his accomplishments he has achieved a permanent place in the annals of American business.

#### Baldwins Grew with the Railroads

The history of the growth and development of The Baldwin Locomotive Works parallels the history of the

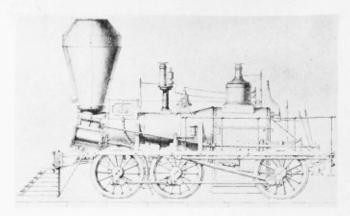


A Baldwin Locomotive of 1834—Mr. Baldwin Placed the Driving Axle Back of the Firebox To Secure a Longer Wheel Base, Better Riding Qualities, and Less Damage to the Track

growth of steam railroad transportation in America. Beginning with the period when steam locomotives were a public curiosity and when the future place of the steam railroad in the economic life of America was still a matter of controversy, the facilities and output of the Works grew as the increase in railroad mileage and traffic density created a constantly increasing demand for locomotives.

It would be impossible in the scope of a single article to record all of the events in the early evolution and the later development of the steam locomotive in America in which the men in The Baldwin Locomotive Works played a part. Because of their general significance, however, a few of these events will be dealt with,

Within ten years after Matthias Baldwin had built Old Ironsides for the Philadelphia, Germantown & Norristown Railroad, the problem of increasing adhesion and tractive force was becoming acute. Use was made of four-coupled driving wheels with a four-wheel leading truck in a locomotive designed by Henry R. Campbell in 1836. Mr. Baldwin, however, did not take kindly to this wheel arrangement and after he had attempted to solve the problem by building an experimental geared

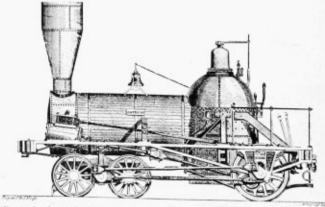


A Six-Wheels-Connected Locomotive of 1842 Employing the Flexible-Beam Truck

locomotive of the 4-2-0 type, he finally effected a solution of the problem which was successfully embodied in many locomotives from 1842 to the early sixties.

This was a scheme for a six-wheels connected locomotive in which the entire weight of the locomotive was available for adhesion and the necessary flexibility for rounding curves was provided by the flexible-beam truck composed of the two leading pairs of drivers. The principle on which this truck operated is shown in the illustrations. The rear driving wheels were placed rigidly in the frames, usually behind the firebox, with inside bearings. The inside bearings at the ends of the two front driving axles ran in boxes which were mounted in the ends of two deep double wrought-iron beams, one on each side of the locomotive. The two pairs of beams were not connected and a spherical pin projecting downward from each main locomotive frame rested in a socket in the top of the beam midway between the two driving boxes. The pedestals and the driving boxes were of the cylindrical type to which reference has already been made. With this construction the two leading driving axles were free to move laterally in opposite directions, but always remained parallel. The connecting rods were made with spherical brasses to accommodate themselves to the lateral movements of the wheels, while the shortening of the longitudinal distances between the pins due to the angularity of the rods was too small to be of practical consequence.

The first locomotive of this type was built for the Georgia Railroad in 1842. It weighed 12 tons and pulled a trailing load of 250 tons up a grade of 36 ft. per mile. While this scheme did not attain permanence as a feature of locomotive construction it met the needs of its day admirably and was not entirely superseded in new con-



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Baldwin's Geared Locomotive

struction until after 1860. It has its counterpart in modern practice in the form of the lateral-motion devices which have been developed to extend the length of coupled wheel bases beyond the practicable limits of

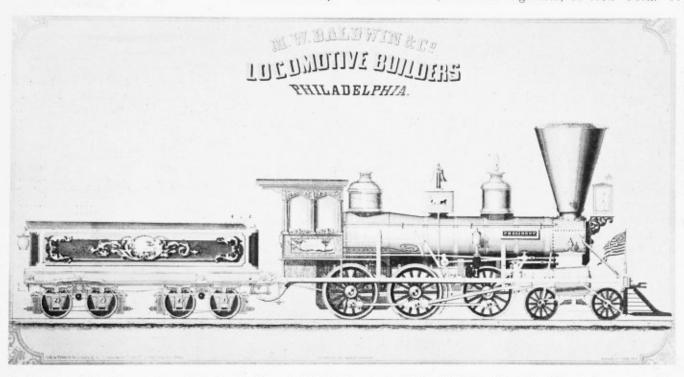
a rigid wheel base.

The early fifties are particularly notable with respect to locomotive development for the rapid extension in the use of the link motion with double eccentrics, permitting a variable cut-off. Mr. Baldwin strongly opposed the use of this motion on theoretical grounds which, while correct in themselves, proved not to be seriously detrimental in practice. After a determined effort to prove the superiority of his own scheme for effecting a variable cut-off, however, in common with a number of other builders who had been equally strongly opposed to its use, he adopted the Stephenson link motion as a regular feature of the locomotives turned out of the Baldwin shops.

Among the interesting developments of the sixties may be mentioned the growing use of steel in various parts of locomotive construction. Steel fireboxes were first aptribution to this development by The Baldwin Locomotive Works was the Vauclain compound which was patented by Samuel M. Vauclain, then general superintendent of the Works, and first applied to a Baltimore & Ohio locomotive turned out of the shops in 1889.

In 1895 a locomotive with the customary four-wheel leading truck, two pairs of coupled wheels, both placed in front of the firebox, and a pair of trailing wheels under the firebox was built by Baldwin for the Atlantic Coast Line, and this wheel arrangement became known as the Atlantic type. Although the firebox in this locomotive did not assume the characteristic form of modern trailer-borne fireboxes, advantage was taken of the opportunity offered by the trailer to place the mud ring above depressed frames and thus increase the firebox volume without unduly raising the center of gravity.

It was also during 1895 that The Baldwin Locomotive Works built its first electric locomotive. The electrical parts of this locomotive, which was built for the North American Company, were designed by Sprague, Duncan & Hutchinson, electrical engineers, of New-York. A



An Early Ten-Wheel Locomotive Built for the Cleveland & Pittsburgh in 1856—Baldwin's First Ten-Wheel Locomotive Was Built for the Pennsylvania in 1852

plied to locomotives built by the Baldwin Works in 1861. The first application, on some locomotives built for the Pennsylvania, was of an English steel of high temper which cracked while the sheets were being fitted and it became necessary to replace the steel firebox with copper. The so-called homogeneous "cast steel" of American manufacture was then tried out on two locomotives completed early in 1862 for the Pennsylvania. This material was found to work successfully and by 1866 its use had become general.

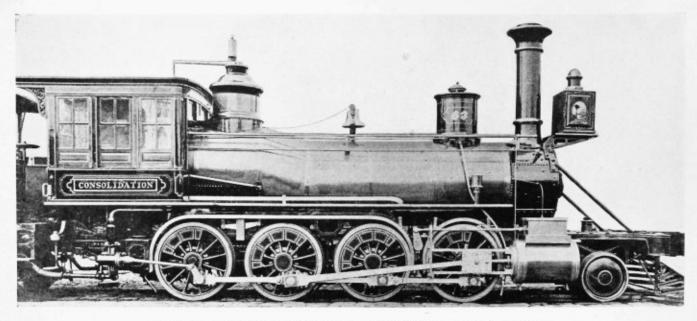
The Baldwin Locomotive Works also made its first application of steel tires in 1862. These tires were imported from Germany and, in order that a supply might be available in this country for replacements, Mr. Baldwin imported and carried a stock of some 500 tires.

An event of outstanding importance in the development of American locomotives was the application of compounding which made rapid progress during the last decade of the nineteenth century. The most notable conyear later two locomotives were built for mining operations in co-operation with the Westinghouse Electric & Manufacturing Company, which supplied the electrical equipment. This was the forerunner of a co-operative arrangement under which these two companies have participated in the building of electric locomotives for many years.

#### The Growth of the Locomotive Market

During nine of the ten decades of Baldwin's history there was a steady growth in the mileage of steam railroads in the United States, the rate of growth accelerating rapidly from 1870 to 1890, decreasing somewhat for the next two decades and declining rapidly between 1910 and 1920. Since that time the extension of mileage has ceased and more miles have been abandoned than have been built. For most of the thirty years from 1890 to 1920 there was a steady increase in traffic density, revenue ton-miles of freight traffic doubling each twelve

Baldwin



The Locomotive Which Named a Type-Built in 1866 for the Lehigh Valley

years. The table shows that during this period of rapid growth the number of locomotives in service more than doubled and the number built by Baldwin more than trebled.

The slow growth in the volume of Baldwin's output during the decade from 1840 to 1850 may be accounted for in part at least by the fact that during that decade the major increase in mileage was in the New England states, which looked to builders geographically nearer at hand. After 1850 construction of railroads in New England declined and during the next decade the skeleton of the railroad system of the Middle and South Atlantic states was rapidly filled in and the system in the states east of the Mississippi was assuming the form of its subsequent development. While the crisis of 1857 and the Civil War put a stop to the growth of railway mileage, particularly in the west, the demand for transportation by the federal government and by the branches of trade and industry stimulated by the war increased the demand for locomotives. The government itself became a large purchaser of locomotives, and in 1864, when Baldwin's production reached its maximum for the war period, 33 of the 130 locomotives built were for the United States military railroads.

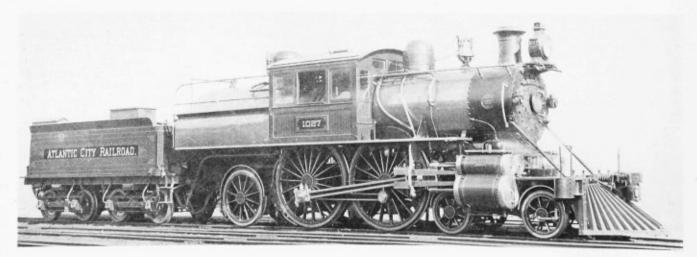
During the decades of growth and development of the railroad system in the United States The Baldwin Locomotive Works grew from a shop employing some 300 men in 1837 to an aggregation of shops employing a maximum of 21,500 men.

#### Growth of the Railroads and of Baldwin Output

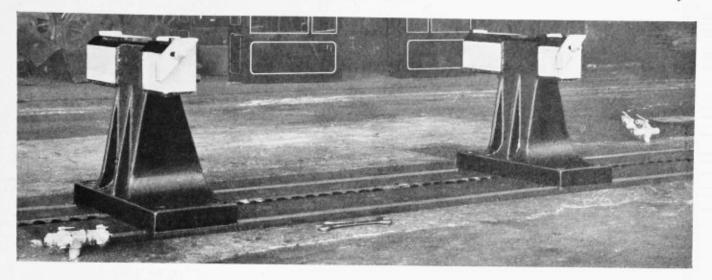
Decade ending		Miles in operation	Increase during decade	Number of locomotives in service	output during decade	
1830		23	23		*****	
1840	+ - 1 + - + + + + + + + + + + + + +		2,795		158	
1850			6,203		251	
1860			21,614	* * * * *	579	
1870			22,287		1,340	
1880*		93,262	40,340	2.14.4.5	3,049	
1890			70,335	30,140	6,058	
1900			29,749	37,663	7,037	
1910	*************		57.093	58,947	17.302	
1920			12,406	66.867	18,518	
1921-	1929	249,433	-3,412	58,746	6,829	

The mileages for the decades up to 1880 are taken from Poor's Manual of the Railroads of the United States. Subsequent figures for mileages and locomotives in service are from Interstate Commerce Commission Statistics.

After having expanded steadily on land now within the heart of the City of Philadelphia, it ultimately became necessary to find more room for further ex-



A Famous Vauclain Compound Built in 1896—This Locomotive Regularly Made 55 1/2 Miles in 50 Minutes from Start to Stop



An Adjustable Jig which Greatly Simplifies the Alinement of Frames in the Erecting Shop

pansions. Accordingly in 1906 a site of 184 acres was purchased at Eddystone, Pa., and the foundries and blacksmith shops were established on this property. At various times during the next twenty-two years additional departments were transferred to new quarters erected at Eddystone, some of them in buildings which were first used for the production of munitions during the war. Since the transfer of the last department in June, 1928, the Eddystone plant of The Baldwin Locomotive Works, now occupying sites aggregating 518 acres, presents a picture of well integrated and co-ordinated facilities that it falls to the lot of few industries developed over so long a period to possess.

#### A New Trend

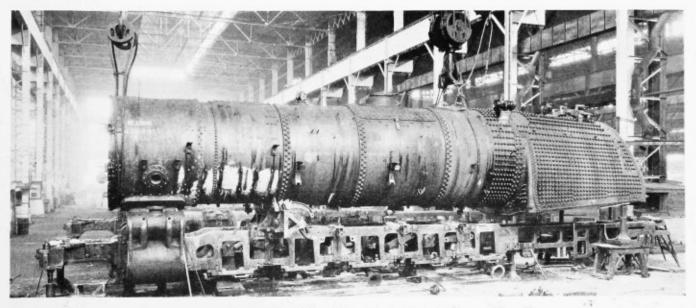
The facts with respect to the growth of railroad mileage set forth in the table clearly indicate the marked change in the trend of the railroad industry which has taken place since the World War. This change is further indicated by the trends in railroad traffic. The volume of passenger-traffic, measured in passengermiles, declined from 46.8 billions in 1920 to 31.1 billions in 1929, or 33.5 per cent, while the rate of increase in revenue freight traffic during the same period was very slight as compared with the geometrical progression of the growth for many years prior to that time. From 410 billions of ton-miles in 1920, freight traffic increased to 447 billions in 1929—only nine per cent in nine years.

In just what form this change will be projected into the future it is impossible to say with any degree of assurance.

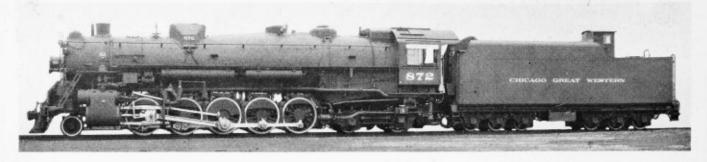
There are, however, numerous indications that a period of relative stability has been reached, partly as the result of changes in the industrial growth of the country and partly as the result of the development of other forms of transportation.

These changes have had a marked influence on the demand for locomotives during the past few years—which may be regarded as a transition period—and undoubtedly have effected a change in the nature of the future motive-power needs of the railroads.

Throughout the first nine decades of American railroad history the compelling motive for the purchase of locomotives was the need for more locomotives to equip new mileage and to move new traffic. The question of obsolescence was not one requiring much consideration on the part of the railroad managements. It is true that locomotives became obsolete and were scrapped,



A Locomotive Takes Shape in the Erecting Shop



"Old Ironsides" Weighed Something Less Than 6 Tons in Working Order—This Locomotive Weighs 232 Tons in Working Order, Exclusive of the Tender

largely because of inadequate tractive capacity. In the main, however, the character of the motive power in operation was kept in step with improvements in motive power design automatically as the demand for more and more locomotives was satisfied.

Improvements in motive-power efficiency and capacity have not ceased with the growth of railway mileage or with the stabilization of the volume of traffic. Indeed, the last decade has been one of unusual activity in improving locomotive design, and it has seen the beginning of marked innovations which promise further important improvements in efficiency for the future. Modern locomotives of the kind extensively built within the last five years have demonstrated their ability under a wide variety of conditions to effect an average reduction in unit fuel consumption of 30 to 40 per cent as compared with locomotives designed but a few years earlier and may be expected to earn a net return on the investment of from 10 to 20 per cent.

### Obsolescence Takes on New Meaning

If the application of modern motive power must await the development of a demand for more locomotives than are already in service, it will be many years before the railroads will have realized any practical benefit from what is ready for their use today, and the developments in the art of locomotive design and construction which have made large numbers of locomotives obsolete which were built even less than ten years ago will have been in vain.

While the volume of railroad traffic was increasing rapidly, the greatest opportunities for increasing net operating income lay in providing facilities adequate to handle all the business offered. With the opportunity for increasing revenues greatly curtailed or entirely eliminated, future opportunities for improvement in net operating income must depend more and more on reducing expenses.

The extent to which the railroads have met this situation by improving the efficiency of many phases of their operations is sufficient evidence that they will not long continue to overlook the opportunities in this direction by retiring and replacing their obsolete locomotives

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With the election of Mr. Houston as president in 1929, a major step was taken in the transition of the actual management of The Baldwin Locomotive Works from the personal owner-management implicit in the many years of its operation as a partnership to that of a modern industrial corporation. As the new century opens, the development of new methods of merchandizing which faces the locomotive building industry, as the result of the transition through which the railroad industry is passing, is a major problem of the new management.



Moving Freight Over the Mountains on the Southern Pacific



One Hundred

Years Ago

Baldwin Built

"Old Ironsides"

#### HIS year The Baldwin Locomotive Works passes the century milestone rounding out one hundred years of service both to railroads and to industry the world over. It is distinguished as the one locomotivebuilding establishment in the United States which has been

in continuous operation for over a century. One hundred years ago America was young.

Transportation facilities were incredibly primitive—only a comparatively small amount of track had been built and the few locomotives in use could hardly be described as efficient and dependable. But progressive and far-seeing individuals visioned steam power as a basic need for national development and a powerful influence on American business and public wel-

Matthias W. Baldwin of Philadelphia was the outstanding figure of this period of locomotive development. Mr. Baldwin, a successful builder of stationary steam engines, was one of the first to visualize the possibilities latent in the application of steam as motive power on railroads. At the request of his friend, Frank-

lin Peale, proprietor of the Philadelphia Museum, Mr. Baldwin built a miniature locomotive for exhibition purposes. On April 25th, 1831 this locomotive with two cars was placed in motion in the museum and immediately attracted crowds of admiring spectators.

Then and there Matthias W. Baldwin kindled the torch of locomotive progress and laid the foundation of the Baldwin Institution which today is the largest locomotive building company in the world with unsurpassed plant facilities, an emblem of stability, and an international influence.

The success of the model was so impressive that the Philadelphia, Germantown & Norristown Railroad Company late in 1831 placed an order with Mr. Baldwin for a locomotive to be used on its six-mile line between Philadelphia and Germantown.

This was no simple task. Suitable tools and competent mechanics were scarce. Much of the work had to be done by hand and improvised tools. Diligently and with undaunted faith Mr. Baldwin surmounted these obstacles

> and completed the historic "Old Ironsides" in his small shop in Lodge Alley. On November 23rd, 1832, this locomotive was placed in service. All circumstances considered, "Old Ironsides" was regarded as a success and subsequently attained a speed of 30 miles per hour with its train:

So great had been the difficulties attending the construction of "Old Ironsides" and also in obtaining settlement for it that Mr. Baldwin remarked "That is our last locomotive!" But it was not-"Old Ironsides" was the



Baldwin Locomotives Were Built.

Historic "Old Ironsides," the First Baldwin Locomotive, Placed in Service on November 23rd, 1832.



first of 62,000 locomotives which have been built by The Baldwin Locomotive Works up to the present time.

Locomotive building, however, had become too fascinating and the romance of railroading too great for Mr. Baldwin. When an order for a locomotive was re-

for a locomotive was received from Mr. E. L. Miller of Charleston, S. C. in behalf of the Charleston & Hamburg Railroad Company he agreed to build it. This locomotive, named the "E. L. Miller," was completed on February 18th, 1834. Its design embodied the four wheeled leading truck, a single pair of driving wheels and various improvements which were original with Mr. Baldwin. The "E. L. Miller" performed so admirably on the rough and crooked tracks that locomotives of this type were built until 1842.

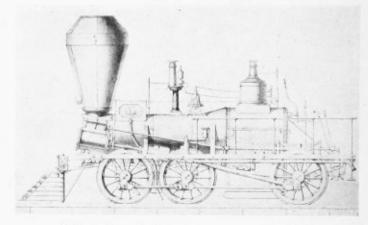
Steam motive power proved a great stimulant to industrial progress, resulting in a big demand for more powerful locomotives. Mr. Baldwin's small Lodge Alley shop became inadequate and a new shop was accordingly erected at Broad and Hamilton streets—the site, in part, of the great Philadelphia plant which continued in operation until 1928.

This development marked another stepping stone to greater achievements in locomotive building and symbolized the Baldwin spirit to serve the railroads efficiently and to keep pace with their progress.

The increased facilities enabled Mr. Baldwin to turn out 40 locomotives in 1836 and an equal number in 1837. Then came a serious financial panic and with it the first test of Baldwin stability. This crisis which brought ruin to so many did not leave Mr. Baldwin un-

Baldwin Expands And Starts New Plant In Philadelphia

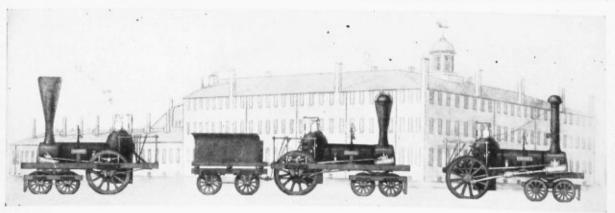
scathed. Mr. Baldwin, however, a man of sterling integrity and singular conscientiousness, courageously met the situation, and after a heroic struggle and personal self-denial was enabled to pay all his obligations in full and retain complete control of his business.



Baldwin Six-coupled Flexible Beam Truck Locomotive for Heavy Freight Service, 1842

After the financial storm had cleared, railroad business reached far greater proportions and demanded bigger locomotives. Accordingly, in 1842 Mr. Baldwin introduced his "flexible beam truck" to meet this demand for locomotives of greater hauling capacity.

This important development enabled him to build locomotives with either three or four pairs of coupled wheels carrying all the weight on the drivers and having an exceedingly flexible wheel base. These locomotives were remarkably successful and met the requirements of heavy freight traffic more efficiently than any other locomotives of this period.



Typical Baldwin Locomotives of the Period 1834-1842 with the Baldwin Shop at Broad and Hamilton Streets



# The adoption of the flexible beam truck opened the way at once to the heavier and more powerful locomotives. The six-wheeled locomotives of this type weighed from 12 to 17 tons, and the eight-wheeled from 18 to 27

tons. In 1845, Mr. Baldwin first built the "American," or 4-4-0 type, and these engines weighed from 12 to 19 tons.

### Six and Eight Coupled Flexible Beam Truck Locomotives For Heavier Traffic

off gear was superior to the link; but he too was finally won over to the link motion and its use soon became universal. At the time of the

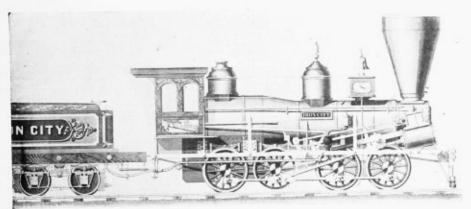
At the time of the Civil War, the typical American locomotive was the 4-4-0 type with wide-spread truck

wheels, horizontal cylinders, bar frames, and link motion valve gear. The demand for transportation by the general government and the

industries stimulated by the war taxed the carrying capacity of the Northern railroads to the fullest extent. The production during the war period reached a maximum of 130 locomotives in 1864.

The introduction of steel in locomotive construction was a distinguishing feature of this period. The use of steel tires and steel fireboxes soon became general. Another feature was the placing of the cylinders horizontally.

One of the most notable locomotives built immediately after the Civil War was a heavy freight engine for the Lehigh Valley Railroad designed to operate on a grade of 133 feet per mile. This locomotive, the first of the 2-8-0 class with separate tender, was named "Consolidation." The name was subsequently applied to the type, and "Consolidation" engines have since been constructed for a large number of railroads in the United States and many foreign countries.



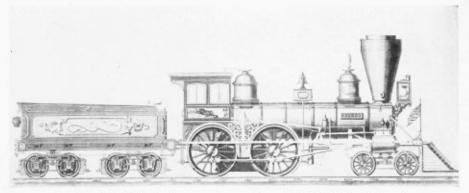
A Baldwin Eight-coupled Flexible Beam Truck Locomotive with Variable Cut-off, 1854

A notable Baldwin locomotive of this period was the "Governor Paine," a passenger locomotive for the Vermont Central Railroad designed to pull a train at the astonishing speed of 60 miles per hour. During its career, it was said to have covered a mile in 43 seconds.

In 1849, three high-speed locomotives similar to the "Governor Paine" were built for the Pennsylvania Railroad Company and a few years later, twelve freight locomotives, each

weighing 56,000 lb., were also built for the same railroad.

The early-fifty period was marked by a most important step in the progress of American locomotive practice. The link motion was introduced, and soon proved its superiority over the various types of complicated gears formerly used. Mr. Baldwin, who was naturally conservative in adopting new devices, maintained that his variable cut-



The "Tiger," a Baldwin Passenger Locomotive with Link Motion Valve Gear Built for the Pennsylvania Railroad in 1856 Cylinders 15 in. x 24 in. Drivers, diam. 66 in. Weight, total engine 59,190 lb



N September 7th, 1866, Mr. Baldwin died. As a mark of respect a pause is therefore fitting, during this celebration of the Baldwin Centennial, to pay tribute to his memory. Mr. Baldwin had made many notable and permanent contributions to the art

of locomotive building and the most appropriate monument is the Works which immortalize the name of Baldwin.

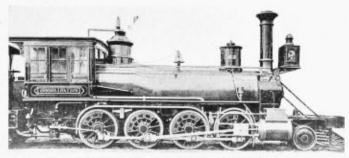
### Baldwin Locomotive In Constant Service For 153,280 Miles Without Repairs

of 2,500 locomotives per annum. This development was of a magnitude which, under private initiative, probably has had few equals in the industrial world.

The reliable, trouble-free and low cost operation of Baldwin power was very

evident during the early periods. An excellent example was one of the eight-wheeled four-coupled engines built for the Pennsylvania in 1867 which remained in constant service from September 9, 1867 until May 14, 1871 having made a total mileage of 153,280 miles without being taken off its wheels for general repairs.

The Consolidation type was followed by the Decapod, the Atlantic, the Mikado and others, many of Baldwin origin. The development of the various types characterizes the Baldwin spirit of progressiveness and demon-



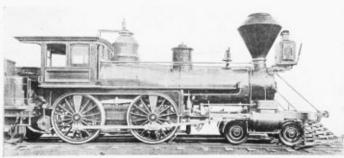
The "Consolidation," 2-8-0 Type for Freight Service Built for the Lehigh Valley Railroad, 1866 Cylinders, 20 in. x 24 in. Drivers, diam. 48 in. Weight, total engine 90,000 lb.

Subsequent to Mr. Baldwin's death, the torch of locomotive achievement was passed to his associates who carried on as a copartnership, continuing the policies of the founder, and increasing the prestige of what has been for years the world's largest locomotive plant.

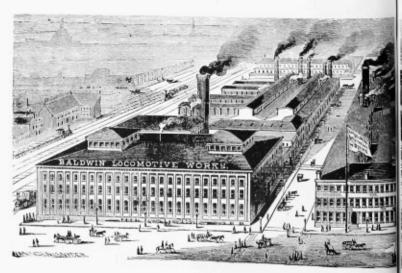
It was the members of this copartnership who successfully guided the concern through the difficult period which followed the panic of 1873, and who in the early eighties launched a vigorous policy of expansion. The business was conducted as a copartnership for 78 years during which period 33,500 locomotives were built, and the plant was enlarged to a capacity



American (4-4-0) Type Locomotive for Passenger Service Built for the Northern Pacific Railroad, 1883 Cylinders 17 in. x 24 in. Drivers, diam. 62 in. Weight, total engine 83,800 lb.



The Locomotive That Made 153,280 Miles Before Shopping Built for the Pennsylvania Railroad, 1867 Cylinders 17 in. x 24 in. Drivers, diam. 66 in.



The Baldwin Plant in 1872 Had

strates a willingness to build new designs for the purpose of attaining improved locomotive operation.

To this end the works built a compound locomotive for the Baltimore and Ohio Railroad as early as 1889. The economy in fuel and water and the effici-

ency of this design led to its extensive use on many leading railroads.

Baldwin's ability to build locomotives quickly as well as accurately was established in 1889 when a narrow gage locomotive of the American type was completed in eight working days.

While these developments were transpiring in steam locomotive design, the feasibility of electric motive power was receiving serious consideration. The first electric locomotive was constructed for experimental purposes in 1895 and the following year two others were

Atlantic (4-4-2) Type Locomotive for Passenger Service Built for the Atlantic Coast Line, 1895

Cylinders 19 in. x 24 in. Drivers, diam. 72 in. Weight, total engine 129,800 lb.

Baldwin Builds
First Consolidation
Atlantic and Mikado
Types of Locomotives

built in cooperation with the Westinghouse Electric and Manufacturing Company. Electrification offered the only solution to many important traffic problems and Baldwin - Westinghouse electric locomotives became increasingly prominent. Today they repre-

sent one of the most important branches of the business. Typical units built during the 35year Baldwin-Westinghouse affiliation are il-

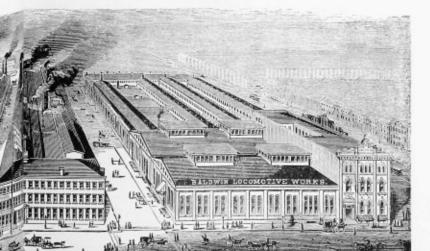


Ten-Wheeled (4-6-0) Type Locomotive for Passenger Service Built for the Baltimore & Ohio Railroad, 1896 Cylinders 21 in. x 26 in. Drivers, diam. 78 in. Weight, total engine 145,000 lb.

lustrated on pages 34 to 41 inclusive.

The beginning of the twentieth century witnessed larger demands for railway freight transportation. The introduction of cars having greater capacities involved increased train tonnage, improved road beds, heavier rails, stronger bridges and more powerful locomotives. This led to the development of the Prairie type, a large number of which were built for the Chicago, Burlington and Quincy Railroad, the Atchison, Topeka and Santa Fe Railway and other lines.

The rapidly increasing business made it evi-



The Pioneer Mikado (2-8-2) Type for Freight Service Built for the Nippon Railway (Japan), 1897 Cylinders 1834 in. x 24 in. Drivers, diam. 44 in. Weight, total engine 119,600 lb.



dent as early as 1906 that further expansion in the heart of Philadelphia was not practicable. A site was selected at Eddystone, Pennsylvania, on the bank of the Delaware

River and 12 miles from Philadelphia. An immense erecting shop, especially designed for the construction of locomotives of the largest size, marked one of the earlier steps in the Eddystone development.

In 1909 an important change in organization was effected. The then existing partnership of Burnham, Williams & Company was dissolved, and a stock company under the name of Baldwin Locomotive Works was incorpor-



Santa Fe (2-10-2) Type Locomotive with Tandem Compound Cylinders Built for the Archison, Topeka & Santa Fe Railway, 1903 Cylinders 19 in. and 32 in. x 32 in. Drivers, diam. 57 in. Weight, total engine 287,240 lb.



Pacific (4-6-2) Type Locomotive for Heavy Passenger Service Built for the Oregon Short Line, 1906 Cylinders 22 in. x 28 in. Drivers, diam. 77 in. Weight, total engine 222,000 lb.



Mallet Articulated Compound (2-6-6-2) Type Locomotive for Heavy Freight and Pusher Service
Built for the Great Northern Railway, 1906
Cylinders 213/4 in. and 33 in. x 32 in. Drivers, diam. 55 in. Weight, total engine 255,000 lb.

Bigger Locomotives With Labor And Fuel Saving Devices

ated under the laws of the State of Pennsylvania. Two years later, the company was re-incorporated as The Baldwin Locomotive Works. Both reorganizations

were effected without drastic changes in personnel or management.

The successful introduction of the superheater, together with such fuel and labor sav-



The Philadelphia Plant in 1913-001 laday

ing devices as feedwater heaters, mechanical stokers, coal pushers, power operated fire doors, grate shakers, and improved air brake equipment, was followed by locomotives of greater capacity and efficiency than those previously built. Large units of the Santa Fe, the Mallet Articulated, the Pacific, the Mountain and other types were placed in service.

Then came the World War in 1914. Baldwin officials immediately perceived the significance of the conflict and placed the facilities of the company at the disposal of the Allied Governments. New shops were erected at Eddystone for the manufacture of munitions. With the entrance of the United States into the war in 1917, the world wide demand for locomotives became enormous.

The large and efficient plant facilities with the ability to step up locomotive output quickly won for Baldwin the biggest and most May 16, 1931



### IN 100 YEARS OF LOCOMOTIVE PROGRESS

The Completion Of

The Baldwin Plant

At Eddystone

### urgent orders for locomotives ever placed. A total of 5,551 locomotives were built for the War activities of the United States and the Allied Nations. Contracts exe-

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cuted by Baldwin and its associate companies totaled approximately \$250,000,000.

After the war, the capacity of the manufacturing facilities of The Baldwin Locomotive Works was far in excess of the locomotive re-



ghis Plant is ng a Landmark in the Industrial World

quirements of the United States. To utilize these facilities more fully, The Baldwin Locomotive Works inaugurated a vigorous foreign sales policy, and also acted as agents for the sale of various engineering products not necessarily related to locomotive building.

The year 1928 marked an event of vital importance in the history of Baldwin. The task of erecting new shops and transferring the Works from Philadelphia to Eddystone, was completed. The official closing of the old plant marked the passing of what had long been a landmark in the industrial world. It was the beginning of a more formal ceremony which commemorated on June 28th, 1928, the opening of the new plant at Eddystone.

The exercises held on that eventful occasion symbolized far more than the mere inauguration of a vast locomotive building institution. They signified an outstanding faith in the future of the nation, and a firm belief that the

growth of rail transportation would continue to demand greater facilities than the world had ever known.

Baldwin, now one hundred years old, stands on

the threshold of new achievements. The old spirit of loyalty and integrity grounded in the traditions of progress and dependable service is ever renewed. New blood and new enthusiasm carry forth the torch of achievement and pledge themselves to the advancement of railway transportation the world over.

Today Baldwin, with one hundred years of cumulative experience and unsurpassed plant facilities, stands prepared to build any type of motive power, either to Baldwin designs or to specifications furnished by the purchaser.



2-10-2 Type Locomotive for Freight Service Built for the Baltimore & Ohio Railroad, 1923 Cylinders 30 in. x 32 in. Drivers, diam. 64 in. Weight, total engine 436,500 lb.

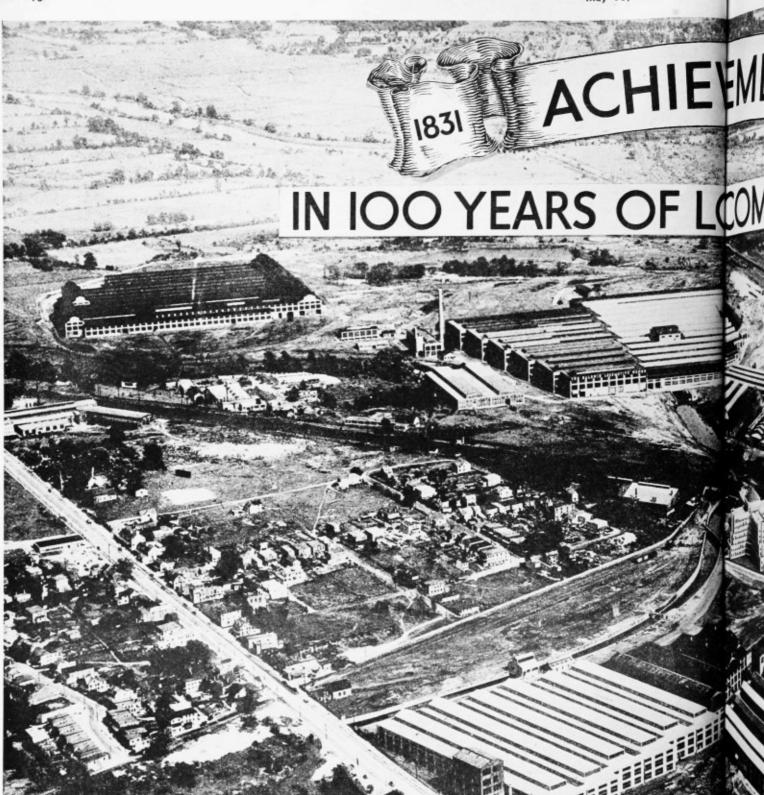


Baldwin Three-Cylinder 4-10-2 Type Locomotive with Water-Tube Firebox. 1926

Cylinder, inside, 1 high pressure 27 in. x 32 in.
Cylinders, outside, 2 low pressure 27 in. x 32 in. Drivers, diam. 63% in.
Weight, total engine 457,500 lb.



Pacific (4-6-2) Type Locomotive for Passenger Service Built for the Pennsylvania Railroad, 1927 Cylinders 27 in. x 28 in. Drivers, diam. 80 in. Weight, total engine 316,510 lb.



## THE EDDYSTONER WHERE BALDWIN



### NPLANT — WLOCOMOTIVES ARE NOW BUILT

train



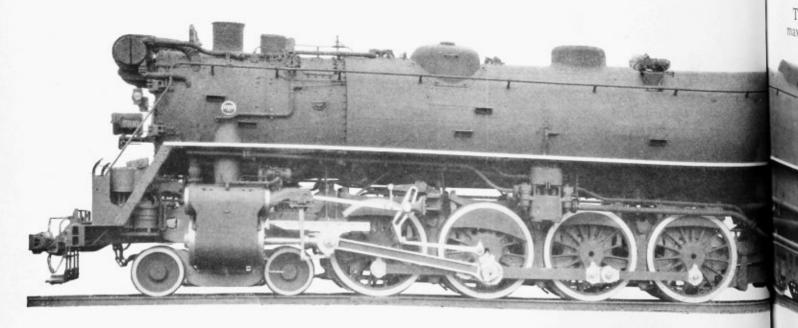
### Baldwin Modern Motive Power Incre



4-6-4 Type Locomotive for Passenger Service
Built for the Chicago, Milwaukee, St. Paul & Pacific Railroad
Cylinders 26 in. x 28 in. Drivers, diam. 79 in. Weight, total engine 375,850 lb.



4-8-4 Type Locomotive for Passenger and Freight Service Built for the Chicago & North Western Railway Cylinders 27 in. x 32 in. Drivers, diam. 76 in. Weight, total engine 498,000 lb.



1931



### owIncreases Net Operating Income

THE locomotives illustrated on these and the following four pages are typical of some of the modern classes of power built by The Baldwin Locomotive Works at its Eddystone Plant. Each represents a type or variation of a type designed and built to solve a specific problem—the high capacity locomotive for fast freight service—the powerful but flexible locomotive for heavy suburban ex-

hour with minimum maintenance and have proved to be profitable investments which return big dividends in the form of reduced operating costs and increased net operating income.

The extent to which high capacity locomotives improve operating efficiency is indicated by the 15.8 per cent increase in the average freight train load of Class I railroads of the



2-10-4 Type Locomotive for Freight Service Built for the Chicago, Burlington & Quincy Railroad

Cylinders 31 in. x 32 in. Drivers, diam. 64 in. Weight, total engine 511,710 lb.

press service—the high tractive force and large steaming capacity locomotive for fast speeds and long runs—the articulated locomotive for heavy grade and pusher service—the powerful switcher for handling main line trains—and the locomotives with larger capacity tenders for long continuous runs.

These powerful locomotives operating at maximum efficiency deliver more ton-miles per

United States from 1920 to 1925 during which period only 14 per cent of all freight locomotives were purchased new, an average of less than three per cent a year.

The further increase in boiler capacity and tender capacity and the improvements in combustion efficiency effected from 1925 to 1929 enabled locomotives to increase the average train load by another 11.4 per cent, during





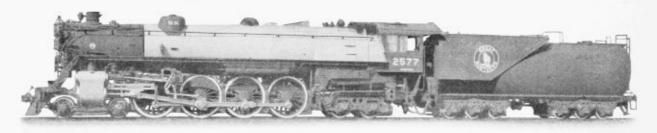
### Modern Motive Power Reduces Fue

which period about 9 per cent of the freight locomotives in service were new, less than 2 per cent per year.

Modern locomotives have demonstrated substantial economies in fuel consumption, and under intensive utilization may be expected to show a net return on capital investment of 10 to 20 per cent, contributed largely from the savings in fuel, repairs, and crew wages.

lays at terminals but have also permitted a greater utilization of the locomotives. This has resulted in faster movement and increased tonnage per train, and has effected a steady increase during the past seven years of 58 per cent in the gross ton miles per train hour.

Only one half of the number of locomotives are required to protect the service by doubling the length of engine runs. The engines are



4-8-4 Type Locomotive for Passenger Service on Level Divisions
Built for the Great Northern Railway

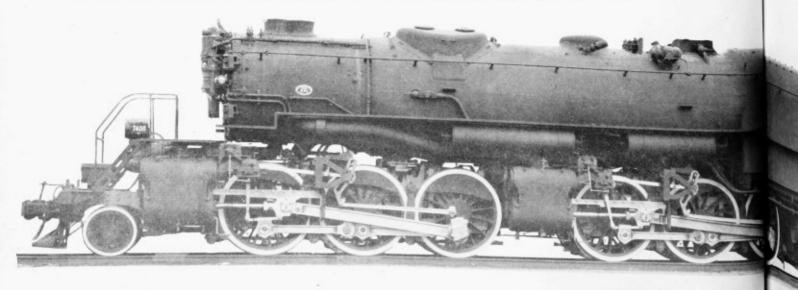
Cylinders 29 in. x 29 in. Drivers, diam. 80 in. Weight, total engine 420,900 lb.

An outstanding example of profitable operation of the larger and more modern power is shown on one of the railroads. This road, by doubling the average length of engine runs, has reduced the total cost of operation per locomotive mile as much as 30 per cent in some instances, with an average of 10 per cent in both passenger and freight service.

These long runs have not only reduced de-

turned more frequently and they make their mileage in less time.

Improved transportation and greater net operating income today are not a question of more locomotives with which to increase gross revenue—but of fewer and more efficient locomotives to haul a relatively fixed volume of traffic more quickly and at less cost.





### Fuel and Maintenance Expense



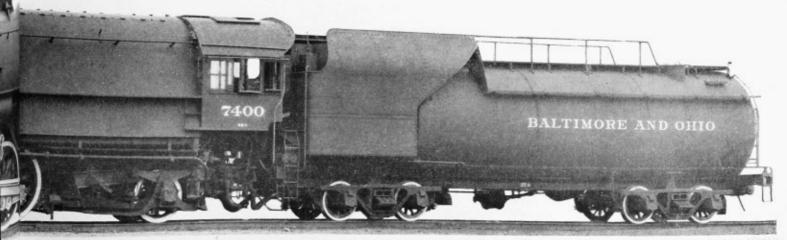
4-8-4 Type Locomotive for Fast Freight Service
Built for the St. Louis Southwestern Railway
Cylinders 26 in. x 30 in. Drivers, diam. 70 in. Weight, total engine 422,500 lb.

Pacific (4-6-2) Type Locomotive for Heavy Express and Suburban Service Built for the Central Railroad of New Jersey

Cylinders 26 in. x 28 in. Drivers, diam. 74 in. Weight, total engine 333,830 lb.

Single Expansion 2-6-6-2 Type Locomotive for Heavy Fast Freight Service Built for the Baltimore & Ohio Railroad

Cylinders (4) 23 in. x 30 in. Drivers, diam. 70 in. Weight, total engine 465,000 lb. Fitted with Emerson Water-tube Firebox





### Modern Motive Power is Essential



4-8-4 Type Locomotive for Fast Freight Service Built for the Wabash Railway Cylinders 27 in. x 32 in. Drivers, diam Weight, total engine 454,090 lb.

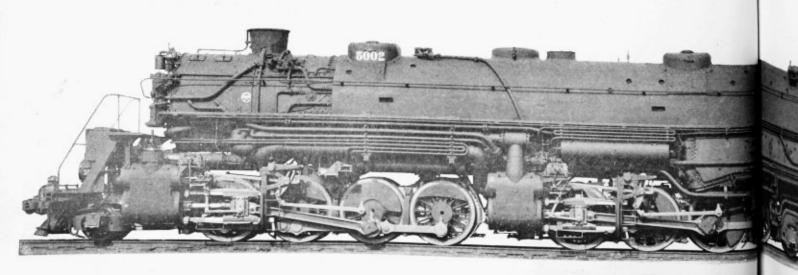


2-10-4 Type Locomotive for Fast Freight Service on Heavy Grade Divisions Built for the Santa Fe System Cylinders 30 in. x 34 in. Drivers, diam. 69 Weight, total engine 502,260 lb.

OTIVE power is the most dominating V factor in transportation. Therefore, the most effective gains in efficiency can be made by the substitution of modern motive power for much of the equipment now in use. Locomotives built five, ten or fifteen years ago to haul slow drag freight trains are entirely inadequate for present high speed schedules.

The question arises—when does a locomotive become obsolete and when should it be retired? The answer is, just as soon as costs of maintenance and operation exceed the carrying charges plus the maintenance and operating costs of new motive power. It is more economical to operate modern motive power at a profit, and improve the service, than it is to keep obsolete power in service at a loss and retard progress. Then does not efficient management require that old equipment be retired? Cost records prove that this subject is of vital importance to many American railroads.

During the past five years pronounced improvements have been made in locomotive design. Increased boiler capacity has been accompanied by higher steam pressures and superheat temperatures. The larger grate area has effected a marked increase in combustion efficiency. The cast steel bed with integral cylinders has simplified locomotive construction. The larger capacity tenders permit



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### to Economical Railroad Operation

longer continuous runs, resulting in fewer roundhouses and water stations. Modern metallurgy provides specific improvements in boiler plate, forgings, tires, wheels and other parts which have added safety to transportation.

These increases in operating efficiency and reductions in locomotive maintenance have made obsolete many of the 5 to 15-year-old locomotives. Yet nearly 80 per cent of the locomotives now in service are more than 10 years old. It is a fact that if many of the locomotives comprising the 80 per cent were scrapped, and the amount spent annually for repairs and maintenance applied to the purchase of new equipment, there would result material savings in operating expense and marked improvements in service, namely—

Improved train operation, including longer and heavier trains, faster speeds and greater safety.

Improved locomotive operation, including a more economical use of fuel, water and lubricants, and reduced roundhouse servicing.

Reduced costs of repairs and replacements.

The money saved by the substantial reduction in costs soon returns the purchase price of the locomotives, and the marked improvements in train operation strengthen the position of the railroad to meet competition and the growing demands of the future.



Single Expansion 2-8-8-4 Type Locomotive for Heavy Freight Service
Built for the Northern Pacific Railway

Cylinders (4) 26 in. x 32 in. Drivers, diam. 63 in. Weight, total engine 723,400 lb.

The Largest Steam Locomotive in the World

Mountain (4-8-2) Type Locomotive for

Fast Freight and Heavy Passenger Service

Built for the Pennsylvania Railroad Cylinders 27 in. x 30 in. Drivers, diam. 72 in Weight, total engine 390,000 lb.





## THE rapid development of American industry, which commenced soon after the Civil War, made it evident that the demand for steam locomotives would

that many of these industrial locomotives, especially those intended for mining and lumbering districts, would have to operate under conditions and in locations where

not be confined to railway companies alone.

The utility of steam transportation in connection with the promotion of extensive lumbering, mining and manufacturing projects was quickly recognized, and this resulted in the opening up of a new field for Baldwin locomotives.

the problem of maintenance would be one of supreme importance. These locomotives, therefore, had to be built with this problem always in view; parts had to be interchangeable and details made to standards or gages so that the ordering and assembling of repairs would be facilitated to the greatest possible extent.

Orders began to arrive at the Philadelphia plant for a wide variety of engines to meet the needs of America's growing industries, as they spread from coast to coast over the entire continent. Practically all of this equipment had to be designed and built in accordance with special industrial requirements. In many respects these requirements involved numerous departures from contemporary steam railway practice, necessitating the development of most unusual types of locomotives.

As early as 1839 Mr. Baldwin felt the importance of making all like parts of similar engines absolutely uniform and interchangeable. Owing, however, to the many imperfections in machinery and tools available at that time, the production of interchangeable parts was not attempted until the year 1861, when a beginning was made by organizing the various locomotive manufacturing departments on this basis. From this beginning grew an elaborate and perfected system embracing all

Right from the beginning it was realized



Eight-Coupled (0-8-0 Type) Locomotive for Heavy Switching Service

Built for Mahoning Ore & Steel Company

Gage 4 ft. 815 in. Cylinders 25 in. x 28 in. Drivers, diam. 51 in. Weight, total engine 258,400 lb.



Mikado (2-8-2) Type, Oil Burning Locomotive for Heavy Logging Service
Built for the Edward Hines Western Pine Company for operation on the Oregon and North
Gage 4 ft. 8½ in. Cylinders 24 in. x 30 in., Drivers, diam. 57 in. Weight, total engine 280,560 lb.



the essential details of locomotive An independent construction. department of the Works, having special tools adapted to the purpose, was organized as the Department of Standard Gages. A system of standard gages for every description of work to be done is made and kept by this department. The original templates are retained as "standards" from which exact duplicates are made and issued to the foremen of the various departments. Working gages are compared with the standards at frequent intervals, and absolute uniformity is thus maintained.

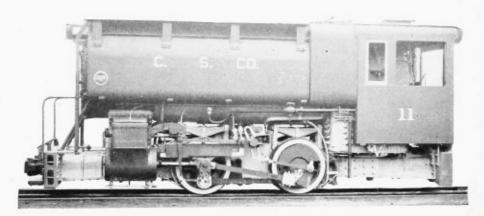
This system makes certain that every essential detail of each industrial locomotive manufactured by The Baldwin Locomotive Works can be duplicated with precision and exactness at any time. These locomotives are built to meet a wide range of curvature, grade, fuel and haulage requirements for every type of industry, regardless of location and operating conditions.

Baldwin's complete manufacturing and shipping facilities insure the highest constructional efficiency and prompt delivery to all parts of the world.



Built for the United States Metals Refining Company

Gage 4 ft. 8% in. Cylinders 18 in. x 24 in. Drivers, diam. 44 in. Weight, total engine 121,130 lb.



Four-wheel (0-4-0) Side Tank Locomotive for Switching Service Built for the Carnegie Steel Company

Gage 2 ft. 6 in. Cylinders 17 in. x 20 in. Drivers, diam. 40 in. Weight, total engine 101,800 lb.





To Railways

The World Over

THE success of "Old Ironsides" created world wide interest, for all eyes were focused on Baldwin's locomotive developments and activities.

It was only a few years later, or in 1838, that the first Baldwin Locomotives

for export were shipped to Cuba. In 1841 a shipment was made to Austria. Thus was inaugurated a most important branch of the business, for today Baldwin Locomotives are in operation on railways the world over.

Baldwin's service to foreign countries covers more than the mere building and shipping of locomotives. Baldwin Engineers consult and cooperate with the railway's representatives and engineers. They make a careful study of the profile maps showing the ruling grades. They study curvatures, clearances, bridges, tunnels, gages, weight limitations, traffic conditions and available fuels. They bring to bear on the foreign problem complete knowledge of the numerous economizing devices now available for reducing

Baldwin Locomotives
Have Been Shipped
the cost of locomotive operation.
With this information, in addition to an intimate

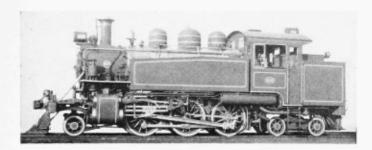
With this information, in addition to an intimate knowledge of world motive power needs, standards and systems of measurement, Baldwin Engineers are prepared to

design locomotives best suited to meet any specified conditions. On a number of occasions locomotives have been constructed throughout to the metric system.

The stability of the Baldwin Organization and the reliability of its products assure a quick and dependable supply of repair parts which are accurate in every detail, thoroughly tested and qualified to stand up in service.

The locomotives illustrated on this and the next page are representative of the different types which are giving economical performance under widely varying conditions.

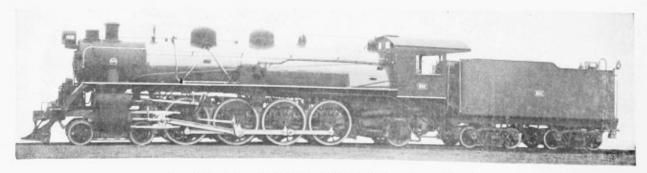
At present we are building five locomotives of the 2-10-2 type, comparable in capacity to the motive power used in the United States, for the Union of Soviet Socialist Republics.



Tank Locomotive, 2-6-4 Type
Built for the Mukden Hailung Railway, China
Gage 4 ft. 836 in. Cylinders 18 in. x 24 in Drivers, diam. 54 in
Weight, total engine 168,100 lb.



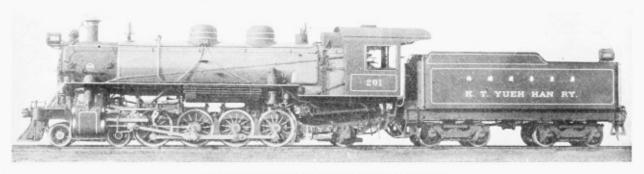
Eight-Coupled 4-8-2 Type Side Tank Locomotive for Freight Service
Built for Vryheid Coronation, Ltd., South Africa
Gage 3 ft. 6 in. Cylinders 18 in. x 22 in. Drivers, diam. 42 in.
Weight, total engine 168,100 lb.



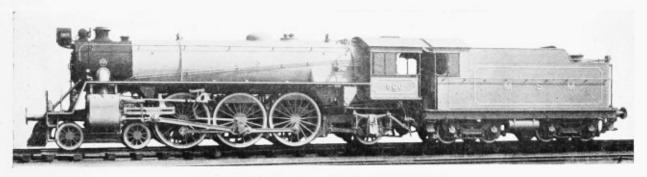




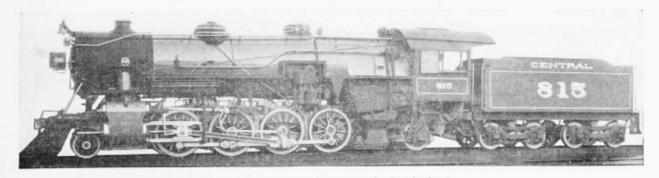
Pacific (4-6-2) Type Locomotive for Passenger Service
Built for the South African Railways and Harbours
Gage 3 ft. 6 in. Cylinders 22 in. x 26 in. Drivers, diam. 60 in. Weight, total engine 199,900 lb.



Mountain (4-8-2) Type, Three-Cylinder Locomotive
Built for the Kwangtung Yueh Han Railway, China
Gage 4 ft. 8½ in. Cylinders 17 in. x 24 in. Drivers, diam, 50 in. Weight, total engine 185,960 lb.



Pacific (4-6-2) Type Locomotive for Passenger Service
Built for Madras & Southern Mahratta Ry. Co., Ltd., India
Gage 5 ft. 6 in. Cylinders 22 in. x 28 in. Drivers, diam. 74 in. Weight, total engine 184,600 lb.



Mikado (2-8-2) Type Locomotive for Freight Service
Built for the E. de F. Central do Brazil
Gage 5 ft. 3 in. Cylinders 23 in. x 28 in. Drivers, diam. 57 in. Weight, total engine 239,200 lb.



When it is realized that the total product of The Baldwin Locomotive Works to date is nearly 62,000 locomotives, thosewho are familiar with the complexities of modern locomotive construction, will be able to form some idea as to the immensity

of this institution. It would be only natural

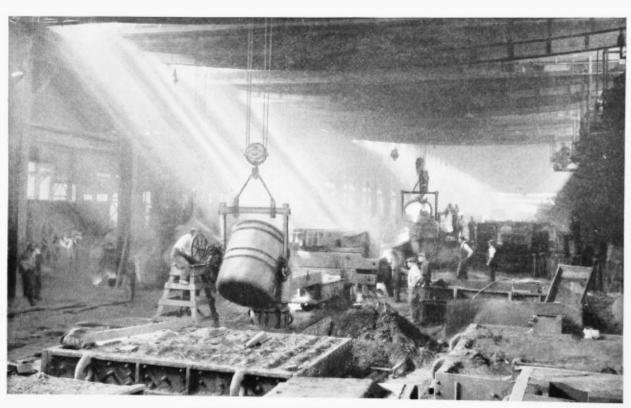
for railroad men to attempt a visualization of

Eddystone by making comparisons with some

# Baldwin Facilities At Eddystone Insure Speed and Precision In Locomotive Construction

administration building, a chemical laboratory, a physical laboratory, a shipping wharf and other associated properties. These facilities occupy 518 acres of land and are located on the shore of the Delaware river.

The shops mentioned above comprise what is virtually a coordinated group of large manufacturing establishments, each designed for the mass production of spe-



Pouring a Large Casting in One of the Four Foundry Units

of this country's large locomotive repair shops. In doing this, however, it should always be remembered that the Baldwin product is complete locomotives; and that these machines are fabricated (with the exception of certain specialties) from what is essentially raw material—cast, forged and machined—right at Eddystone.

The principal components of this plant are a foundry, a pattern shop, a smith shop, a boiler shop, a cylinder shop, frame shop, wheel shop, tank shop, machine shop and a main erecting shop; together with a general cific locomotive details, either in a rough or finished form, with the main erecting shop as their common focal point to which the output of all producing units must finally come for assembly.

And, it is right here—in the erecting shop—where we find the dominating motif of this entire picture. The Baldwin erecting forms—they stand where the erection of locomotives begins and have exercised a most profound influence on every branch of locomotive construction. They have forced absolute accuracy in every line of machining; they demand



efficiency of organization in every shop which handles foundation material; they preach the gospel of accuracy and practice what they preach.

Standing rigid and four-square, they accept no incorrectly machined part. When the frames are clamped in place, they are as square and level as the forms. Unless the cylinders and cross-ties conform to the same unvarying accuracy, they cannot be applied. Once applied they are reamed and bolted while held in position. The whole locomotive foundation is not only as level and square as the forms but is also free from strains. Frames do not break in road service from erecting strains and driving boxes are always in linc.

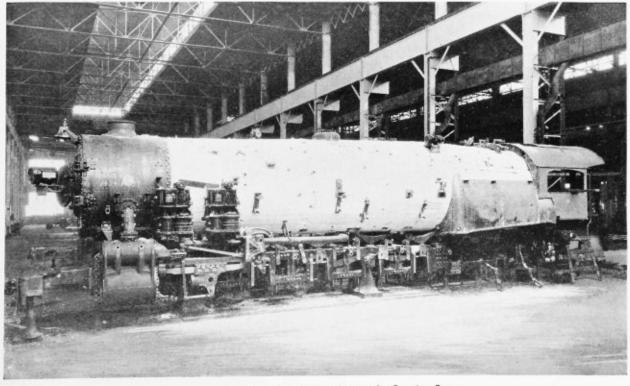
The example of orderly procedure set by the forms has been carried out in all sections of the plant and has resulted in the formation of an organization which meets the pace they set. The comfort and satisfaction of handling accurately machined parts has raised the standard of workmanship, and this standard has spread to all parts of the Baldwin Works. There are no half-way measures to these Baldwin erecting forms. Grim and unyielding they stand, barring the unfit and accepting only that which meets the most exacting demands.

In addition to the perfect workmanship and machining accuracy thus insured, Eddystone also provides unsurpassed laboratory facilities for the expert testing and inspection of all materials entering into Baldwin locomotives.

A technical personnel of thorough competence covers every phase of locomotive construction from sand for the foundry to the composition of steel for the boilers; from the billets in the smith shop to the paint and varnish which give a finishing touch to completed locomotives.

This department administers existing specifications and makes new ones as the need arises; it selects from a great variety of materials offered, those best suited to the purpose in view. Its inspectors visit every important manufacturing center and its chemists analyze products from all over the world. They delve deep into the realm of metallurgy in almost all of its many aspects, that materials may be found to meet the ever-growing demands of super-powered locomotives.

The story of The Baldwin Locomotive Works at Eddystone is truly one of achievement, of purpose and of faith in the broad principle that the best service that can be rendered, is the only service that is worth offering.



A Reading Locomotive on the Erecting Forms



T HE Eddystone Wharf, known as No. 251, with its powerful cranes and the 35-feet deep and 300-feet wide water channel to the Delaware main seaway, has a worth while significance to the railroads and industries of the world. These loading and

water facilities give Baldwin the decided advantage of being able to ship completely assembled locomotives and thereby serve foreign countries more promptly and economically.

# Complete Locomotives Are Shipped To Foreign Countries From The Eddystone Plant

vised by experienced and competent inspectors.

Baldwin service is not confined to the shipment of complete locomotives. In many cases they are shipped in small units to foreign countries where the unloading facilities are limited or where parts

must be carried over mountain trails.

The wharf is equipped with 50- and 75-ton gantry cranes which run the entire length of the loading slip. When the vessel docks a



Completely Erected Locomotives Being Shipped from Wharf No. 251

The shipment of completely erected locomotives makes possible many tangible savings at the point of destination. The locomotives can be placed in service a few hours after unloading, with minimum delay. This eliminates the cost of dismantling the locomotives at the shop after they have been erected and tested, as well as the time and expense of boxing the parts and the cost of reassembling the locomotives.

Railroads and industrial companies receiving completely erected locomotives from the Baldwin Plant have full assurance that the assembly has been consummated in a modernly equipped shop with every mechanical convenience, and that all adjustments have been super-

stream of locomotives starts moving from the nearby shops. Steel cable slings are placed around the locomotives—powerful cranes pick them up and place them on the ship—all is accomplished in a minimum amount of time.

The wharf offers every convenience for servicing vessels. It is piped for water and oil so that vessels can fill their tanks without delay. Fire protection is provided by high pressure fire lines with outlets at strategic points.

The method of shipping complete locomotives has proved highly satisfactory. Over a thousand have been loaded since the wharf was opened, and the largest single sea shipment of engines ever made, sailed from Wharf 251.



The Administration Building at Eddystone, Pa

### THE BALDWIN LOCOMOTIVE WORKS

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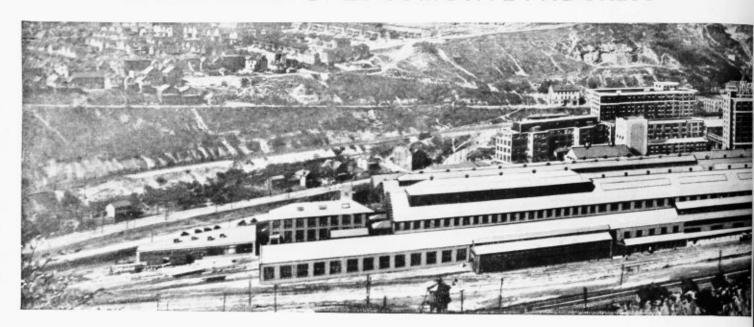
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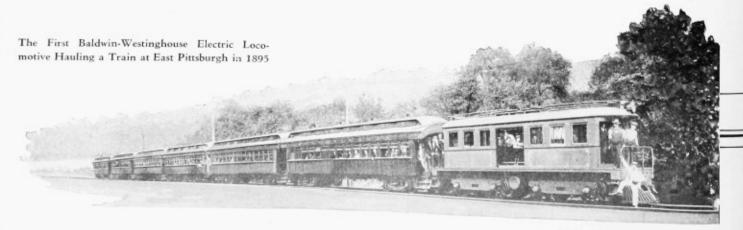
East Pittsburgh, Pa. Works of the

## The History of the Development of Railroad Electrification

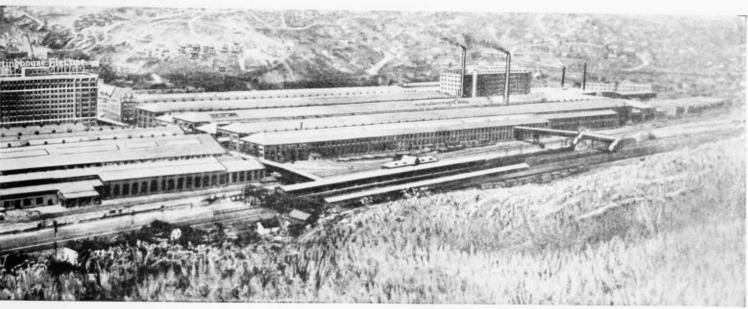
I T WAS early recognized by the Westinghouse Company that the key to comprehensive railway electrification of the future was through the use of the alternating-current system, and with this objective Westinghouse started development work

almost as soon as the direct-current motor was placed on an unquestionable commercial basis.

The first single-phase railway motors were built by Westinghouse in 1894 and were placed in operation on an experimental line near the home of Mr.







Westinghouse Electric & Manufacturing Company

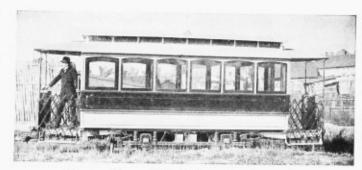
Westinghouse at Pittsburgh. These motors were rated at about 15 hp. and were operated at low frequency.

Realizing that many problems would arise in the design of the mechanical parts of electric locomotives, the Westinghouse Company at an early date formed a cooperative agreement with The Baldwin Locomotive Works and thus was enabled to make use of the more than 60 years of experience of this great organization in locomotive design and construction.

The first Baldwin-Westinghouse locomotive was completed in 1895. It is interesting to note that this locomotive has been in active service for many years on the Lackawanna & Wyoming Valley Railway.

More than 5800 Baldwin-Westinghouse locomotives have been built since 1895. These include all types from the smallest locomotive for mining and industrial service to the mightiest in the World for trunk line service on mountain grades.

During the past 35 years Baldwin-Westinghouse locomotives have been designed for all types of electrification—for single-phase, alternating current from 3300 volts to 22,000 volts; for three-phase,



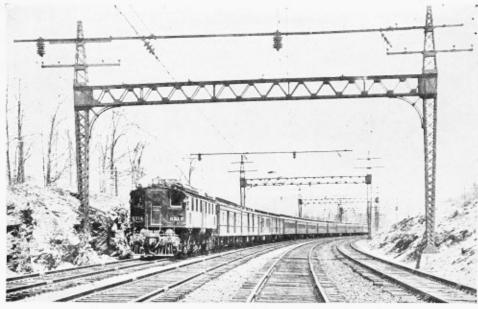
An Experimental Single-Phase Car Operated at the Home of Mr. Westinghouse about 1894

alternating current at 3,000 volts; for direct current from 600 volts on the third rail to 3,000 volts on an overhead trolley—on 55 different railroads in the United States and in ten other countries.

The Baldwin Loco. Works, Philadelphia, Pa. Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.







One of the 178-Ton, Single-Phase Baldwin-Westinghouse Locomotives placed in Service on the New Haven in 1921.

#### Heavy Trunk Line Service

NEW YORK, NEW HAVEN & HARTFORD

The New York, New Haven & Hartford was the first trunk line railroad to operate heavy freight and passenger traffic, both local and high speed, with electric locomotives. For this reason the history of the development of the New Haven locomotives practically represents the history of motive power development for the whole industry.

Initial operation from New York to Stamford, Conn. took place in July, 1907 with 41 Baldwin-Westinghouse locomotives. Later extensions required additional locomotives until now this electrification comprises 120 miles of route, including more than 800 track miles, and employing 133 Baldwin-Westinghouse electric locomotives, 63 multiple unit motor cars and 112 trail cars. All services — freight, passenger and switching—are electrified, the latter comprising the largest electrified yard in the world.

Everyone of the original locomotives is still in continuous service and each has made more than 1,500,000 miles. The switching locomotives are regularly in service 24 hours a day for 30 consecutive days, averaging 37,000 miles per locomotive per year.

Each year on the New Haven, electric locomotives travel more than 7,000,000 miles.



50-Ton, Single-Phase Baldwin-Westinghouse Locomotives Handle all the Switching Operations in the Oak Point Yards of the New York, New Haven and Hartford Railroad.

The Baldwin Loco. Works, Philadelphia, Pa. ~ Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.







#### Mountain Grade Service

NORFOLK & WESTERN

The Norfolk & Western, which serves the large smokeless coal fields of West Virginia, was the first to solve a difficult heavy grade operating problem.

When the 11,000 volt a-c. electrification was introduced in 1915, twelve Baldwin-Westinghouse electric locomotives replaced fifty steam locomotives. Under steam operation three Mallet type locomotives were required to take 3250 tons up the Elkhorn grade at seven miles per hour. Under electric operation, a double-unit 302-ton electric locomotive handles 4200 tons with ease at twice the speed.



Two of the Early Single-Phase Baldwin-Westinghouse Motive Power Units on the Norfolk and Western Railway.

Two of the 179-Ton, Single-Phase, Motor-Generator Type Baldwin-Westinghouse Motive Power Units hauling a 105-Car Train on the Great Northern Railway.

#### CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC

In 1920, ten 3000-volt d-c. Baldwin-Westinghouse locomotives were furnished to the Chicago, Milwaukee, St. Paul and Pacific for heavy electric passenger service over the mountains.

They were designed to regularly haul 960-ton trains

on a 440-mile run including 21 miles of grades averaging from 1.72 to 2 per cent. These locomotives have electric regeneration of power on descending grades.

This still remains the longest railway electrification.



Chicago, Milwaukee, St. Paul & Pacific Railroad Main Line Passenger Train drawn by a 1000-Hp. D-c. Baldwin-Westinghouse Locomotive.

#### GREAT NORTHERN

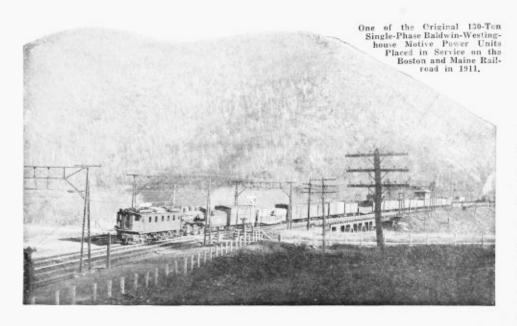
On February 6, 1927 Baldwin-Westinghouse double-unit, motorgenerator type locomotives introduced electric service on the Great Northern Railway between Skykomish and the Eastern Portal of the Cascade Tunnel.

This operation has been extended to include the new Cascade Tunnel nearly eight miles long and the extension to Wenatchee, comprising the most difficult profile of this railway. The extreme flexibility of operation, both motoring and regenerating, makes this operation most conspicuous.

The Baldwin Loco. Works, Philadelphia, Pa. Westinghouse Elec. & Mfg. Co., E.Pittsburgh, Pa.







The Hoosac Tunnel on the Boston & Maine Railroad is nearly five miles long, and was for many years the longest railroad tunnel in America. It is located on one of the busiest divisions of the System. Operation was greatly improved in 1911, when the tunnel was electrified. Baldwin - Westinghouse single-phase locomotives have since handled the heavy traffic through the tunnel with great success.

#### **Tunnel Service**

#### GRAND TRUNK

In 1908 the Grand Trunk Railway electrified its tunnel under the St. Clair River, using the single-phase system. Since that time, Baldwin-Westinghouse electric locomotives have made an average of nearly 700,000 miles per locomotive in short run and switching service. During the 23 years of operation, the total delay chargeable to locomotive failures has been less than one hour.

It is a distinct tribute to the design and construction of these locomotives that, when an additional unit was ordered in 1926, a duplicate of the original Baldwin-Westinghouse locomotives was specified.



Two of the 66-Ton, 3300-Volt, Single-Phase Baldwin-Westinghouse Motive Power Units Placed in Service on the Grand Trunk Railway in 1908.

The Baldwin Loco. Works, Philadelphia, Pa. ~ Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.





# Belt, Short Line and Industrial Freight Service

More than 166 Baldwin-Westinghouse electric locomotives ranging from fifty to eighty-five tons, rated weight, with a total of more

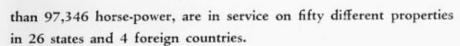




Above — A Standard 50-Ton Baldwin-Westinghouse Freight Locomotive of the Northeast Oklahoma Railroad.

Left — A Standard 60-Ton Baldwin-Westinghouse Locomotive Recently Delivered to the Salt Lake & Utah Railroad.

Below — A Standard 85-Ton Baldwin-Westinghouse Locomotive in Service on the Chicago, South Shore & South Bend Railroad.



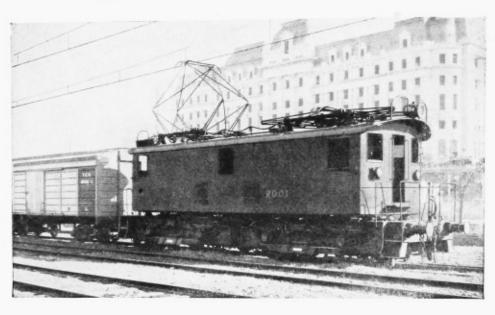
More than 5500 Baldwin-Westinghouse electric locomotives, weighing from  $1\frac{1}{2}$  to 80 tons each, economically serve the mining and manufacturing industries both in this country and abroad.



The Baldwin Loco. Works, Philadelphia, Pa. Westinghouse Elec. & Mfg. Co., E.Pittsburgh, Pa.







Foreign Service

#### PAULISTA RAILWAY

In the State of Sao Paulo, the richest and most productive state in Brazil, the Paulista Railway forms the principal part of the broad gauge trunk line system.

In addition to the original order for Baldwin-Westinghouse freight and passenger locomotives which introduced electric operation in 1921, three

repeat orders for duplicate equipments have been shipped.

In 1926, the Board of Directors made the following statement:

"In this respect it is sufficient to say that electric operation of the line from Jundiahy to Tatu has cost about \$100,000 per year, whereas steam operation would have cost not less than \$533,000 at the present cost of coal."

This 73-Ton Baldwin-Westinghouse Locomotive Initiated Electric Operation on the Buenos Aires Western Railway in 1922.

#### BUENOS AIRES WESTERN RAILWAY

The Buenos Aires Western Railway operated its first electric train in 1922 with Baldwin-Westinghouse locomotives.

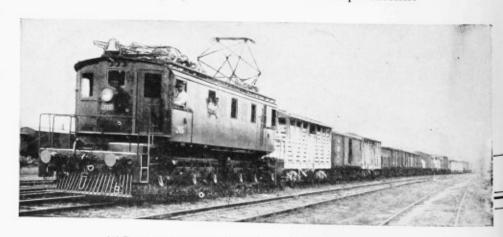
Specifications for the locomotives were prepared in accordance with British standards and engineering practice.

Baldwin and Westinghouse engineers met these specifications and the locomotives are render-

ing continuous service with complete satisfaction.

#### CHILEAN STATE RAILWAYS

In 1923 the Chilean State Railways purchased 39 Baldwin-Westinghouse electric locomotives of four types, in order that each class of service might be handled most effectively by locomotives specifically proportioned to meet the requirements.



142-Ton, 3000-Volt D-c. Baldwin-Westinghouse Locomotive on the Paulista Railway of Brazil.



Electric operation of the express passenger service has permitted 35 per cent heavier trains to make the trip in 20 per cent less time. Electric freight train tonnage has been increased 15 per cent and the running time cut in half.

As a result of the remarkable performance of these locomotives four exact duplicates of the express passenger units were ordered in 1930. This is a notable example of Baldwin-Westinghouse design and engineering.



Baldwin-Westinghouse 1500-Volt, D.c. Passenger and Freight Locomotives Operate on the Imperial Government Railways of Japan.

#### IMPERIAL GOVERNMENT RAILWAYS OF JAPAN

In 1922 the Imperial Government Railways of Japan initiated electric service with two freight and two passenger Baldwin-Westinghouse locomotives.

In 1926 repeat orders were placed for eight similar passenger locomotives. Baldwin-Westinghouse freight haulage locomotives also are in operation on six other railways of Japan.

#### CHICHIBU RAILWAY

Increasing freight and passenger movement and the ever present fuel problem made it imperative for the Chichibu Railway in Japan to seek a solution of

their power difficulties.

After careful consideration, a decision was made calling for the electrification of 35 miles of main line on which 5 Baldwin-Westinghouse locomotives initiated service in 1922.

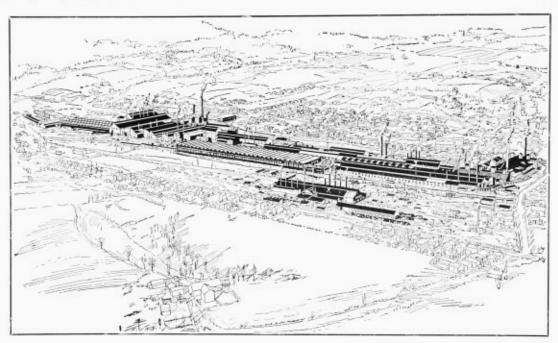


115-Ton, 3000-Volt, D-c. Baldwin-Westinghouse Locomotive in Freight Service on the Chilean State Railways.

The Baldwin Loco. Works, Philadelphia, Pa. ~ Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.







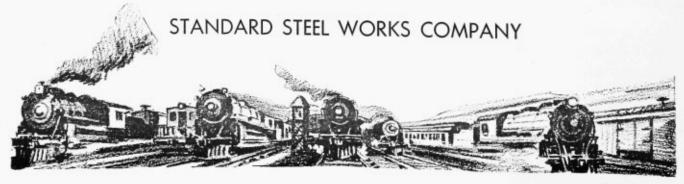
# STANDARD STEEL WORKS COMPANY High Quality Steel Parts For Railroad Service

From the little "Freedom Forge" of 1795 has emerged the Standard Steel Works Company of today, one of the most prominent producers of high quality locomotive parts, with a background of one hundred and thirty-six years in the development, research and manufacture of steel and parts for the Railroad industry.

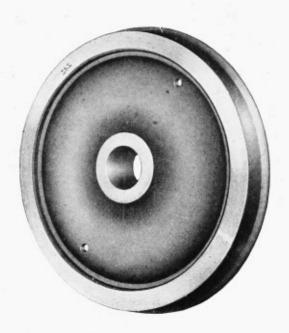
Starting with the making of the steel, every process in the manufacture of "Standard" products is conducted within the Works at Burnham, Pennsylvania under the constant supervision of an organization experienced in producing High Quality steel parts.

This accurate control of every step in process of manufacture, together with the carrying on of constant scientific research is an assurance of High Quality in "Standard" parts.









# "STANDARD 'Q T'" WHEELS

OVER 2,000,000,000 WHEEL-MILES have demonstrated the super-service of "Standard 'Q T'" steel wheels. Under the heaviest loads and most severe conditions of service these wheels have shown greatly superior structural strength and wear life.

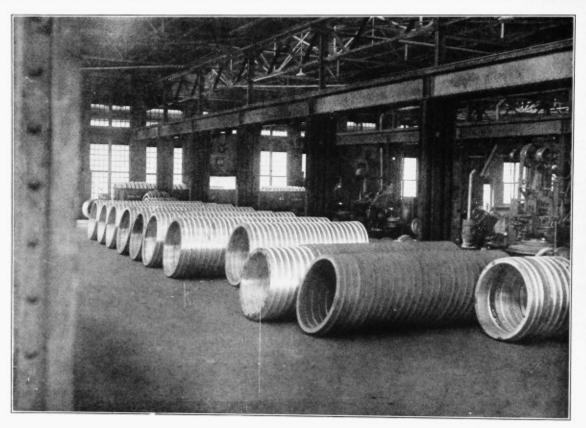
Scientific heat treatment, which produces, high physical properties and refinement of structure is responsible for the super-service of "Q T" wheels. These wheels are uniformly Oil Quenched throughout and Tempered to relieve all internal strains.

For maximum safety and minimum operating cost—use Standard "Q T" Wheels.



STANDARD STEEL WORKS COMPANY





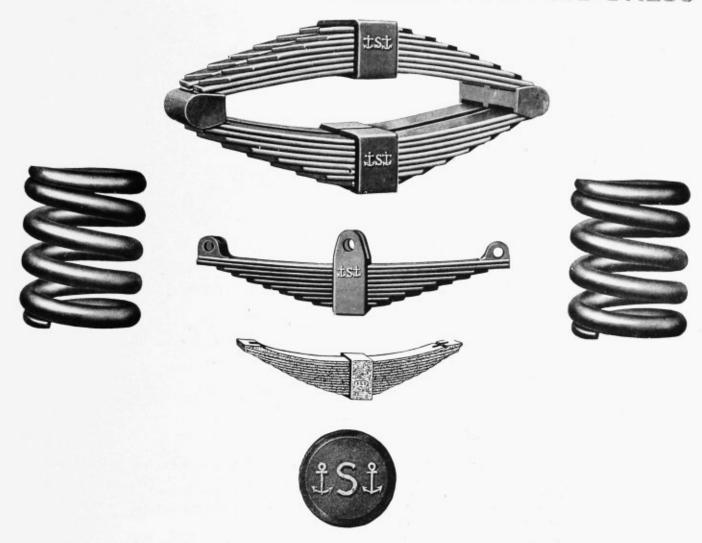
# "STANDARD" TIRES

Toughness and resistance to wear are required in all tires. This is gained by a thorough control of all processes of manufacture—from the making of the steel through each painstaking step to the final inspection. "Standard" tires have been used on many roads for many years because of their inherent toughness and resistance to wear.



STANDARD STEEL WORKS COMPANY

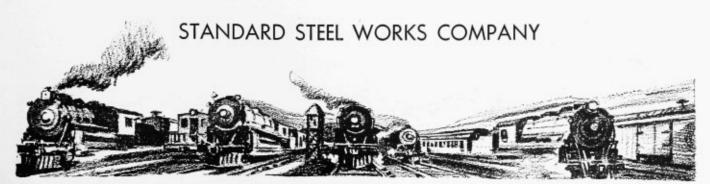




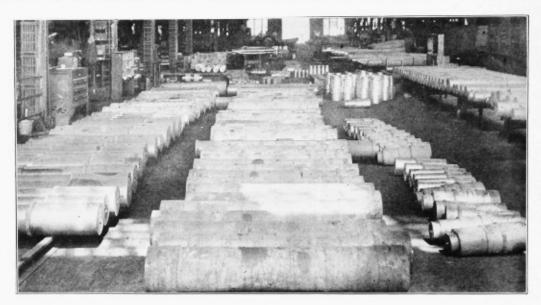
# "STANDARD" SPRINGS

Designed and made to meet a particular need. This is the requirement of every railroad spring.

"Standard" offers the benefit of the many years experience in the successful manufacture of helical and elliptical springs.







# "STANDARD" AXLES PISTON RODS CRANK PINS

The continued growth in the size and power of locomotives, has made necessary great improvement in the quality of locomotive forgings. "Standard" have developed to a high degree of perfection, by careful study and research, all phases of the heating and mechanical working of ingots into forgings.

The excellent physical characteristics of forgings made under the exacting conditions employed by "Standard"—justify the painstaking methods employed and are an assurance of long life and dependability in service.



STANDARD STEEL WORKS COMPANY

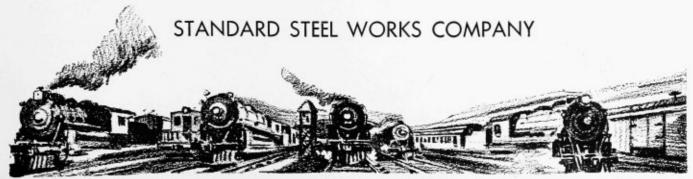




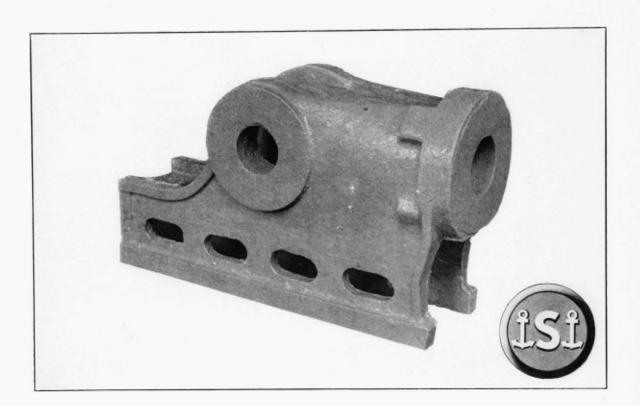
# "STANDARD" CONNECTING RODS

Even with the uniformity of "Standard" forgings regulated by our complete control of raw material and manufacture, nothing is left to chance. Standard Steel Works Company makes a careful microscopic examination of the forging steels used, to assure *known quality* in every forging produced. This check *must* meet our exacting standards.





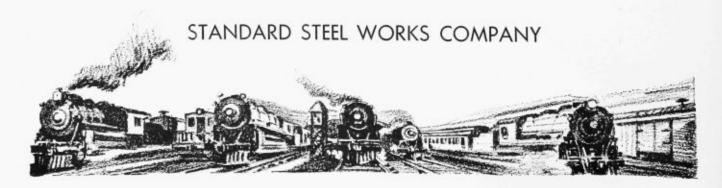




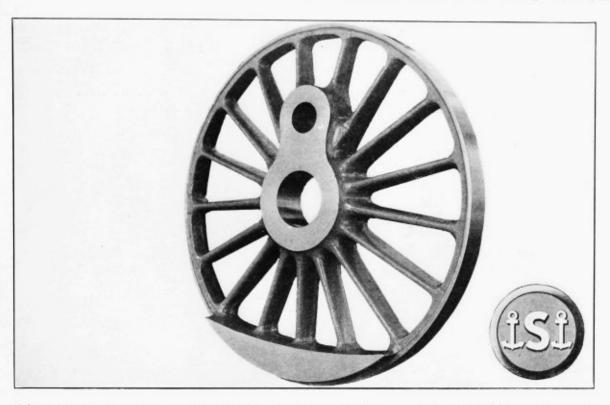
# "STANDARD" STEEL CASTINGS

(Specification S-302-31)

A new specification, S-302-31, was recently brought out to cover a new and better type of steel casting for locomotive use. It provides for a normalized and tempered high-test casting with particularly high physical properties. While this steel contains no alloys, it provides practically all of the properties of an alloy steel casting at but little more than the cost of our regular steel castings and at considerably less cost than an alloy casting.







# "STANDARD" STEEL CASTINGS

(Specification S-302-31)

Each of these castings are microscopically tested before being shipped. The new specification makes an ideal steel for crossheads, wheel centers, driving boxes, cylinder heads and other miscellaneous castings. The steel is made by the acid open-hearth method, and after cooling below the critical range of temperature, is normalized and tempered.

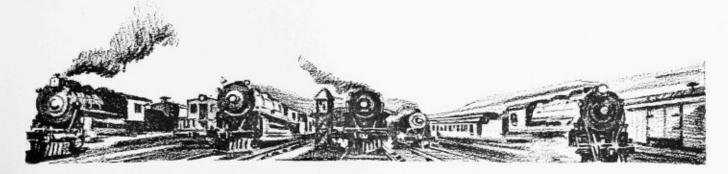
 Tensile Strength
 85,000 lbs.
 Elongation
 22%

 Yield Point
 50,000 lbs.
 Reduction
 35%

#### STANDARD STEEL WORKS COMPANY

General Offices & Works: Burnham, Penna.

CHICAGO NEW YORK PHILADELPHIA ST. LOUIS RICHMOND AKRON PORTLAND SAN FRANCISCO





Southwark Foundry and Machine Co. Division



EARLY SOUTHWARK HISTORY

MERRICK & TOWNE

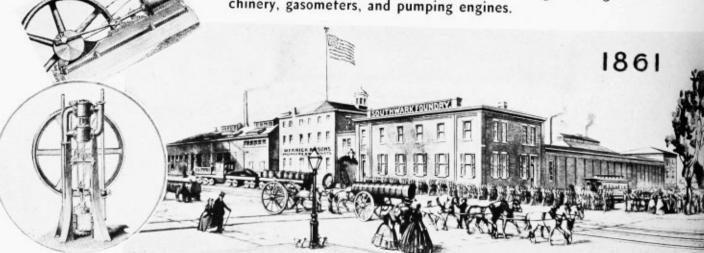
This partnership, formed in 1836, marks the inception of "Southwark" activities in early American industry. Starting as an iron foundry, machine tools were later added, and a general machine business conducted. From 1840 to 1861 this firm also built boilers and engines for frigates and steamers of the U. S. Government. This partnership existed until 1861.

BRANDYWINE SHOALS LIGHTHOUSE Built by MERRICK & TOWNE—1850 Still in Existence

#### Horizontal Steam Engine

#### MERRICK & SONS

Reorganized in 1861 as "Southwark Foundry, Merrick & Sons, Engineers and Machinists," the same line of business was continued with the addition of the manufacture of steam engines, sugar mill machinery, gasometers, and pumping engines.

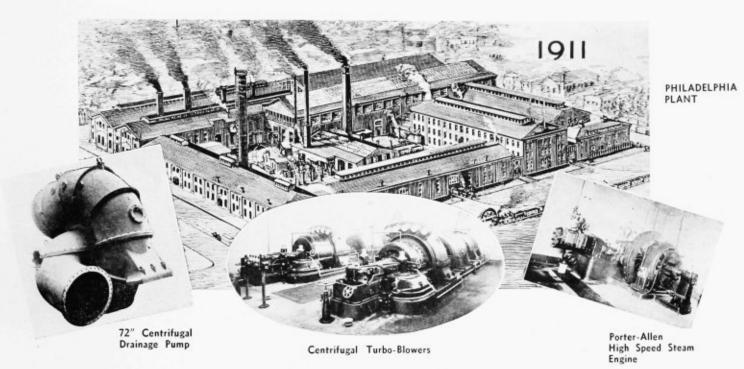


Direct Acting Vacuum Engine

Fifth & Washington Ave., Philadelphia



Southwark Foundry and Machine Co. Division



#### SOUTHWARK FOUNDRY AND MACHINE CO.

This corporation, formed in 1880, has made hundreds of outstanding contributions to the mechanical, process, transportation and scientific research fields covering special machinery and equipment.



Office and Plant-Eddystone, Pa.

# BALDWIN SOUTHWARK CORPORATION Southwark Foundry and Machine Co. Division

Affiliated with the Baldwin interests, January 1931, with greatly increased facilities, the Southwark policy of development engineering and production of machinery for general and specific application is being maintained.

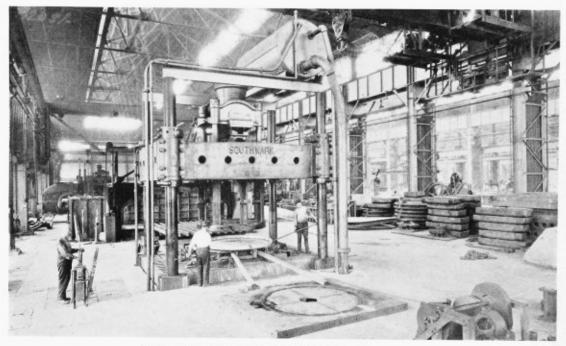
AKRON

PHILADELPHIA

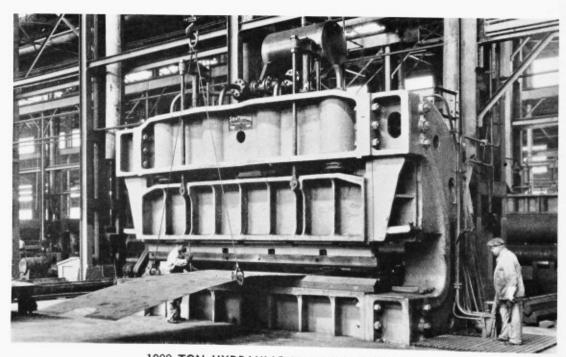
CHICAGO



Southwark Foundry and Machine Co. Division



1000 TON HYDRAULIC PRESS FOR FLANGING LOCOMOTIVE BOILER HEADS

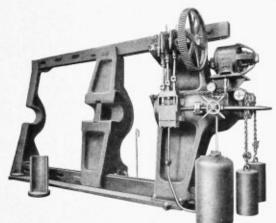


1000 TON HYDRAULIC BENDING MACHINE

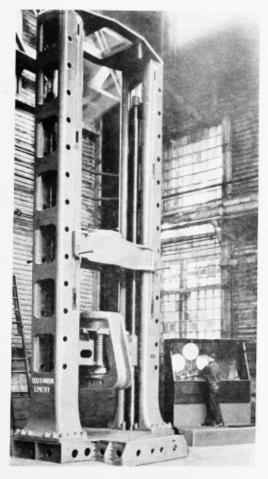




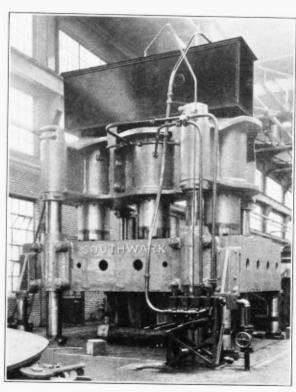
Southwark Foundry and Machine Co. Division



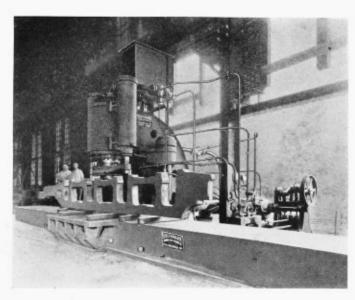
SOUTHWARK WHEEL PRESS-INCLINED



1,000,000 LB. SOUTHWARK-EMERY UNIVERSAL TESTING MACHINE C. & O. RAILROAD



2100 TON FLANGING PRESS
ILLINOIS CENTRAL RAILROAD SHOPS,
PADUCAH, KY.



600 TON HYDRAULIC PRESS STRAIGHTENING LOCOMOTIVE SIDE FRAMES





Southwark Foundry and Machine Co. Division



# BUTLER AIRWAY TRACKMASTER

Speeds up ballasting work shifts and lays tracks operates compressed air tools.

A gang car and light switching engine.



2-8-8-4 TYPE LOCOMOTIVE, CLASS Z-5, NORTHERN PACIFIC RAILWAY



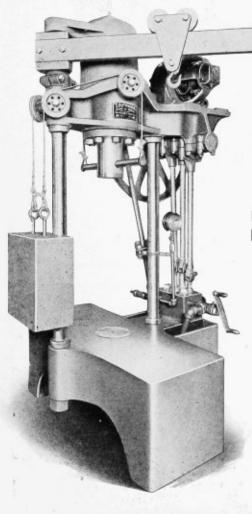
AKRON

PHILADELPHIA

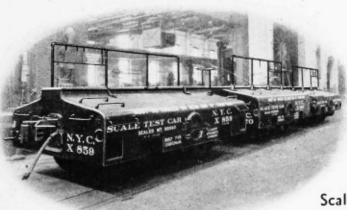
CHICAGO



Southwark Foundry and Machine Co. Division



Rapid Action Bushing Press



AKRON

1,000,000 lb. Compression Testing Machine—Gould Coupler Company

Scale Test Cars—Capacities from 40,000 to 100,000 lb.



PHILADELPHIA

CHICAGO



# LOCOMOTIVE PROGRESS Through One Hundred Years





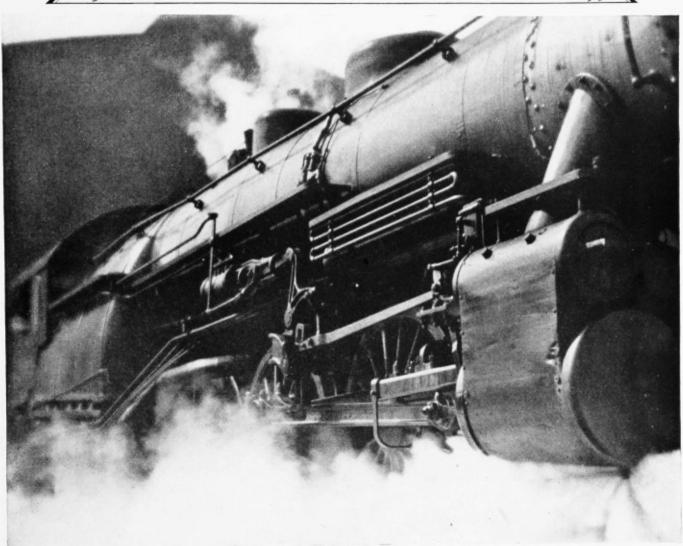


#### LOCOMOTIVE PROGRESS

Through One Hundred Years







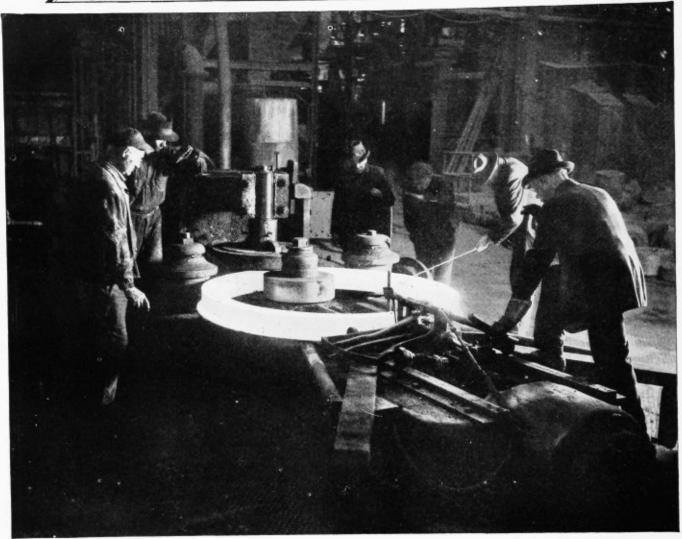
HE centenary of any organization is a great event. It proves that the vision of the founder carried beyond the horizon that limits most men. It means that the craftsmanship of several generations of workers has built into their products a genuine quality that guarantees lasting service. It means that each change in the business conditions of the nation and the world has been met by an adaptable leadership in the heads of the organization as year followed year.



# LOCOMOTIVE PROGRESS

Through One Hundred Years





The centenary of The Baldwin Locomotive Works means all this—and more. For no single product has meant so much to the expansion and progress of our nation as has the iron horse. Nor have the boundaries of our country limited the usefulness of Baldwin. On the bleak steppes of Russia, in the steaming jungles of the tropics—wherever man has had transportation problems you are likely to find Baldwin helping to solve them.

Just as the locomotive has helped make possible Today—so steel has





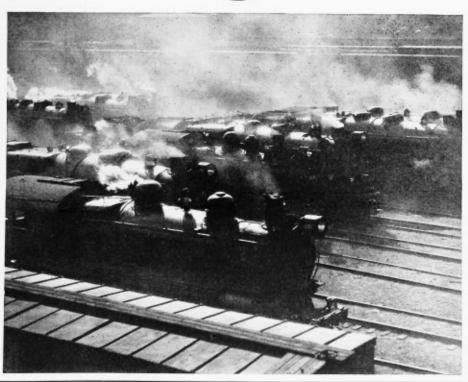
# LOCOMOTIVE PROGRESS Through One Hundred Years



made possible the locomotive. The history of Midvale parallels and co-ranks the history of Baldwin. The type of workmanship, the quality of product have been synonymous with the ideal of service under the most testing conditions.

For years, in tires, piston rods, connecting rods, crank pins and axles, Midvale Forgings have rendered a dependable service—essential to railroad needs. The Midvale Company is always at the command of the railroad, and those who, like Baldwin, serve the railroad—at any of its offices—Philadelphia, New York, Washington, Pittsburgh, Cleveland, Chicago or San Francisco.





MIDVALE





Meeting through trains from Toronto and Montreal, making seven round trips every twenty-four hours, on a run of five miles between Gananoque and Gananoque Junction and doing mercantile switching between times, a special dual power-plant 40-ton gaselectric Whitcomb locomotive is operating for the "Thousand Islands Railway" a direct subsidiary of the "Canadian National Railway." It hauls an average of 238 tons, consisting of nine freight cars and a coach, and is saving well over 50% of the cost of operating the steam power which was formerly used on this work.

THE WHITCOMB LOCOMOTIVE COMPANY ROCHELLE . . . . . . . ILLINOIS

# WHITCOMB



# the new york board of transportation switches with whitcomb



With equal efficiency and with decided economy, a standard 30-ton mechanical drive Whitcomb Locomotive, runs about the yards at the 207th Street Terminal, busily switching and transferring passenger cars for the New York Board of Transportation. In use for some time it is giving "perfect satisfaction," an example of the unfailing, service-free performance of all Whitcombs.

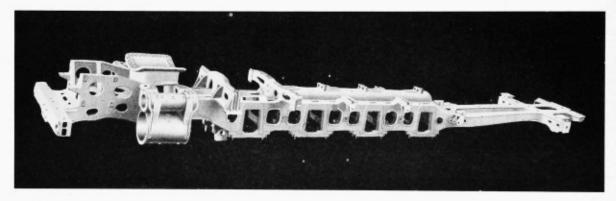
For more complete details of these operations and of other projects where Whitcombs are proving themselves and for full information on the original advancements in design and construction, built into every Whitcomb, write, wire or 'phone the factory at Rochelle.

THE WHITCOMB LOCOMOTIVE COMPANY ROCHELLE - - - - ILLINOIS

# LOCOMOTIVES

# INTEGRAL CAST Commonwea The Foundation Locomotives

**STRENGTH** 



LOCOMOTIVE BED WITH INTEGRAL CYLINDERS

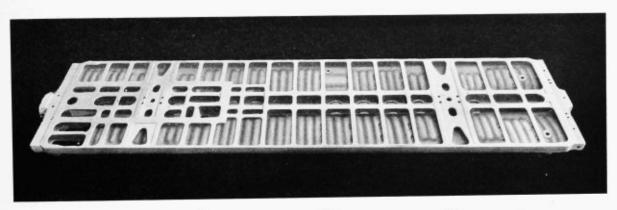
# PROGRESSIVE

Other Essential Commonwealth Products

Engine and Trailer Trucks Swing Motion Tender Trucks Pilots Pilot Beams Ashpans

GENERAL STEEL CAST GRANITE CITY, ILL.

# STEEL CONSTRUCTION Ith Products of Modern and Tenders ECONOMY



WATER BOTTOM TENDER FRAME

# ACHIEVEMENTS

Unification of Hundreds of Parts

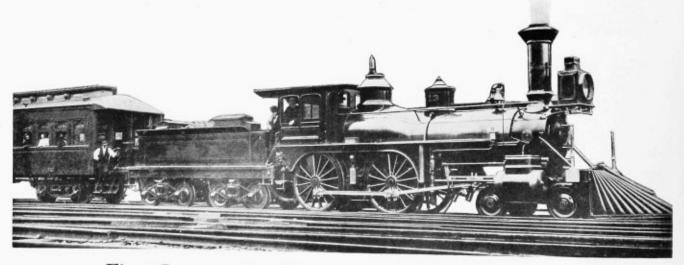
Eliminates Maintenance Provides Maximum Strength Increases Revenue Service Reduces Operating Costs

INGS

CORPORATION EDDYSTONE, PENN.



has been a powerful factor in locomotive development



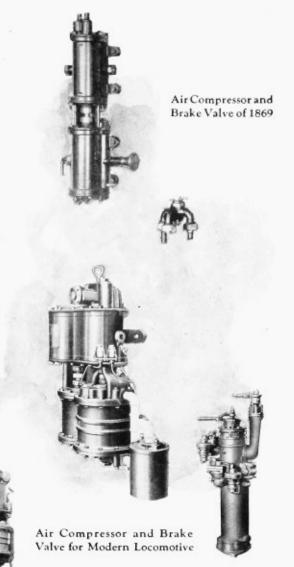
First Locomotive Equipped With the Air Brake

# WESTINGHOUSE AIR BRAKE COMPANY

WONDERFUL advancement in locomotive design was made during the first 40 years of development, but progress of the last 60 years has been even more striking.

Many factors have contributed to this development—none more outstanding than the AIR BRAKE. Its introduction 62 years ago gave new impetus to railroading. Prevailing restrictions regarding train weight, length, and speed imposed by hand brakes were thereby removed and a new element of safety provided. Consistent development of motive power to meet changing conditions through successive years has thus been permitted and encouraged by adequate brake control.

This company is proud to have been associated with locomotive builders in the development of better motive power and the consequent advance in railroad transportation.



Modern transportation conditions demand the use of strictly up-to-date locomotives, having characteristics that make for greatest over-all operating efficiency... The Air Brake is of course a recognized fundamental element. It too has been modernized in vital particulars, and is possessed of many refinements that harmonize with advances made in locomotive design and best operating practices.

Modern Locomotive Having Latest Type of Air Brake

# » » » General Office and Works « « « WILMERDING, PENNSYLVANIA

DISTRICT OFFICES IN ALL PRINCIPAL CITIES OF THE UNITED STATES

# Achievements in 100 Years of Locomotive Progress-



Since the advent of Matthias Baldwin's "Old Ironsides," we have lived through a century of remarkable progress in locomotive design and construction.

Acceleration. Faster speed. Greater speed in everything we do. Increased motive power to produce these greater speeds. And each progressive improvement of the locomotive has been dependent almost entirely upon equal progressiveness in signaling. Of what avail locomotives capable of maintaining a speed of one hundred miles per hour, without adequate signals to assure their safety?

Modern science is giving us time and money saving inventions and improvements at a steadily increasing rate. Train speeds in excess of one hundred miles per hour will soon become necessary to meet future

District Offices:

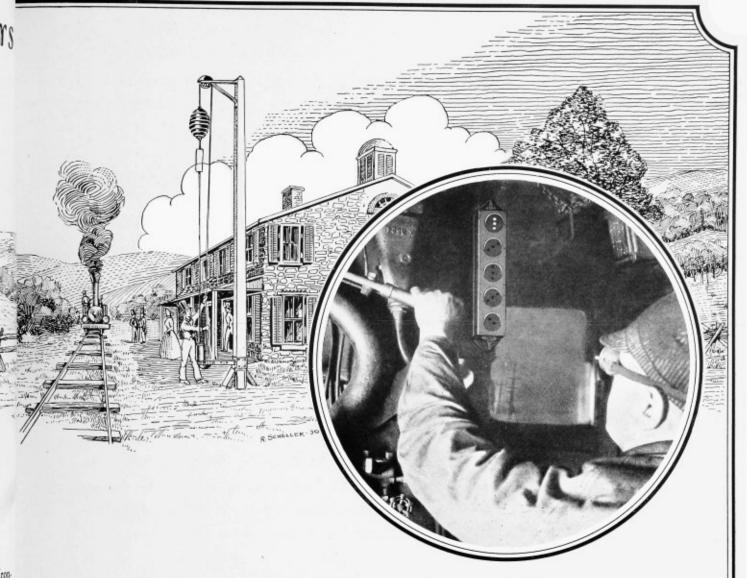
**NEW YORK** 

MONTREAL

CHICAGO

ST. LOUIS

SAN FRANCISCO



competition successfully, say trade paper editorials. Probably the governing factor in the attainment of such train speeds is signaling! And the signaling problems brought on by increased train speeds have been anticipated and are already being met by Union Switch & Signal Company engineers. This is exemplified by the "Union" Continuous Cab Signal System, a development whose primary object it is to increase speed with safety.

Just as the Union Switch & Signal Company has kept pace with each progressive step of railway development during the past fifty years, so will it continue in the future. Your signaling problems in the attainment of future higher train speeds with safety will be solved.

rely

vzil



Inion Switch & Signal Co.



1931

#### THE "ACTIVE"

One of the first Boldwin engines to use Sellers Injectors

The Baldwin Locomotive Works' original record book describes it, "Phila. & Reading engine ACTIVE, built in 1860, was a small switching locomotive of the 0-4-0 type. It had cylinders 11 x 16 inches and driving wheels 36 inches in diameter. The wheels were of chilled cast iron. The locomotive weighed approximately 10 long tons." Beside the engine is a sectional view of the original Sellers injector.





# Baldwin's .. Sellers . . Associated in

- 1848 William Sellers & Company was founded for the manufacture of machine tools and railroad shop equipment. The original plant, built adjoining the Baldwin Locomotive Works in Philadelphia, still stands.
- 1860 The injector patented by Giffard in France in 1858 was introduced to America by William Sellers in 1860. A picture of the original device is shown above. Sellers developed this to a practical instrument and Matthias Baldwin was the first to apply it to a railroad locomotive. The same year, the Pennsylvania and the Reading were the first railroads to avail themselves of this device.
- 1865 William Sellers patented the self-adjusting injector.
- 1876 The Sellers self-adjusting "76 injector" was developed to such a high point of efficiency that it was universally adopted as the correct method of feeding boilers.



Sellers U. S. Standard Non-Lifting Injector



Sellers Duplex Top Check and Stop Valve



#### serving the railroads since 1848

- 1887 Sellers offered locomotive manufacturers and railroads an automatic, self-adjusting double jet injector with fixed nozzles.
- 1925 Baldwin Locomotive Works installed the first Sellers Exhaust Feed Water Heaters on Reading Company engines. This type of feed water heater has since been applied to locomotives of 15 leading railroads.
- 1931 83 year old William Sellers & Company, Inc. congratulates the century old Baldwin Locomotive Works on the great contributions they have made to railroading, through the years. They likewise take this opportunity of thanking the men of Baldwin's for their constant helpful co-operation in the development of the Sellers line of locomotive equipment —today used by 241 North American railroads, as well as the roads of many foreign countries.

#### MAY, 1931

The latest Baldwin engines are Sellers equipped

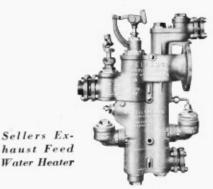
Coincidental with Baldwin's Centennial, 10 giant Sante Fe type locomotives are being completed. These are Reading engines Nos. 3011 to 3020. All of the locomotive equipment which Sellers manufactures is being installed on these engines.

EXHAUST FEED WATER HEATER: Exhauot Regulating Valve, Steam Starting Valve, Cab Operating Stand, Retarding Valve, Terminal Relief Valve, Indicator Gauge. NON-LIFT. ING. INJECTOR: Steam Starting Valve, Cab Operating Valve, Injector Indicator, Turret Steam Valve, Duplex Main Check & Stop Valve, Feed Water Strainer. Coal Sprinkler and Rail Washer, Steel Bronze Coupling Nuts, etc.





Sellers Exhaust Regulating Valve



#### WILLIAM SELLERS & COMPANY, INC. Philadelphia, Pa.

Sellers Industrial Tools comprise Drill Grinders, Tool Grinders, Spiral Gear Drive Planers, Boring and Turning Mills Floor Boring Machines, Planer Type Milling Machines, etc. Sellers Railroad Tools comprise Car Wheel Lathes, Driving Wheel Lathes, Car Wheel Borers, Driving Box Borers, Locomotive Frame Slotters, etc.



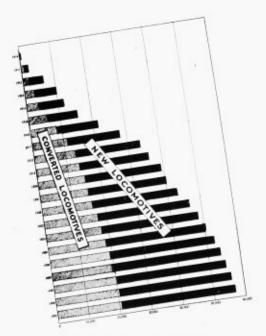
# Two Important To the Development ELESCO SUPERHEATERS



An Elesco Type "A" Superheater Unit



An Elesco Type "E" Superheater Unit



Application of Elesco Superheaters to American-built Locomotives to the End of Each Year from 1910 through 1930

C ONTINUED improvement of railroad operation during the past twenty years parallels the increased application of Elesco superheaters. Introduced at a time when the size of the locomotive, using saturated steam, could not be further increased, Elesco superheaters gave the locomotive one-third more hauling power upon a more economical fuel and water rate. Hence, they played an outstanding part in advancing the modern high-capacity locomotive.

The original type "A" superheaters, now installed in many thousands of locomotives in American and foreign countries, employ large flues, located in the upper part of the boiler. This type of arrangement has long been standard on all railroads the world over, and has rendered valuable service. But with the demands on the boiler increasing with the size, and more and more capacity required to meet the demands of steam consumption of engine and auxiliaries, superheaters with greater surface and steam area were required. This increase in proportions had to be acquired within the limits of boiler diameters and weight. The result is the Elesco type "E" design. This type employs 3½-in.o.d. flues, occupying all the tube sheet surface where it is possible to place a unit and obtain the necessary superheating surface and steam area. The use of the 3½-in. o.d. flue with the type "E" superheater also provides greater tube evaporating surface than if the type "A" superheater of proper surface is used. This combination results in greater overall boiler capacity and efficiency than previously was obtainable with the given boiler diameter and weight limitations considered.

Whether for large or moderate capacity locomotives, Elesco superheaters provide the high sustained boiler capacity necessary for economical operation.

Elesco superheaters are standard equipment for all steam locomotives. 57,000 have been applied to American-built locomotives, which are in service principally in this country, Canada, Cuba and Mexico. It is conservatively estimated that these superheaters are saving the railroads each year millions of dollars in fuel, besides increasing hauling capacity of the locomotives.

#### THE SUPERHEATER COMPANY

60 East 42nd Street NEW YORK



Peoples Gas Building CHICAGO

Canada: THE SUPERHEATER COMPANY, Limited, Montreal Superheaters
Superheated Steam Pyrometers

A.500

Exhaust Steam Injectors



# CONTRIBUTIONS of MODERN LOCOMOTIVES

#### **ELESCO FEED WATER HEATERS**

BETTER operating efficiency results from increased steaming capacity of the modern locomotive. Improved steaming capacity is obtained by

feed water heating.

The Elesco feed water heater has successfully met the demands of modern train and locomotive operation. It insures maximum heat transfer from the exhaust steam to the feed water by directing the flow of the feed water so that every particle comes into direct contact with heat-absorbing surface—this avoids all possibility of a cool water core and guarantees maximum temperature rise.

The boiler feed pump adds to the efficiency of the combined equipment by handling the boiler water requirements with the minimum of steam consumption per hundred pounds of water delivered. Further, its design embodies control affording constant flow of water under the boiler check.

Elesco feed water heaters are proved cost reducers. They are available to meet the needs of any locomotive regardless of capacity.



Utilizing waste heat through an Elesco feed water heater effects certain definite advantages which may be summarized as follows:

- Boiler capacity increased approximately 15 per cent.
- Cylinder horsepower increased approximately 6 per cent.
- Loaded weight of boiler for equal capacities decreased approximately 13 per cent,
- Overall boiler efficiency increased approximately 12 to 15 per cent.
- Tender capacity increased approximately 15 per cent.
- 6. Fuel savings 12 to 15 per cent.

The Elesco Feed Water Heater and Pump



Modern High-speed Passenger Locomotive Equipped with the Elesco Type "E" Superheater and Elesco Feed Water Heater.
4-6-4 Type Locomotive, C. B. & Q. R. R.



### AN ECONOMICAL BOILER FEED

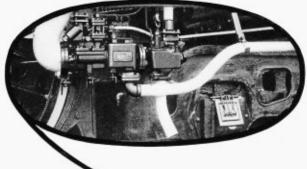
Operation of the Elesco SFX type injector is automatic. When exhaust steam is available it operates on exhaust steam. If the locomotive is standing or drifting it automatically changes over to live steam and back to exhaust steam as soon as exhaust steam is again available. Under all operating conditions it provides dependability of boiler feed without other attention on the part of the engineman than opening the steam valve and regulating the water supply.

## THE ELESCO EXHAUST STEAM INJECTOR

U TILIZING exhaust steam to heat and inject feed water into locomotive boilers has long been practiced. This type of feed water heater has been used successfully in Europe since 1870. The same principle is followed in the Elesco exhaust steam injector. But to adapt it to American methods of locomotive operation the control has been greatly simplified, so that it is operated exactly as any live steam injector.

The use of exhaust steam for energy in operating the injector results in economies of 8 to 12 per cent in fuel and water, respectively, by reason of the fact that the heat in the exhaust steam is returned to the boiler. This is reclaimed heat and not taken from the boiler as when a live steam injector is used. And this heat, reaching the boiler from a source other than the firebox, adds materially to the boiler capacity.

Simple in design and operation and easy to maintain the Elesco exhaust steam injector has proved its dependability by more than nine years of successful operation.



#### THE SUPERHEATER COMPANY

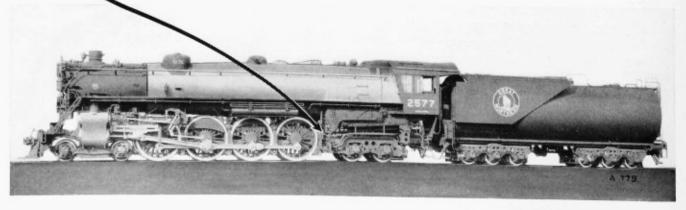
NEW YORK 60 East 42nd Street



CHICAGO Peoples Gas Building

Canada: THE SUPERHEATER COMPANY, Limited, Montreal Superheaters
Superheated Steam Pyrometers

Feed Water Heaters Exhaust Steam Injectors





# THE MODERN THROTTLE FOR MODERN POWER

THE American multiple throttle marks another forward step in locomotive improvement. It combines all the advantages of the smokebox location with many other important advantages due to its design.

Its multiple valves, opened successively—a distinctly new departure—provide ease of throttle operation and close graduation of steam supply. On any locomotive this means greater flexibility of operation, better, quicker control and increased safety of train movement. Any required steam area may be had merely by employing a suitable number of valves.

Built into the superheater header...it adds no weight above the dome throttle which is displaced...it adds no more steam joints in the front end...it reduces cost of application...it facilitates maintenance.

Because of its arrangement in the superheater header and location in the smokebox, the superheater units are constantly filled with steam, eliminating the need of the superheater damper. This arrangement also permits the use of superheated steam for all auxiliaries, thereby effecting additional economies.

American multiple throttles have demonstrated their flexibility and dependability under all conditions of operation. They provide an ideal arrangement for modern power and meet every condition of modern train operation.

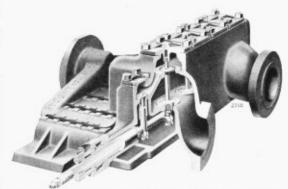
Recognition of the fundamental advantages of the American multiple throttle is exemplified by the steadily increasing proportion of its application to new power—from 55 per cent in 1928 to more than 70 per cent in 1930.

Applications to New Power	1928	1929	1930
Dome throttles Smokebox throttles	35.0% 31.9% 65.0% 68.1%		20.1% 79.9%
American multiple throttles	55.3%	56.0%	71.2%

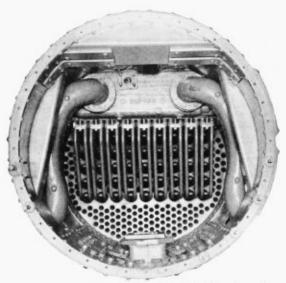
#### AMERICAN THROTTLE COMPANY, Inc.

60 East 42nd Street NEW YORK Peoples Gas Building CHICAGO

Canadian Representatives:
A-544 The Superheater Company, Limited, Montreal



American Multiple Throttle Combined with Superheater Header, for Either Type "A" or Type "E" Superheater.



Front End of Locomotive Showing Superheater Header—Combined with American Multiple Throttle—and Superheater Units and Steam Pipes in Place.





S. P. Mountain Type Passenger Locomotive

# Why twenty-nine railroads prefer

#### Armco Locomotive Jackets

PROBABLY the most convincing evidence of the excellence of Armco Locomotive Jackets is the fact that twenty-nine great railroads use them almost exclusively. These specially-made sheets are preferred—for their smooth, flawless finish, for their easy-forming qualities, for their low-cost service through more shoppings.

Whether you contemplate the purchase of new, modern-type locomotives or reconditioning of the old, your investment justifies the use of Armco Locomotive Jackets.

There is a correct grade, size and finish for your every requirement. Probably it can be shipped from stock on short notice. Just let us know your needs.

#### ARMCO RAILROAD SALES CO.

Executive Offices, Middletown, Ohio

DISTRICT OFFICES

New York Chicago

Philadelphia

Cleveland

St. Louis

Specially Processed

# ARMCO IRON AND STEEL SHEETS

A late-type Baldwin locomotive, in the service of a well-known western railroad. Like hundreds of other modern locomotives, it is covered with a smart-looking, long-wearing Armco Jacket.

#### ARMCO

RAILROAD PRODUCTS

WROUGHT STEEL WHEELS

SPECIAL CAR SIDING SHEETS

LOCOMOTIVE JACKET SHEETS

PASSENGER CAR SHEETS AND PLATES

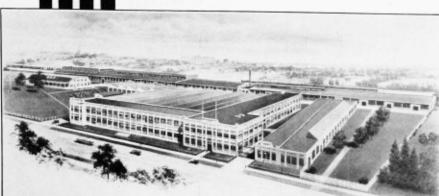
FREIGHT CAR SHEETS AND PLATES

GALVANIZED INGOT IRON AND STEEL SHEETS

BLUE ANNEALED INGOT IRON AND STEEL SHEETS







**SKF** Hartford, Conn. ball and roller bearing plant.



**SKF** Philadelphia, Pa. ball plant.



**SKF** Philadelphia, Pa. ball and roller bearing plant and testing laboratory.



FOR over a quarter of a century the SSS American plants pictured above have been producing anti-friction bearings.

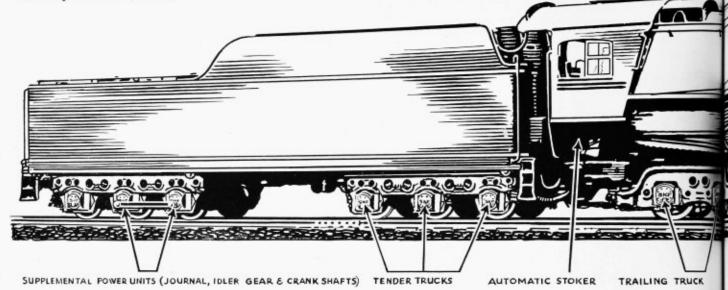
For half of this period a division of BDSF has devoted its time to the practical adaptation of BDSF products to the railroad industry.

The plants are equipped to supply many types of ball or roller bearings and can take care of all bearing requirements of American railroads.

MAR REVERSE

# THE LOCOMOTIVE

**SKF** Bearings have already been applied to locomotives at the points indicated.



# BY THE COUNTRY'S LEADING RAILROADS

Long runs, higher speeds and heavier loads are searching out the weak spots in mechanical equipment.

Increasingly difficult conditions of operation have caused the locomotive designer to turn more and more to anti-friction bearings to improve mechanical efficiency.

Today many important mechanical elements of the locomotive are already using bearings as shown in the above illustration. As time goes on these uses are steadily increasing. Locomotives of the future, both steam and electric, will further improve their

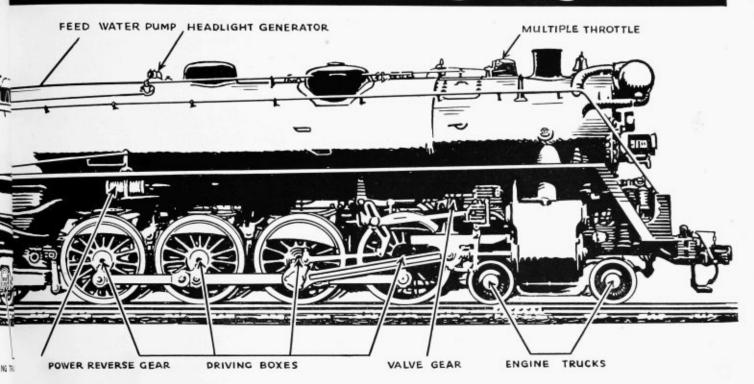
efficiency by continuing to extend the application of BESF bearings.

Fit your new locomotive with bearing adequate for modern high speed, heavy load operations. Apply ESS bearings to every journal.

The result will be greater dependability more continuous locomotive service and far lower maintenance.

and development of anti-friction bearing for engine, trailer and tender trucks; driving boxes and supplementary power units.

# OF THE FUTURE



principles of design which particularly fit them for engine truck service. Radial load is distributed equally on two rows of rollers and the continuously reversing shock loads from guiding the locomotive are absorbed laterally on this spherical bearing by angular rolling contact, an important feature not found in any bearing except to the principles of the service of the service

When time comes to inspect the bearing, the complete accessibility of DISF bearings keeps costs at a minimum. Inboardengine trucks have split boxes; outboard boxes for engine, tender, and car journals have the split tapered sleeve—two exclusive DISF features.

A fundamental EDSIP principle is to make the bearing for each job big enough to give continuity of service and dependability.

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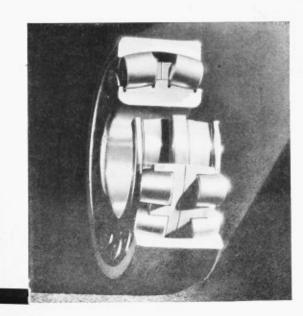
95 |

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5KF
JOURNAL
BEARINGS



#### YEARS OF SERVICE ARE ROLLING UP RECORDS OF 5KF PERFORMANCE

A MILLION miles of service under passenger equipment is guarantee in itself of the fundamental dependability of the SCF Journal Bearing.

Add to this seven years of service on heavy locomotive tenders.

Then top it with four years of work under engine trucks that guide some of the country's fastest trains.

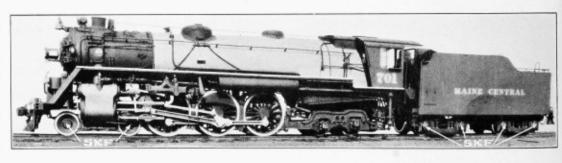
The result is a record of endurance and dependability unapproached by any other anti-friction journal bearing.

BCSF pioneered in the application of anti-friction bearings to railroad work.

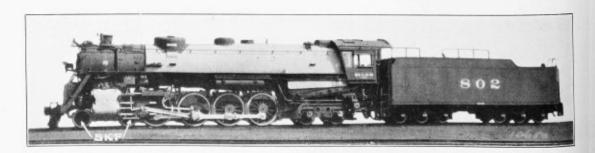
It still leads—for SEF has sold more anti-friction bearings to American railroads than all other similar manufacturers combined. Proved performance is one reason for this preference.

One railroad alone has 178 engine trucks equipped with SSF bearings.

SKF INDUSTRIES, Inc., 40 East 34th St., New York, N.Y.













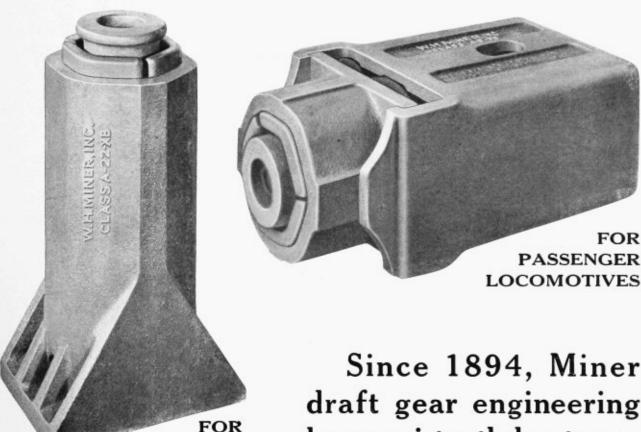


FOR



# MINER

FRICTION DRAFT GEARS



Since 1894, Miner draft gear engineering has consistently kept pace with locomotive progress.

The result has been that Miner shock absorbers have been more extensively specified for locomotive use than any other design. The devices illustrated are outstanding achievements providing maximum efficiency at minimum cost.

W. H. MINER, INC.

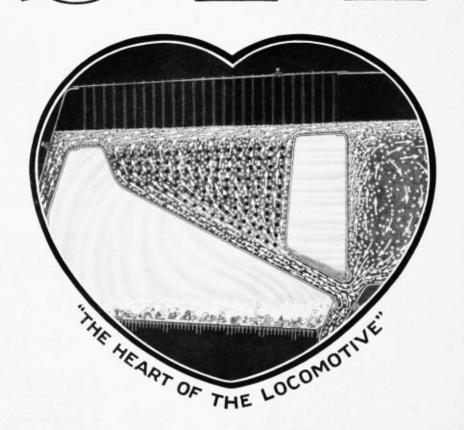
FREIGHT

LOCOMOTIVES

**CHICAGO** 



# NICHOLSON



The vital, living part of the boiler promotes improved service at lower operating costs.

### LOCOMOTIVE FIRE

NEW YORK

CHICAGO

MONTREAL



# THERMIC

Nicholson Thermic Syphons have taken a prominent place among outstanding improvements in locomotive boiler design.

Thermic Syphons are now a recognized standard for old and new passenger, freight and switching locomotives because they promote:

Better Locomotive Performance Lower Expenditures for Locomotive Fuel Lower Expenditures for Locomotive Maintenance

More Safety for Locomotive Operators

[Nicholson Thermic Syphons, water containing units scientifically designed and located in the firebox, accomplish these results by adding heating surface in the right place and, by thermic impulse, creating a definite and rapid circulation of boiler water.]

In a series of exacting tests conducted at the University of Illinois, it was demonstrated that Nicholson Thermic Syphons increase boiler efficiency 8.47%.

The University Bulletin No. 220 states: "At all rates of evaporation the Syphon-equipped locomotive showed a definite and notable superiority over non-Syphon engine as regards both evaporation per pound of coal and boiler efficiency."

BOX COMPANY

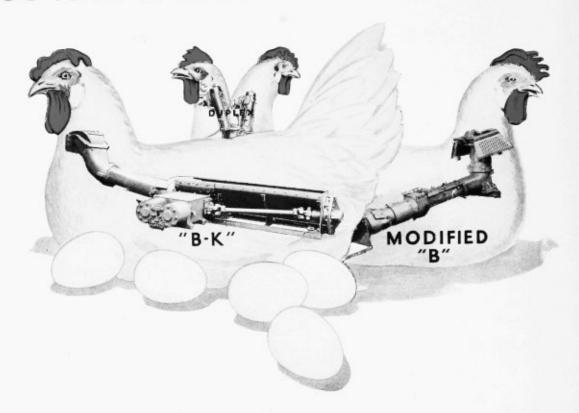
NEW YORK

CHICAGO

MONTREAL







# Which Came First, The Hen or the Egg?

You answer that one, and then you can understand this one. The development of the large Locomotive made the Me-

But only the development of the Standard Stoker made the large Locomotive possible!

To paraphrase Longfellow—

chanical Stoker necessary.

"As	unto	the	bow	the	cord	is"
"So	the	stoke	er to	the	engi	ne"
**						-

"Useless one without the other."



THE STANDARD

NEW YORK

#### The LOCOMOTIVE STOKER

T IS INDEED fortunate that the development of the Mechanical Locomotive Stoker kept pace with the development of American railroads, otherwise the locomotive of today would not have been possible.

While it is a comparatively simple matter to construct a machine that will crush and deliver a certain amount of coal per hour, the development of a machine that can meet all the conditions of the exacting demands of present-day locomotive service was a problem that taxed the combined ingenuity of many of the most competent engineers in this country.

Generally speaking, increased efficiency in mechanical devices is obtained through the addition of parts or accessories tending toward that end. In Locomotive Stokers however, it was found that increased efficiency was obtainable only through elimination of parts, simplification and perfect coordination of the essential features.

The job was difficult. Not only difficult but long and costly. Costly not only to the manufacturers concerned, but to the railroads that used their product.

It is only through a full realization of what the modern locomotive stoker must do that an appreciation of the problem is possible. Therefore to see the picture in its true perspective, imagine a machine having a delivering range of from two to forty thousand pounds of coal per hour, and a distribution range capable of distributing this amount of coal, over a grate area varying from thirty to one hundred and ninety square feet!

True, the same stoker will not have this maximum and minimum range, but the same design, varying only in conveyor dimensions is in service and meeting these requirements. Therefore, the locomotive designer need have no hesitation in designing any type of locomotive regardless of the size of the grate or coal burning capacity. The Standard Stoker Company will provide a stoker to fire it efficiently and economically.

Capacity and distribution range was but a small part of the problem, however; one big job was to design a machine that had this range but driven by an engine so small that it could be placed in the limited space available and yet powerful enough to crush not only the hardest coal but also the rocks and sulphur balls that are often found mixed with it. But even that was not all. It is nothing unusual to find tramp iron mixed with coal, therefore, the stoker conveyor and driving mechanism had to be so proportioned that if a piece of tramp iron too large to pass through was fed to the conveyor, it would stall the engine that nevertheless had to have power enough to crush rock and sulphur balls.

It is practically impossible to keep all the tramp iron out of the coal placed on the tender. The larger pieces however, are generally seen by the fireman and thrown out before they are fed to the conveyor, but the smaller pieces such as track spikes, bolts, etc., used to play havoc with the older types of stokers that employed hanging bearings in the conveying system or wherein the direction of flow of coal was changed from the horizontal to vertical. The elimination of engine failures and train delays due to these features in combination with tramp iron was another nice problem, but this too was solved.

Experiments demonstrated that it was not only possible to eliminate all elevating screws and mechanism, but also all hanging bearings in the conveying system, so that now in the present up-to-date stoker any piece of tramp iron small enough to pass by the crusher will be carried with the coal to the fire-box, and generally unnoticed.

Such in brief is the history of the development of the modern Mechanical Locomotive Stoker as manufactured exclusively by The Standard Stoker Company. A machine of any desired capacity. One that will handle any grade of coal, lump or slack, wet or dry. That will fire any type of locomotive regardless of size, efficiently and economically, and so nearly fool-proof that its record will compare favorably with the best of any of the appurtenances or accessories on the modern locomotive.

A machine so flexible in design that it can be applied to any type of locomotive, and so flexible in construction as to take any curve that the locomotive will take, and pass undamaged through any ordinary derailment.

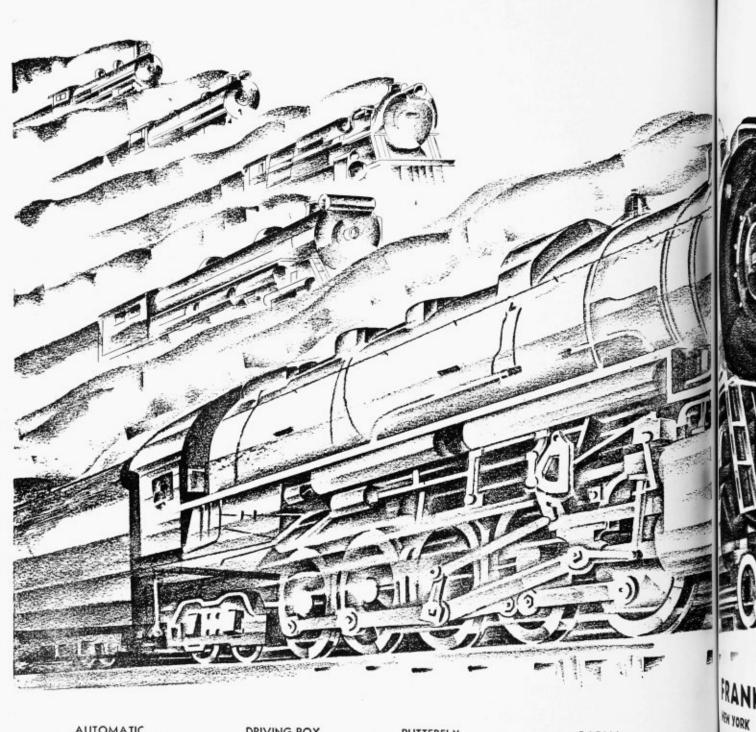
Considered from every angle, design, capacity, simplicity, reliability and efficiency of operation, the Standard Stoker is one of the outstanding engineering developments of the century.

#### STOKER COMPANY, Inc.

CHICAGO

ERIE

#### A QUARTER CENTURY OF

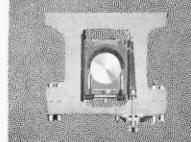


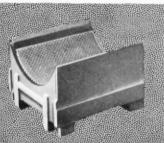
AUTOMATIC ADJUSTABLE WEDGE

DRIVING BOX LUBRICATOR

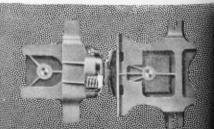
BUTTERFLY FIREDOOR

RADIAL BUFFER

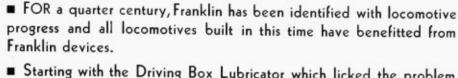








#### LOCOMOTIVE IMPROVEMENT



■ Starting with the Driving Box Lubricator which licked the problem of lubricating the locomotive and made the big locomotive possible, Franklin devices have continually stepped up locomotive economy and capacity.

■ Franklin Automatic Firedoors, Cold Water Sprinklers, Lateral Motion Driving Boxes, Sleeve Joints, Radial Buffers and Unit Safety Bars have taken a lot of the hazard out of railroading.

■ Franklin Steam Grate Shakers, Power Reverse Gears and The Limited Cut-Off have produced substantial economies and improved the generation and use of steam.

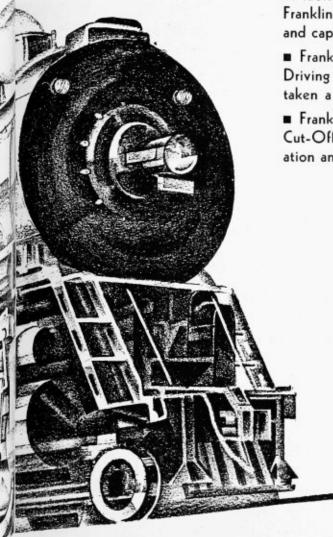
■ Maintenance, too, has been benefitted by Franklin developments. Automatic Adjustable Driving Box Wedges and Tandem Main Rod Drives are reducing repairs and extending service between shoppings.

■ But the outstanding contribution of Franklin to the modern locomotive is The Locomotive Booster.

■ Without The Locomotive Booster to remove the handicap of lack of starting power, the modern locomotive would not be what it is today.

■ With The Locomotive Booster ready to add thousands of pounds of power in starting and where needed on the road, the locomotive designer has been able to restore the tractive effort lost thru friction and has been left free to concentrate on increasing steaming power at speeds.

■ Today, The Locomotive Booster is an essential part of the design of the modern locomotive, since only by its use can you get the intensive power production that makes the modern locomotive excel its predecessors.



#### FRANKLIN RAILWAY SUPPLY CO., INC.

**NEW YORK** 

ST. LOUIS

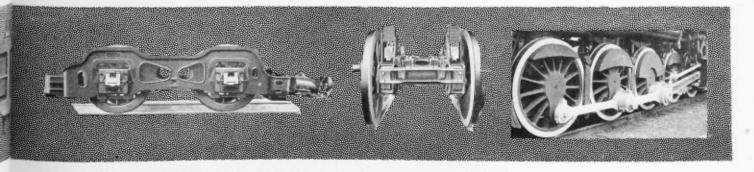
CHICAGO

SAN FRANCISCO

MONTREAL

FOUR-WHEEL TRAILER BOOSTER DRIVING BOX

TANDEM MAIN ROD DRIVE



## Modern Materials



Just as the locomotive designer has removed the handicaps that limited locomotive power so, too, have Republic metallurgists removed the handicaps that the old materials placed on dependable operation and on maintenance.

In Toncan Iron, Republic metallurgists have developed a modern iron, uniform in composition, that has superior resistance to rust and corrosion.

Toncan Iron is now being widely used for:-

#### BOILER TUBES

Here the corrosion resistance of Toncan Iron results in longer tube life. Toncan Iron tubes are also seamless, and cold working leaves the corrosion resistance of Toncan Iron unimpaired.

#### STAYBOLTS

Toncan Iron staybolts have all the fatigue resistance for which iron is noted, but are free from all slag pockets and seams. Then, too, the resistance of Toncan Iron to corrosion prolongs staybolt life.

**TONCAN IRON** 

WHERE RUST AND CORROSION THREATEN



Molybdenum IRON REPUBLIC STEEL

Central Alloy

Division

# Remove Old Handicaps

#### • FIREBOX SHEETS

Many a big locomotive has found that the old time steel sheet cracks, fails and must be renewed in relatively short time. Toncan Iron, however, has an exceptional resistance tofire-cracking, and on scores of Super-Power locomotives is outlasting steel sheets many times.

But other problems confront the railroad mechanical official. Reciprocating parts are subject to greater stresses. Here, special Agathon Alloy Steels will keep weights within reason and reduce dynamic augment.

Axles, springs, engine bolts and other locomotive parts are today encountering increased stresses. For varying conditions of service, there are special Agathon Alloy Steels developed particularly to meet each condition.

These better materials are proving of the greatest assistance in controlling the rising tide of equipment maintenance.



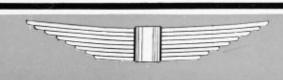
#### CORPORATION

Massillan, Ohio



#### **AGATHON ALLOY STEELS**

WHERE TOUGHNESS, STRENGTH OR LIGHTER WEIGHT ARE NEEDED





Have

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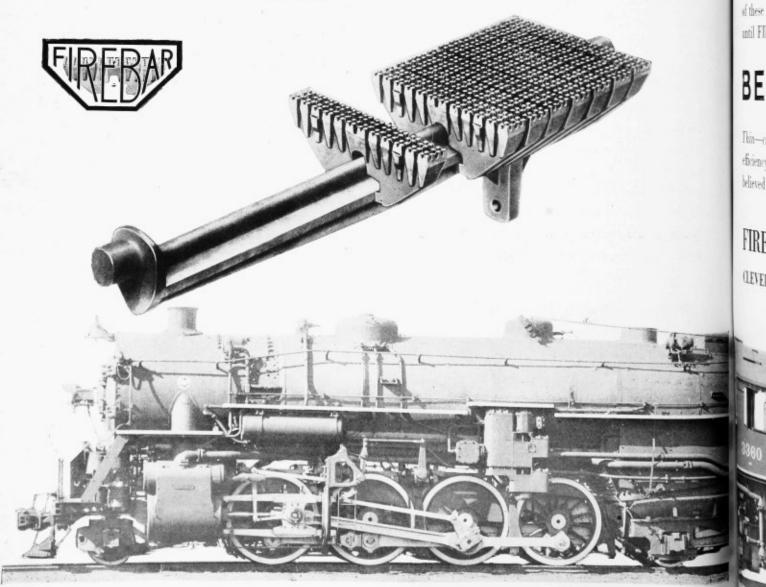
IN 100 YEARS OF LOCOMOTIVE PROGRESS

# Firebars

# Have proved to be one of the most outstanding developments

in fuel saving devices since the construction of Old Ironsides.

Their design provides a direct air inlet through minute channels to eighty-seven and one-half per cent of the fuel bed.





# Firebars

Have changed combustion theories into established facts.

Combustion engineers have for years recommended thin fires as the shortest route to improved combustion.

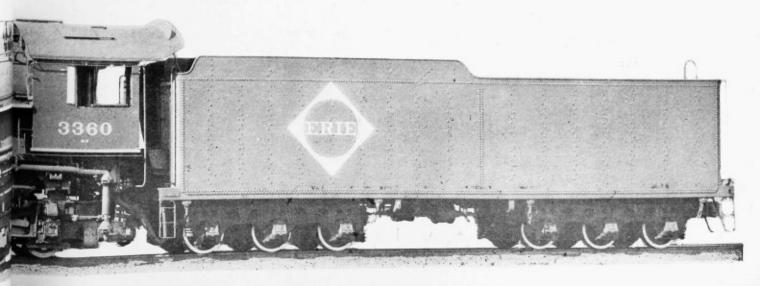
They also meant *clean fires*—but the exact meaning of these theoretical terms was never fully realized until FIREBARS produced

#### BETTER FIRES

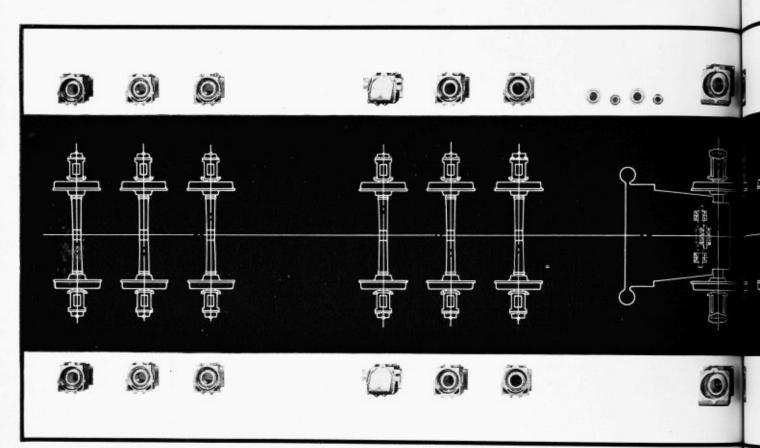
Thin—clean fires which have increased locomotive efficiency, and established savings heretofore not believed possible from fires alone.











# Timken has successfully advantages to modern

The application of Timken Tapered Roller Bearings constitutes a revolutionary advancement in modern locomotive design.

It has brought within reach many new motive power economies and efficiencies of the greatest importance to every railroad.

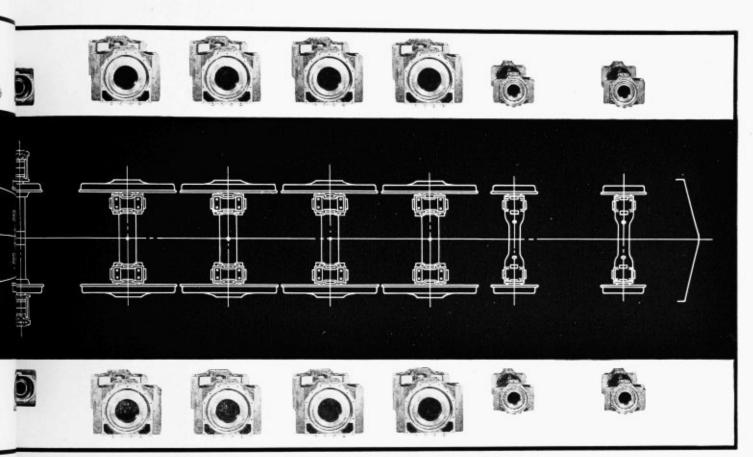
Locomotives of the future will be completely anti-frictionized—Timkenized—in engine trucks, drivers, trailer trucks and tender trucks.

They will be able to start heavier trains and haul them at higher sustained speeds. They will require less lubricating attention and consume less lubricant.

They will be more economical of fuel and water. They will avoid delays due to burnedout bearings and heat-broken axles. Their normal shopping periods will be greatly extended and maintenance costs cut to the bone.

TIMEEN Tapered Roller





# applied anti-friction locomotive operation

Timken-equipped engine trucks and tenders are being used in increasing numbers on modern locomotives of various types.

The Timken locomotive, built to demonstrate the value of Timken Bearings in modern motive power, completed 54,558 train miles of passenger and freight service on March 13, 1931.

Operating economies and general performance have exceeded all expectations.

Obsolescent motive power puts a drag on service and a tax on profits. It will pay you to replace such equipment now.

Have your new locomotives designed with provision for full roller bearing application at some later date. Better still, specify Timken Bearing Equipped.

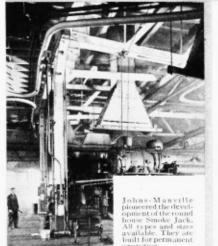
THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

BEARINGS

# ... Cut costs still

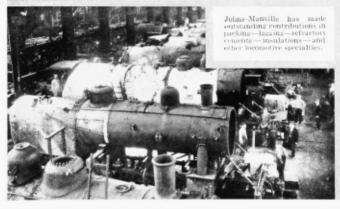






What
Johns-Manville
has done in the past
Johns-Manville
will outdo in the
future







# Johns-Manville<sub>-</sub>

Packings · Refractory Cements · Insulations · Celite for Concrete · Car and Bus Flooring · Engineers' Insulating Tape · Locomotive Lagging · Waterproofing · Built-Up Roofing · Transite · Front End Gasketing Tape · Smoke Jacks · Asbestos Shingles · Asphalt Plank · Masticoke Flooring · Brake Lining · Brake Blocks · Transite Pipe · Passenger, Refrigerator and Tank Car Insulation · Ready-to-Lay Roofing.

Service to

# further ... end waste ... improve improve improve

FOR more than 70 years, Johns-Manvillehasbeen closely identified with improvement and economy in railroading. Many J-M in engineers are railroad men—many J-M products have been developed exclusively for railroad service—and much of Johns-Manville's extensive research work has been done with and for railroads.

But 1931 calls for greater efforts than ever before. In every railroad department, in round house, machine shop, on the right of way—great economies must be effected, improvements must be made. And better than ever before in history is Johns-Manville prepared to serve and to save.

A new terminal building? J-M engineers can show you savings and improved methods and materials for roof and walls and floors, for heating plant and water system.

A bridge to be built? Johns-

Johns-Manville goes all the way with the railroads in meeting the economy challenge of 1931

> Manville can save for you with Asphalt Planking, Flooring, Waterproofing, Celite for Concrete, together with many other special materials that make for permanence and low-maintenance charges.

From coast to coast wherever

transportation service is needed, there you will find J-M engineers, inspecting, advising, working—ready to tackle any problem—equipped to show you savings in a hundred unsuspected corners. And it needs a telephone call to put them

but a telephone call to put them to work for you.

So write down across your 1931 economy program, "Call on Johns-Manville Service to Transportation," and if you wish, write direct to Johns-Manville, 292 Madison Ave., New York City.



Transportation

4 mines, 12 factories, 56 branch offices strategically located, service the needs of Transportation promptly and efficiently.

MONTREAL

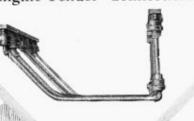


# Flexible Joints

**BARCO** 

3 - V

Engine-Tender Connections



**BARCO** 

Metallic Car Steam Heat Connections



for

Locomotive Piping

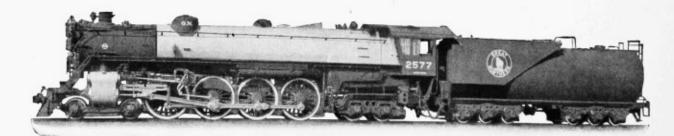
Between Engine & Tenders

and on Passenger Cars

FAILURES of locomotive piping have been almost entirely eliminated by the use of BARCO FLEXIBLE JOINTS between the pipe and such auxiliaries as air pumps, air reservoirs, brake cylinders, power reverse gears, distributing valves, headlight generators and feed water pumps.

Their universal flexibility has solved a big problem between engines and tenders on the majority of roads by eliminating the continual replacement of unsatisfactory connections for steam, air and oil lines. BARCO JOINTS are absolutely dependable and require very little attention between general shopping periods.

The design of BARCO Metallic Steam Heat Connections for the rear of tenders and passenger cars eliminates all 90 degree bends. They are made of forged steel with hardened steel metal wearing parts and will safely carry the high steam pressures required today without leaking. These connections are equipped with the standard BARCO non-metallic gaskets which guarantee uninterrupted and satisfactory service for an entire steam heating season—only two gaskets are required for each connection.



Two of the latest locomotives constructed by Baldwin. Equipped with BARCO Flexible Joints and BARCO Power Reverse Gears BARCO



### Protection

against

#### Boiler Explosions Caused by Low Water

FOR over one hundred years railroads have been haunted by the fear of boiler explosions.

Today there is no longer any reason for worry. The CLEVELAND Float Low Water Alarm always functions when low water threatens.

It will warn enginemen in plenty of time to prevent one of the most horrible disasters that can happen on any railroad.

#### Power Reverse

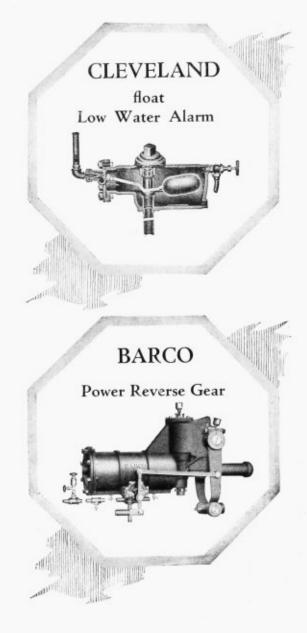
The BARCO Power Reverse Gear has been designed to take care of the rapidly increasing efficiency and size in steam locomotive development.

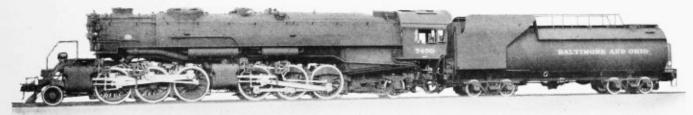
Among the outstanding reasons which make the BARCO Power Reverse Gear the logical choice of railroad designing engineers is the fact that it provides the same positive adjustments formerly obtained with the old hand lever, by means of an air operated irreversible worm and gear which will absolutely hold any desired point of cut-off without fluctuation.

#### Barco Manufacturing Co.

1801 Winnemac Avenue, Chicago, Illinois THE HOLDEN CO., LTD.

In Canada Montreal-Moncton-Toronto In Canada Winnipeg—Vancouver

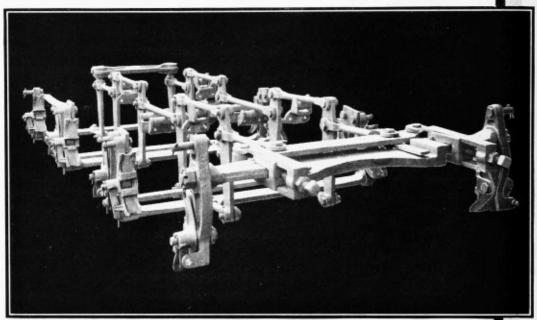




# PRODUCTS

## 183

## CONGRATULATIONS



AMERICAN TENDER CLASP BRAKES



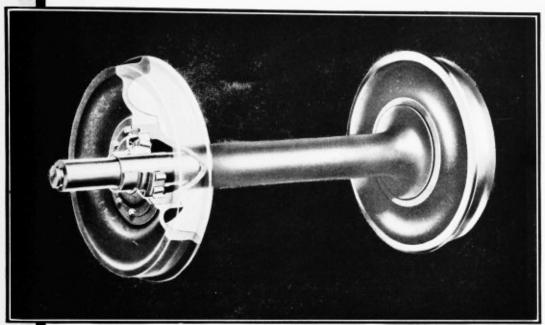
LOCOMOTIVE SPRINGS

Greater tonnage at higher speeds and longer runs, demands long lived specialties that materially contribute to the faultless performance of the modern locomotive. The A. S. F. ROLLER BEARING UNIT contributes considerable to this achievement. The AMERICAN TENDER CLASP BRAKE makes possible



## BALDWINDSSSSS





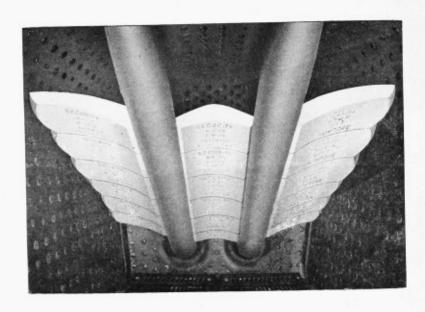
A. S. F. ROLLER BEARING UNITS

short . . . smooth . . . stops. The modern rugged AUTOMATIC COUPLER provides a safe dependable connection between cars and permits utilization of the increased locomotive power. The highly developed custom made SPRING has kept pace with these other specialties. «« «« «« «« ««



AMERICAN STEEL FOUNDRIES
NEW YORK CHICAGO ST.LOUIS





#### THE MODERN LOCOMOTIVE ARCH is a Development of American Arch Company

Every modern locomotive uses the Arch as a matter of course. In its present effective form, the locomotive Arch is the creation of the American Arch Company.

When the old, cumbersome slabs gave way to Arch Tubes and easily handled sections of brick, the American Arch Company was responsible for the change.

When Arch Brick were of an infinite variety of shapes and sizes, American Arch Company worked out standards that brought order out of chaos.

Later, the introduction of the stoker brought new conditions in the firebox, but American Arch Company

engineers were ready with suitable Arch designs.

The Syphon, again, changed locomotive combustion and once more American Arch Company engineers revised the Arch to harmonize with the new conditions.

For years past, practically every new design of locomotive has had the arch designed by American Arch Company.

This constant engineering development of the locomotive Arch is one of the important contributions of the American Arch Company to improved operating efficiency.

SECURITY ARCHES JUST BRICK THERE'S MORE

#### HARBISON-WALKER REFRACTORIES CO.

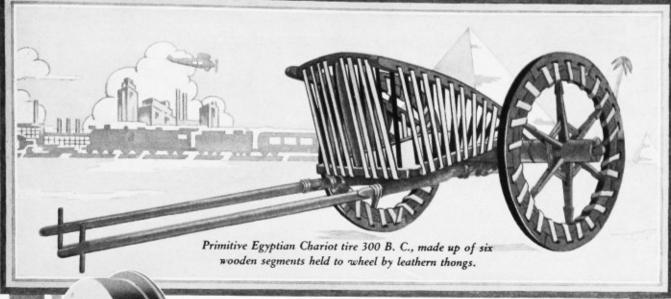
Refractory Specialists



#### AMERICAN ARCH CO.

Locomotive Combustion Specialists

# Folution of the Tire



TUDY of the wheel of this Egyptian Chariot of 300 B. C., shows that its designer was an engineer of marked ability. Limited in his choice of materials he used them intelligently and efficiently.

Time and the accumulated thought and work of tens of thousands of engineers who have succeeded their Egyptian fore-runner have changed the wood and hide-bound chariot wheel into the Steel-tired Locomotive Wheel and the Solid Rolled Steel Wheel.

Edgewater Steel Company has, since its start, pioneered in high quality, and by the use of correct mechanical and metallurgical practice has advanced the art of manufacture of Tires and Rolled Steel Wheels.

### EDGEWATER STEEL COMPANY PITTSBURGH, PA.

Sales Offices:

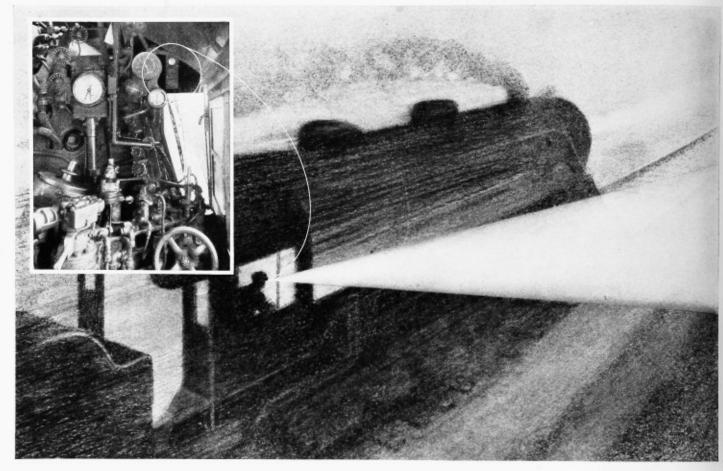
ATLANTA, GA. BALTIMORE, MD. BOSTON, MASS. CHICAGO, ILL.
KANSAS CITY, MO. LOUISVILLE, KY. NEW YORK, N. Y.
PHILADELPHIA, PA. ST. LOUIS, MO. ST. PAUL, MINN.
SAN FRANCISCO, CALIF. SEATTLE, WASH. WASHINGTON, D. C.





RAILWAY AGE

IN 100 YEARS OF LOCOMOTIVE PROGRESS



# G-R-S Cab Signals-



Cab Signals mark a century of progress in Railway Signaling beginning with the Crossbar and Lamp Signal of 1834.

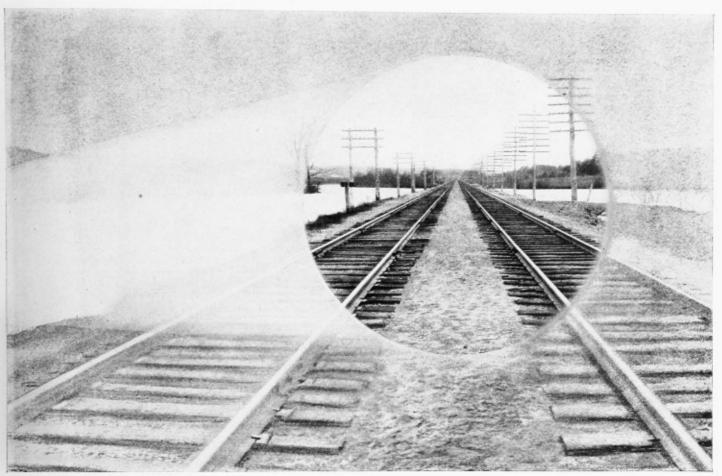
Cab Signals complete the equipment of the modern locomotive, permitting it to maintain schedules in all kinds of weather, by providing it with superhuman eyes to see, every inch of the way, the condition of the track ahead. Nothing obscures the vision of these eyes.

## GENERAL RAILWAY

New York Affiliated Companies' Offices:

Chicago London ROCHESTER Paris Tokyo





# the Eyes of the Locomotive

The engineman controls his train with complete confidence. A glance tells him the condition of the track ahead. He does not have to strain his eyes to catch a glimpse of a wayside signal flashing past nor does he have to remember the indication of the last signal and forget all other indications.

The Cab Signal has audible indications supplementing the visual.

The G-R-S Cab Signal can be used in any combination desired, with or without wayside signals; with or without train stop or train control.

Any number of indications can be given to suit requirements.

Equally adaptable to steam, electric or self-propelled equipment.

For maintaining schedules with safety equip your locomotives with G-R-S Cab Signals.

## SIGNAL COMPANY

NEW YORK Barcelona St. Louis Melbourne Montreal Calcutta

Buenos Aires

# Lewis Special Hollow Staybolts Used in Baldwin Locomotives



Lewis Special Hollow Staybolts have been specified and used in hundreds of Baldwin Locomotives. They are made from an iron produced especially for Railroad Locomotive staybolts. It is strong and tough, with a rope-like fibre, which gives unusual endurance.

Lewis Special Hollow Staybolts are made from a solid bar of this iron. The hole is drilled straight through the center of the bar—a perfectly round hole easily kept clean and open, providing an infallible warning should failure occur in any part of the bolt.

Lewis Special Hollow Staybolts will pass the most rigid railroad specifications—and they give remarkably long service.

Let us send you samples to test—then compare prices. Furnished headed, threaded, or headed and threaded.

Lewis Special Hollow Staybolts conform to A.S.T.M. Specifications A-84-27 (Grade A).

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City

## RYERSON RAILROAD-SERVICE

## GRIFFIN WHEEL COMPANY

PIONEERS IN THE WHEEL INDUSTRY



# SINGLE PLATE CHILLED TREAD WHEELS

Chilled Tread wheels were used one hundred years ago under the first built railroad locomotives and cars. They are used to-day under approximately 82% of all railroad equipment.

THE FOOD SUPPLY OF THE NATION IS CARRIED ON CHILLED TREAD WHEELS

#### GRIFFIN WHEEL COMPANY

410 NORTH MICHIGAN AVENUE

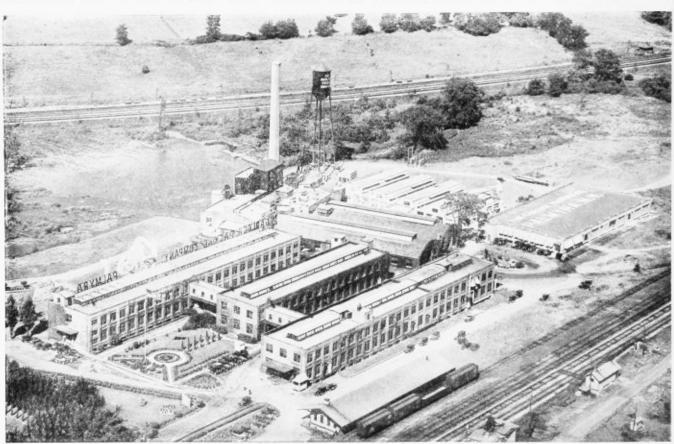
CHICAGO, ILLINOIS

Plants

Chicago Boston Cleveland Detroit Cincinnati Council Bluffs Kansas City St. Paul Denver Salt Lake City

Los Angeles Tacoma





KEEPING PACE

Aerial view of main factory of The Garlock Packing Company at Palmyra, New York.



Step by step, over a period of almost half a century, The Garlock Packing Company has expanded steadily, keeping pace always with the frequent and remarkable improvements in locomotive construction and design.

With our fully equipped chemical and physical laboratories for the development of new products—our test department for testing them—and our unequalled production facilities devoted exclusively to the manufacture of Garlock packings, we occupy today an outstanding position in the mechanical packing industry.

Garlock products are marketed through a world wide organization of Garlock trained packing specialists. Through this alert, progressive organization we are serving thousands of miles of railroads in several countries.

The solution of your packing problems is our business.

GARLOCK



#### GARLOCK RAILROAD

Throttle Packing-Garlock 2000 or Garlock 530 Chevron for Throttles. Garlock 9001 for American Multiple Throttles.

Air Pump Packing-Garlock 2200 Asbestos or Garlock 377 Semi-Metallic Packing for Westinghouse and New York Air Pumps.

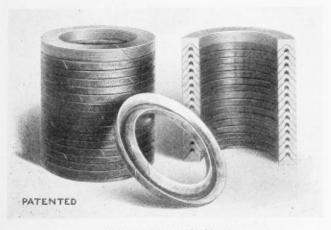
Cab Cock Packing-Garlock 1700 Asbestos Spool Packing for all cab cocks and valves.

Expansion Joint Packing-Garlock 1005-A. Garlock Special 5270 or Garlock 530 Chevron Packing for expansion joint service.

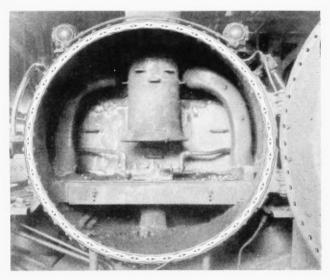
Ball Joint Packing-Garlock 1010 for all ball joint service.

Front End Tape-Garlock 616 Button Hole Asbestos Tape for front end gasketing.

Feed Water Pump Pistons-Garlock 261 for Elesco pumps; Garlock 33 Special or Garlock 108 for Worthington Pumps.



Garlock Chevron Packing An automatic packing with a wide range of service applications.



Garlock 616 Button Hole Tape (Patent Applied for)
Typical application to Locomotive Front End

Feed Water Pump Piston Rods-Garlock 377 for piston rods of feed water numps.

Stoker Engine Piston Rods-Garlock 377 for piston rods of Stoker Engines.

Miscellaneous Packings-Gauge Glass Gaskets -Garlock 95

Tank Hose Gaskets -Garlock 122

Gauge Cock Discs -Garlock 111

Steam Joint Gaskets -Garlock 950

Power Plant Packings-High Pressure Steam-Garlock 150

Low Pressure Steam -Garlock 777

Outside Packed Pumps-Garlock

530 Chevron

Inside Packed Pumps-Garlock 262

Boiler Gaskets -Garlock 604

Steam Joint Gaskets-Garlock 900

or Garlock 7021

Water Joint Gaskets-Garlock 22

#### THE GARLOCK PACKING CO.

PALMYRA, NEW YORK

A World Wide Organization With Sales Offices and Warehouses in All Principal Industrial Centers





T is now recognized more than ever before that for certain vital parts of a locomotive there is no substitute for the highest grades of wrought iron.

One of the best safeguards the purchaser of any material can use is to look to the reputation, responsibility and experience of the manufacturer back of it.

Each passing year has added its endorsement to the unvarying high quality and faithful performance of Tennessee Charcoal Bloom Iron. For staybolts and other forgings where stress, strain and safety place greatest demands, it is unsurpassed.

EWALD IRON COMPANY

CHICAGO

NEW YORK

ST. PAUL

# THE FIRST 100 YEARS!



Built in 1878 by the Baldwin Locomotive Works for the Camden and Atlantic Railroad, now a part of the Pennsylvania System, the "John Lucas" has had a varied career of satisfactory service. Today, standing on deserted tracks in the wilds of Dutch Guiana the locomotive is in an excellent condition of preservation.

For 100 years the railroad industry has proved the satisfactory service of wrought-iron. And in this modern age of material selection, when reduction of maintenance expense is a widespread challenge, the growing appreciation for genuine wrought-iron is especially significant.

Centuries before railroads, wrought-iron was a proved material of service and permanence! Genuine wrought-iron manufactured today by A. M. Byers Company has all the fine qualities of wrought-iron used by the railroad industry a hundred years ago.

For 67 years we have been improving Byers Genuine Wrought and adding to our knowledge of the railroads' physical requirements of this material. Each year, because of modern methods

BYERS WROUGHT

of manufacture and more rigid metallurgical and chemical control, we are better equipped to approach new problems in a thoroughly scientific way. Supported by convincing service records of wrought-iron, this organization offers you the benefit of its technical counsel. A. M. Byers Company, Pittsburgh, Pa. Established 1864.

### **PRODUCTS**

AN INVESTMENT — NOT AN OUTLAY





Casting Guns at the Alger Foundry

# More Thank

H S G I Reg. U. S. Trade Mark

Cylinder Bushings Cylinder Packing Rings Pistons or Piston Bull Rings Valve Bushings Valve Packing Rings Valve Bull Rings Crosshead Shoes Hub Liners Shoes and Wedges Floating Rod Bushings

Parts Finished for Application

Has

Resist

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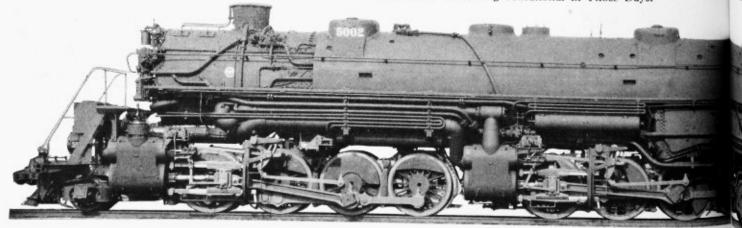
Dunbar Sectional Type Packing Duplex Sectional Type Packing

(Duplex Springs for Above Sectional Packing) Cylinder Snap Rings Valve Rings All Shapes

From Big Guns to Big Mileage on the Wearing Parts of Big Locomotives



A Twelve Inch Rifle of the 40's. This Big Gun Had a Range of About Two Miles. Something Sensational in Those Days.



HUNT-SPILLER Air



# a Century's Experience

Has Been Fabricated Into The Famous Wear Resisting Qualities Of Air Furnace GUN IRON

I N 1810 Cyrus Alger established a small foundry in Boston, Mass., which was destined to play one of the leading parts in the early metallurgical and engineering science of American armaments and transportation.

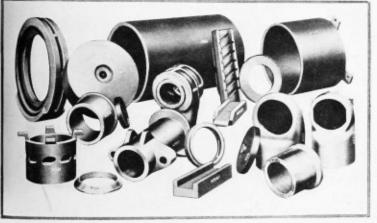
Endowed with remarkable genius Mr. Alger contributed many valuable inventions to the iron industry. One of the most important was the Air Furnace method of melting iron which produced a refined metal of unusually high physical characteristics giving it a distinct ad-

vantage in the manufacture of larger caliber guns of the early periods.

This process was continued by his successors, THE HUNT-SPILLER MANUFACTUR-ING CORPORATION, who, with improvements, developed a material which has contributed greatly to locomotive progress and was early recognized as a material particularly adapted to the cylinder and other wearing parts of superheated locomotives.

HUNT-SPILLER Air Furnace GUN IRON brings to modern locomotive operation a century of experience and results of well-established foundry and metallurgical practice in the manufacture of a special material, the uniformity and quality of which is unsurpassed.

Apply it to those vital parts subjected to great frictional wear. The more completely equipped; the greater your economies.





Office & Works

383 Dorchester Ave.

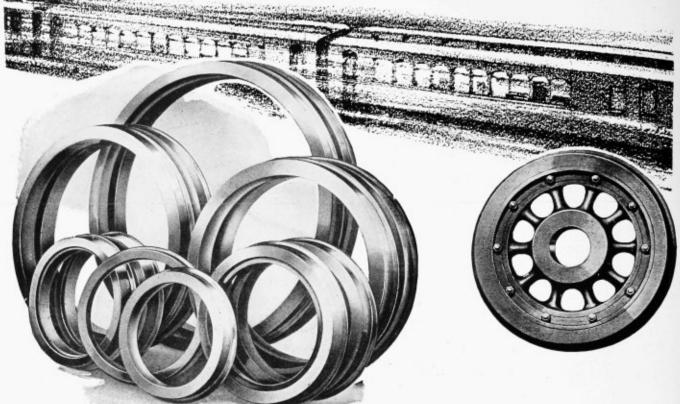
Canadian Representative: Joseph Robb & Co. Ltd., 997 Aqueduct St., Montreal, P. Q.

Export Agent for Latin America:
International Rwy. Supply Co., 30 Church Street, New York, N. Y.



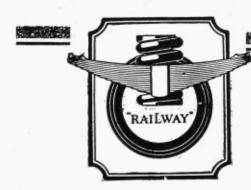
Jurnace GUN IRON-

# RAILWAY STEEL

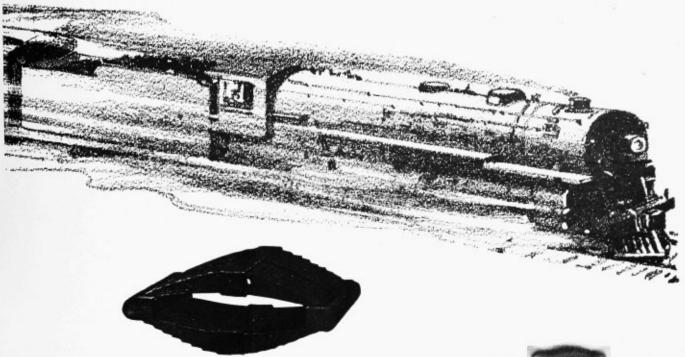


The Railway Steel-Spring Company joins with its contemporaries in congratulating the Baldwin Locomotive Works upon the successful completion of its first century.

The name of Railway Steel-Spring Company has also for many years been associated with the manufacture of Steel Springs, Locomotive and Car-wheel Tires, Steel-tired Wheels, Pressed Steel Journal Box Lids, and kindred products for railroad equipment;

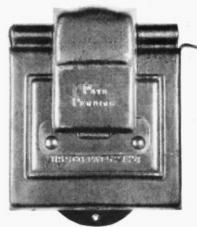


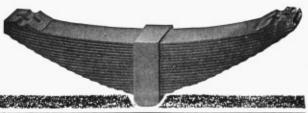
# SPRING COMPANY



also Rolled Steel Roll Shells and Grinding Rings for crushing ore and other materials.

Its reputation has been built upon the strong foundation of achievement and service in these fields. It stands today pre-eminent, and is acknowledged as the foremost manufacturer of these specialties.





### Railway Steel-Spring Company

30 CHURCH ST., NEW YORK

**Branch Offices:** 

Chicago, Ill. St. Paul, Minn. Detroit, Mich. Cleveland, Ohio Richmond, Va. St. Louis, Mo. Pittsburgh, Pa. Denver, Colo. Montreal, Que. San Francisco, Cal.

# 2 Century anniversaries

### 100 years ago Mathias W. Baldwin 100 years ago Michael Faraday

It would seem that the first hundred years are the hardest. Leaders never stop plugging—never stop looking for better ways to do things. It was in the search for a dependable means of powering switching

locomotives with a self-contained electric plant that Baldwin's discovered the unusual advantages of the Exide-Ironclad Battery.

There are many reasons why Baldwin-Westinghouse battery locomotives have been powered with Exide-Ironclad and chosen again and again by many of the world's leading industrials. Ten of them are:

- 1.—They do away with costly track electrification and trolley troubles.
- 2.—Supply a switching service that withstands the most gruelling railroad conditions.
- 3.-Clean, silent operation.
- No sparks, smoke or fumes, thus permitting their use in buildings.



Up Boston way the Edison Electric Illuminating Company finds the Exide-Ironclad Battery in this Baldwin-Westinghouse locomotive switches tons of material with speed and economy. This locomotive has been in service since 1913.

- Reduced maintenance costs due to fewer moving parts.
- 6.—Power consumed only when in operation.
- Large momentary overload capacity.
- 8.—Operated safely and efficiently by one man.
- 9.—Perfect, simple system of control.
- 10.—Ready for instant use.

It's the decidedly different construction of Exide-Ironclads that makes these powerful batteries last so long — makes them such dollar-savers. These same qualities, typical of all Exide Batteries, are what make them so dependable. For this reason the Baldwin Locomotive Works has installed a 60-cell Exide Emergency Lighting Battery and a 25-cell Exide Telephone Battery in the new Administration Building at Eddystone.

Write us for further information on storage battery locomotives and their many uses. You need not feel obligated.





One of the two 70-ton Baldwin-Westinghouse Battery locomotives used by the Twin Branch Railroad for switching service. Exide-Ironclad Batteries supply the power.

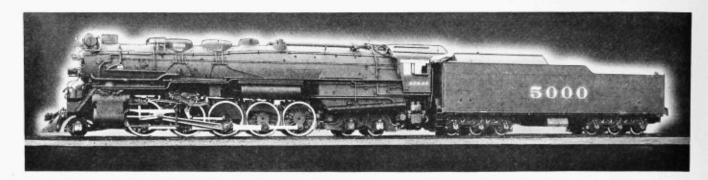
# started making locomotives invented the dynamo

an important factor in the commercial development of the storage battery



One of the 9 Baldwin-Westinghouse combination Battery and Trolley locomotives operated by Chile Exploration Co., all of which are equipped with dependable Exide-Ironclad Batteries.



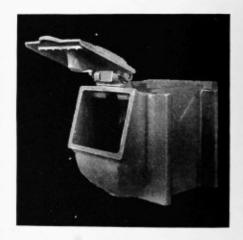


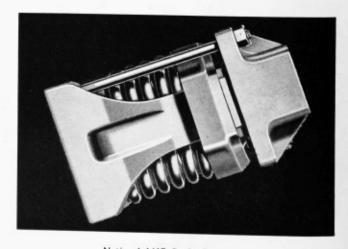
## NATIONAL

The development of National Specialties has kept pace with the progress in the development of heavier, more economical locomotives.

As is the case with modern locomotives, National Specialties are the products of the finest engineering skill and the most up-to-date and scientific manufacturing procedure.

National Extended Floor Pockets, A. R. A. Standard Couplers, National Draft Gears and Journal Boxes are specified by many leading roads for their locomotives. The mouth of the National Journal Box is machine finished. The National A.R.A. coiled spring lid is accurately fitted, making an oil-tight joint. The center bearing design, the hood over the hinge lug, and flanges projecting over the top and sides of the front face keep out dust and water.



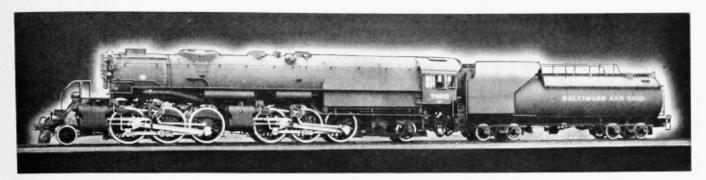


National M17 Draft Gear.

# NATIONAL







### SPECIALTIES



National Extended Floor Pockets.



National A.R.A. Standard Coupler.

Nashville; the Union Pacific; the Chesapeake and Ohio; the Bessemer and Lake Erie; the Erie; the Central of New Jersey; the Chicago, Milwaukee, St. Paul and Pacific; the Reading; the Seaboard Air Line; the Southern Pacific; the Baltimore and Ohio and many others are aided in their daily performance by National Specialties.

Information on any National Specialties gladly furnished on request.

The National Malleable & Steel Castings Co.
General Office: Cleveland, Ohio

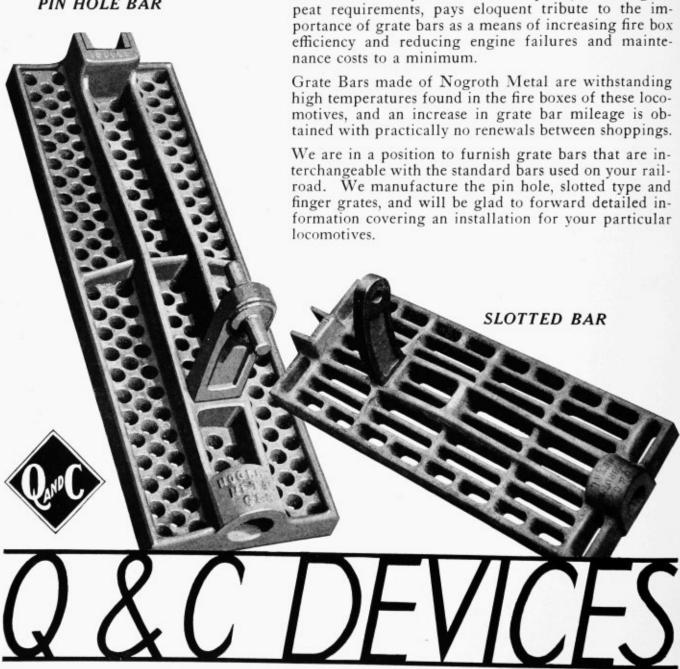
Sales Offices: New York, Philadelphia, Washington, Chicago, St. Louis, San Francisco Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose, III.

# SPECIALTIES

Nogroth Metal Grate Bars are being used by many railroads on their modern equipment, which is designed to carry their famous trains with the greatest efficiency and economy. The fact that Nogroth Metal Grate Bars have been used in many of these locomotives satisfactorily since their inception, including re-

### Q&CNogroth Metal Grate Bars

PIN HOLE BAR



The Q&C Company -- 90 West St.,

# Q & C Bosch Lubricators

The Q & C-Bosch Lubricator offers the latest design and construction in lubricators and assures positive application with minimum operating expenses. Centralized oil and grease lubrication is offered in this unique design, having many advantages for locomotives and in the shops. This lubricator embodies the simplest type of construction with the minimum of moving parts, thus reducing maintenance costs to a minimum.

Valves, springs, stuffing boxes and packing with their inevitable shortcomings are avoided.

All lubricating points are taken care of by a series of pumping units of simple self-contained construction enclosed in a tank. The pumping unit consists of pump body with suction and pressure feed ports.

The lubricator operates both clockwise and anticlockwise, making it adaptable for equipment subject to reverse motion. The Q & C-Bosch Lubricator will reduce your oil consumption and increase the operating efficiency of your locomotives.

Our Engineering Department will gladly furnish all information and specifications to meet your particular requirements upon request.



The lubricator shown above is the TP4 Model and is obtainable with from one to sixteen feeds; it has ten pints capacity.

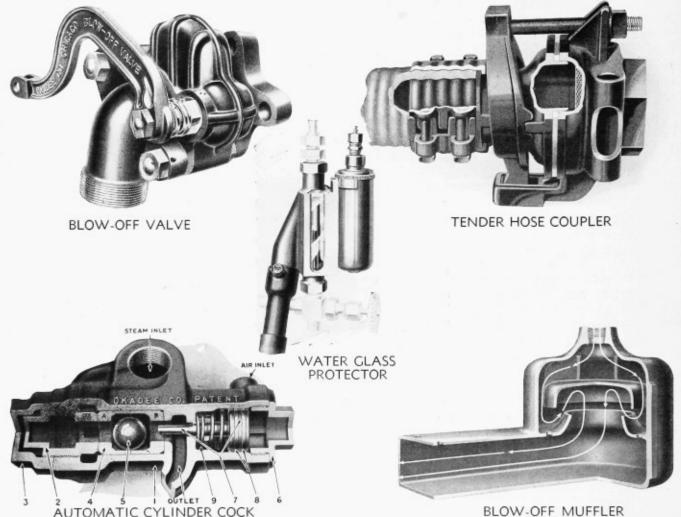
The two illustrations below show the side and end view of the TP8, obtainable with from one to thirty-two feeds and having a capacity of sixteen pints.

We also manufacture a Model TP16 which is the largest size obtainable, with from one to thirty-two feeds and having a capacity of thirty-two pints.



New York -- Chicago -- St. Louis

# OKADEE



MODERN APPLIANCES FOR MODERN

DRAIN VALVES **BLOWER VALVES** 

WASHOUT VALVES **BLOW-OFF VALVES** 

FRONT-END HINGES BLOW-OFF MUFFLERS

TENDER HOSE COUPLERS

GUARANTEED

**FULLY** 

LOCOMOTIVES, OKADEE

DEVICES ARE ASSETS

NOT LIABILITIES

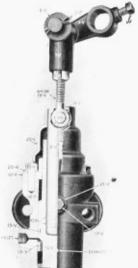
CYLINDER SAFETY VALVES WATER GLASS PROTECTORS LUBRICATORS — ATOMIZING CYLINDER COCKS — AUTOMATIC CYLINDER COCK OPERATING VALVES

E OKADEE CHICAGO, ILLINOIS . BENTON HARBOR, MICH.

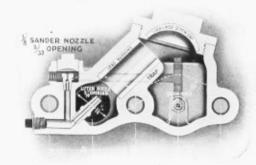
# VILOCO



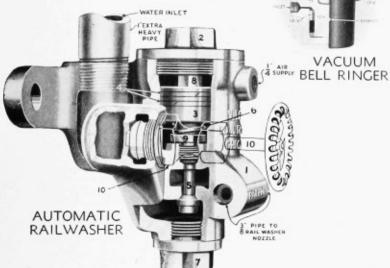
EXHAUST PIPE



VACUUM



SANDER



PNEUMATIC WHISTLE OPERATOR

VILOCO DEVICES INSURE EFFICIENT AND

ECONOMICAL PERFORMANCE.

SANDERS

GUARANTEED IN ALL

**BELL RINGERS EXHAUST PIPES** 

PAINTING MACHINES

GREASE LUBRICATORS

RESPECTS

SAND DRYERS—AUTOMATIC

SANDER OPERATING VALVES

RAIL WASHERS—AUTOMATIC

RELIABLE

BRAKE STEPS—PRESSED STEEL

UNIVERSALLY USED

BELL RINGER THROTTLE VALVES

LOW MAINTENANCE COST

UNCOUPLING LEVER ATTACHMENTS WHISTLE OPERATORS - PNEUMATIC

VILOCO RAILWAY EQUIPMENT CO. CHICAGO, ILLINOIS BENTON HARBOR, MICH.





One of ten Yellowstone type locomotives built by the Baldwin Locomotive Works for the Northern Pacific Railroad.

### TWO OF THE OUTSTANDING ACHIEVEMENTS

### In Locomotive Progress



The Coffin Centrifugal Pump. The pioneer of its type for locomotive boiler feeding.

THE Yellowstone type locomotive of the Northern Pacific, now the largest locomotive in the world, is an outstanding example of locomotive progress since the days of "Old Ironsides."

No less an achievement is the development in Feed Water Heating which made it possible to meet the unusually large capacity of this engine with a feed water

heater of standard manufacture and of guaranteed results.

On these engines, as on others of smaller capacity, the
Coffin Feed Water Heater System retains the stream lines
of the locomotive. It does not interfere with the locating of
other appurtenances, nor obstruct the crews vision. The weight

is equally distributed and advantageously applied.

Feed water temperatures average within nine degrees of the temperatures of the exhaust steam in the heater and results in a gross fuel saving of from 15 to 16 per cent or its equivalent.

Efficient and dependable boiler feeding is assured. The live steam consumption of the Coffin Centrifugal pump is less than 2 per cent of the water pumped.

There are only two moving parts in the entire system and no mechanical maintenance is required between general shopping periods.

The yearly net savings equal 82 per cent of the applied cost of the Coffin System.

We congratulate the Baldwin Locomotive Works on its 100 years of progress and are proud to have had a small part in the results achieved during the past few years.



Trade Mark Reg

The J. S. Coffin, Jr., Company

Englewood, New Jersey

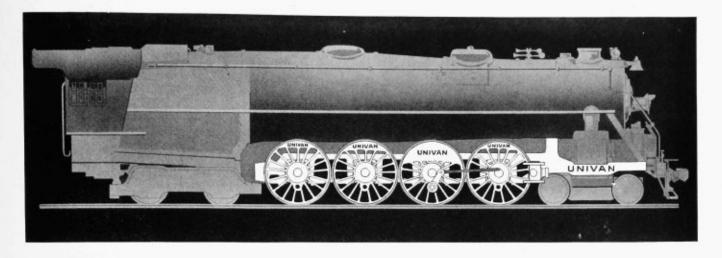


The Coffin Feed Water Heater. The outstanding development in feed water heater design.

U. S. Pat. Off

CANADIAN REPRESENTATIVE: Franklin Railway Supply Company, Ltd., Montreal, P. Q., Canada FOREIGN REPRESENTATIVE: . . . . . International Railway Supply Company, New York, N. Y.





# What "UNIVAN" means to Locomotive Progress

"UNIVAN"—That Tough Steel—from the very first has successfully met the demands of higher power and greater speed, kept step with the increasing demands and today is extending the useful life of locomotive parts many years.

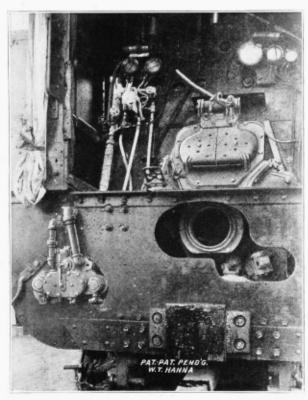
"UNIVAN" Cast Steel has more strength combined with greater ductility than any other cast steel available. These qualities assure longer life.

Further progress in locomotive design will doubtless be along the line of still greater speed with heavier and more frequent shocks which will certainly demand the very best steel available—"UNIVAN" is the logical answer.









Cab View-Hanna Stoker Type S-F

When considering economies

CONSIDER

THE HANNA STOKER

This stoker is to stokers

what the superheated engine is to the saturated engine . . . .

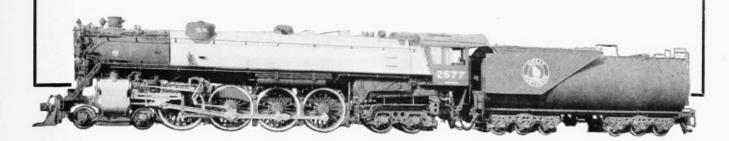
### IT GETS THE MOST OUT OF THE FUEL



THE HANNA STOKER COMPANY

CINCINNATI, OHIO

# NICKEL STEEL boiler plates for 14 new GREAT NORTHERN locomotives...



### ... because they "perform better longer"

Great Northern locomotive with Nickel Steel boiler plate, mfd. by THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa. In all cases Nickel Steel boiler plates used on these 14 locomotives exceeded the following minimum specifications:

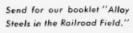


Passenger service have been built by Baldwin for the Great Northern Railroad. The Nickel Steel plate for the boilers of these locomotives, operating under a working pressure of 225 pounds, was furnished by the Otis Steel Company.

The operating experience of many roads, as well as exhaustive laboratory tests, demonstrate beyond question the superiority of Nickel Steel plate for boiler construction. Nickel Steel provides high strength with light weight and insures freedom from aging and embrittlement at high operating temperatures. In high speed, heavy duty railroad service, Nickel Steel "performs better longer".

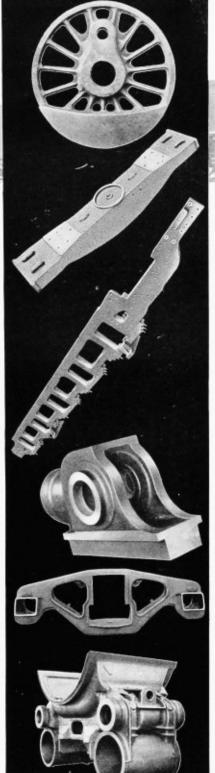
THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

Miners, refiners and rollers of Nickel. Sole producers of Monel Metal











# OHIO STEEL CASTINGS ARE BUILT INTO MANY NEW ENGINES . . . .

Thousands of OHIO steel castings are safely serving American railroads. <u>Driving wheels...bolsters...</u>

main frames...crossheads...side frames...cast steel

cylinders--cast by OHIO--represent modern standards for locomotive and general railway castings.

Higher boiler pressures . . . necessity for less locomotive weight . . . more speed - - these factors led • OHIO to specialize in cast steel for locomotive cylinders some years ago. Now hundreds of locomotives have them.

Steel castings play an important part in the efficiency, speed and dependability of modern locomotives. OHIO'S years of experience in cooperating with the industry has led to a complete understanding of its needs...an anticipation of its requirements...a constant effort to aid in its progress.

THE OHIO STEEL FOUNDRY CO.

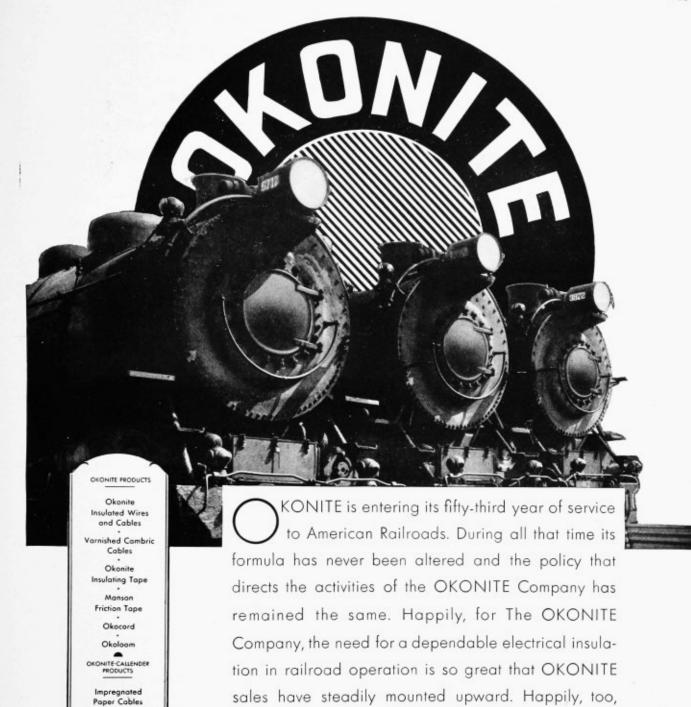
Plants: Lima, Ohio, Springfield, Ohio, Bay City, Michigan



OHIO

Super-tension Cables

Splicing Materials



THE OKONITE COMPANY

the quality of OKONITE has never been lowered and

American Railroads can trust it to give the same excellent service in future that it has given in the past.

THE OKONITE-CALLENDER CABLE COMPANY, INC. Factories: Passaic, N. J. Paterson, N. J. SALES OFFICES

ST. LOUIS PHILADELPHIA PITTSBURGH LOS ANGELES

SEATTLE DALLAS Canadian Representatives: Engineering Materials, Limited, Montreal

CHICAGO

SAN FRANCISCO General Electric Supply Corp., Boston, Mass.

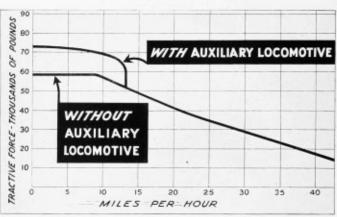


# For higher efficiency of your motive power

Because a locomotive must have sufficient reserve tractive force to start a train and to get it over ruling grades, it is working most of the time at much less than full capacity—an uneconomical condition. In starting and for speeds up to 12 or 15 miles per hour, the locomotive boiler has ample steam generating capacity to supply larger cylinders than those provided. But it would be useless to have extra cylinder capacity on the locomotive, as the adhesion would not be sufficient to transmit the added power to the draw-bar.

The use of one or two Bethlehem Auxiliary Locomotives under the tender solves the problem of applying the full power of the boiler to the load, to start it or pull it over heavy grades. The Auxiliaries supply the cylinder capacity and the tender supplies the weight for the additional tractive effort, which amounts to from 10,000 to 18,000 pounds for each Auxiliary Locomotive.

The Bethlehem Auxiliary Locomotive is made in both four- and six-wheel types. It is readily installed in place of one of the tender trucks and can be cut in or cut out at will, providing an instantly available reserve of tractive force.



The curve above shows the great reserve of tractive force that the Bethlehem Auxiliary Locomotive provides at low speeds, opening the way for more efficient operation at higher speeds.

With this reserve tractive effort for starting, for getting over ruling grades, and for emergencies, the locomotive can haul a train of such weight that it works at more nearly full capacity all of the time, with a consequent decided increase in efficiency.

### BETHLEHEM STEEL COMPANY

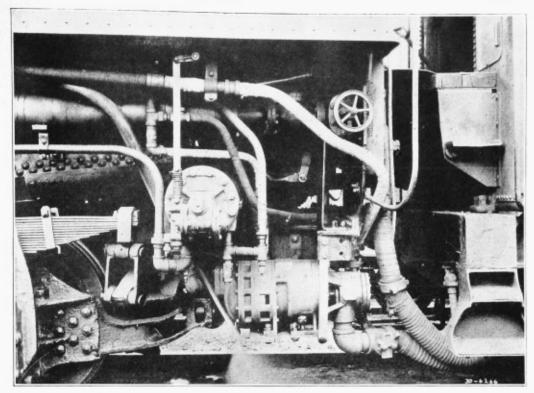
General Offices: Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta. Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago, St. Louis.

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Portland, Seattle, Honolulu. Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.

### BETHLEHEM





The Conditioner boiler feed pump (lower center) and connections. The design of this B-A pump is based on well-established engineering practice. Runsfrom shopping to shopping. Although in operation when this photograph was taken, no vibration is discernable.

# THE CONDITIONER provides heated water when

OPERATING

DRIFTING

STANDING

The Locomotive Water Conditioner supplies hot water to the boiler even during intermittent operation. The hot water storage compartment on the tender has a reserve supply of 700 gallons or more.

Exhaust steam is passed directly into the storage tank, saving both heat units and water.

Automatic means are provided for heating the water supplied to the boiler with live steam only when exhaust steam is not available.

This and the reserve hot water supply of the Conditioner is an unfailing protection against the possibility of damage to the boiler which is caused

by the entrance of cold water.

The manufacture, supply and service of boiler water treatment chemicals is the primary business of The Bird-Archer Company.

These activities and expert services properly include the installation and service of mechanical devices, likewise designed to promote locomotive boiler efficiency.

Send for the Conditioner folder

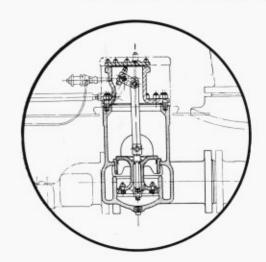
The BIRD-ARCHER Company
NEW YORK + CHICAGO + ST. LOUIS

The Bird-Archer Company, Limited, Montreal

The Locomotive Water CONDITIONER

feed water heating hot water storage oxygen removal water treatment





# Simplicity

In throttle valve design

A NY comparison along these lines will show the outstanding advantages of the BRADFORD design.

In the first place the BRADFORD Front End THROTTLE VALVE is a single unit with all working parts assembled on one shaft.

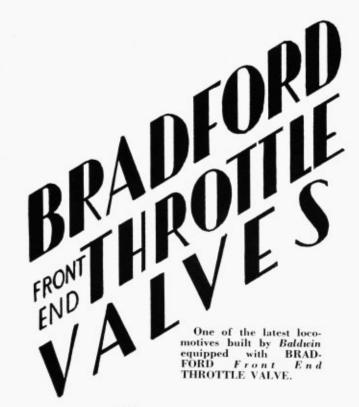
All the internal parts—one main valve, one pilot valve, one balancing piston—can be removed without disturbing any part of the boiler or front end.

Its simple arrangement for perfect balancing of the main valve eliminates the use of small, fragile operating parts. Grinding is seldom necessary because the floating ring seat keeps the *one valve* tight regardless of size.

The efficient and low cost performance of BRADFORD THROTTLE VALVES on thousands of locomotives proves that their design meets all operating requirements without adding any further burdens on the mechanical department.

### THE BRADFORD CORPORATION

NEW YORK 370 Lexington Ave. CHICAGO Railway Exchange

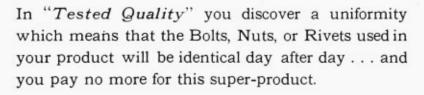






Numerous tests stand between you and the weaklings and misfits in common "mine run" variety of Bolts, Nuts, and Rivets.

Congratulations to Baldwin upon their anniversary commemorating 100 years of locomotive progress. These tests stand as sentinels right in the Neely plant admitting to you only those products that pass, with the result that you actually save both time and money by insisting on having this super-product.



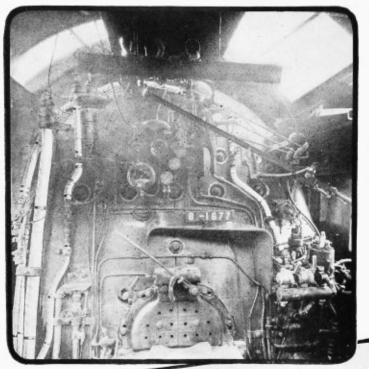
But just as a precaution when you specify Bolts, Nuts, or Rivets add "Tested Quality" to your specification or requisition.



## NEELY NUT & BOLT CO. PITTSBURGH, PA.

This symbol of "Tested Quality" appears on every container. It is the identifying mark of a super product.

BOLTS & NUTS & RIVETS & RODS & UPSET FORGINGS





# INSUTAPE MostImportant Now—for Its Fuel Savings!

For years, railroads have proven the dollars and cents economy of this permanent, high efficiency insulation—on locomotive and car piping, booster, feed water heater, steam heat lines and other piping. Insutape is the only pipe wrapping which maintains its effective insulating efficiency under all conditions of heat, vibration or handling—does not mat or pack, buckle or distort. There is no substitute!

# Other Unarco Specialties for Locomotives

### FRONT END TAPE

An improved gasket tape for front ends of locomotives, which provides a double sealed joint. Economical, easy to apply, and positively prevents air leaks.

#### CAB CURTAINS

Manufactured from asbestos, our curtains are absolutely fireproof. They are impregnated with a special compound to resist all weather conditions and firebox fumes. Made to conform to railroad company's blue prints.

### SEMI-METALLIC AIR PUMP PACKING

Made of highest quality asbestos, in combination with an alloy wire and is especially treated to withstand the most severe conditions. This packing will not score the piston rods.

### MALLET SLIP JOINT PACKING

A high grade product that will not deteriorate under the high heat despite the small amount of lubrication in the steam and the continual expansion and contraction of the working parts.

UNION ASBESTOS & RUBBER CO. 310 SO. MICHIGAN AVE . . . CHICAGO

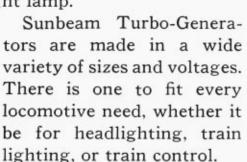




S UNBEAM has played an important part in locomotive development since 1883. Beginning back in the

days when copper reflectors for oil burning headlights were hammered out by hand, Sunbeam has kept pace with developments so that its Electric Headlights and Turbo-Generators are now used in every country in the world where locomotives are known.

Sunbeam Glass Reflector Headlight, Type 4414, is made from Rust-Proof Steel and will last as long as the locomotive. It develops a minimum of 600,000 beam candlepower with the standard 250 watt locomotive headlight lamp.





Type 4414 14 Inch Glass Reflector Rust Proof Steel



Type R4-800 Watt-32 Volt



### ELECTRIC MFG. CO.

EVANSVILLE, INDIANA, U. S. A.

New York Denver San Francisco Richmond Philadelphia Indianapolis ORIGINAL

Hillian .

The plain threaded bolt, now obsolete in the majority of modern power, was the earliest form of boiler stay. However, because it was rigid, staybolt breakages and sheet failures frequently occurred, due to the restricted ex-

Hillian

TATE THREADED ASSEMBLAGE 1904 pansion of the firesheet when the boiler was under pressure. To prevent this damage, hundreds of flexible assemblages were designed, the Leech Type being one of the earliest. All of these assemblages had some mechanical weakness, meeting little or no success, until the Tate was offered to the railroads, and received with almost universal adoption.

THE Flannery Universal Assemblage, welded to the wrapper sheet, was the first major improvement in flexible staybolt

FLEXIBLE

1880

design since the introduction of the Tate. Its unquestioned success when installed in a very great majority of the new equipment constructed during the past twelve years has proved the correctness of the principles involved in its construction.

The latest development in flexible assemblages is found in the Two-Piece design, which eliminates the sleeve portion of the assemblage, and uses a large headed, stronger bolt. The Two-Piece Assemblage was made possible by the introduction of the Flannery Tell-Tale Bolt, which is inspected electrically from inside the firebox. Cap removal is dispensed with, and the closure for the bolt head, being welded to the wrapper sheet, eliminates leakage trouble in the outside sheet.

As a safety measure, all flexible bolts manufactured by Flannery are subjected to an extra finishing process, known as the Nu-Tate, in which the head is normalized after forging, and carburized and surface hardened to reduce frictional resistance under load. This process imparts a strength and service life to the bolt far beyond that of any previous type.

yond that of any previous type.

The Tell-Tale Bolt, illustrated in the Two-Piece Assemblage, is suitable for any of the Flannery Assemblages. Safety for operatives and equipment is assured through the use of these bolts, for, should one be broken or fractured in service, the condition is immediately made known by the leakage of steam and water into the firebox.

### FLANNERY BOLT COMPANY

Flannery Building

Pittsburgh, Pa.

MANUFACTURERS OF FLEXIBLE STAYBOLTS
FOR OVER A QUARTER OF A CENTURY



Illian

FLANNERY

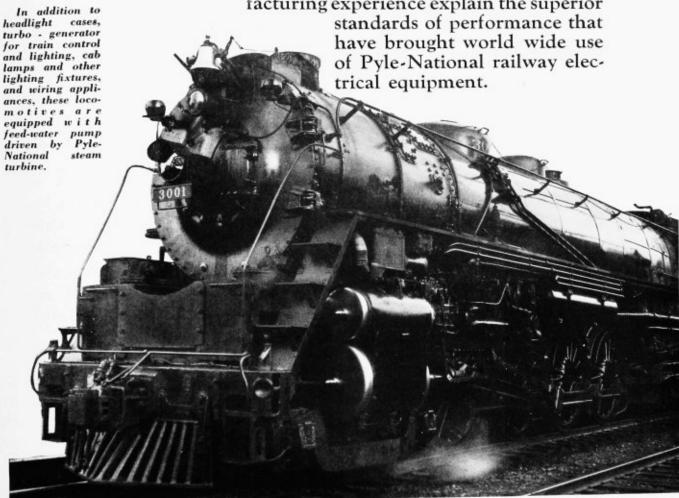
WELDED

1919

FROM the day of the first electric headlight to the present, the development of Pyle-National railway electrical equipment has consistently kept pace with the specialized requirements of railroad service.

The Chicago and North Western Railway's Class "H" locomotives - Baldwin built—are one of many examples of modern motive power where Pyle-National equipment contributes to safety and present day standards of operation.

Thirty four years of design and manufacturing experience explain the superior



The Pyle-National Company



General Offices and Works 1334-1358 North Kostner Avenue CHICAGO, ILLINOIS, U.S. A.

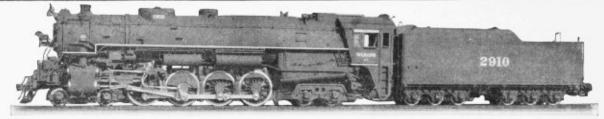
Export Department: International Railway Supply Co. 30 Church St., New York City

Canadian Agents: The Holden Company, Ltd. Montreal, Toronto, Winnipeg, Vancouver BRANCH OFFICES

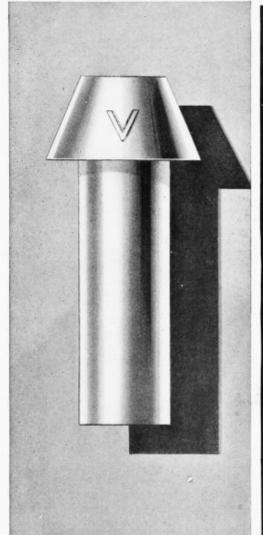
Grand Central Terminal . . New York City Baltimore Trust Bldg. . . . . Baltimore, Md. Boatmen's Bank Building . . . St. Louis, Mo. Builders Exchange Building . St. Paul, Minn. Statler Building . . . Boston, Massachusetts Exchange National Bank Bldg. . Tulsa, Okla. Hobart Building . San Francisco, California



# '. VICTOR



This 4-8-4 type locomotive was built by the Baldwin Locomotive Works Victor Rivets used in the boiler and tender



# RIVETS '

# PROGRESS Demands QUALITY

HE locomotive of today performs tasks unthought of a decade ago. Its efficiency is directly related to and dependent upon its source of energy—the Boiler.

The careful workmanship with which these locomotive boilers must be constructed has set up demands in rivets that exceed the capacity of the ordinary Boiler Rivet.

Victor True - Tolerance Rivets have kept pace with this progress. The exacting requirements of their specifications include — manufacture by the HOT PROCESS — complete elimination of SCALE, FINS, and SEAMS — concentric heads accurately formed — ROUND and TRUE TO SIZE.

Booklet "Scientific Facts" upon request Insure quality construction in your Locomotive Boilers by specifying VICTOR TRUE-TOLERANCE RIVETS.

### THE CHAMPION RIVET CO.

CLEVELAND, OHIO

WESTERN PLANT

Manufacturers of VICTOR BRAND

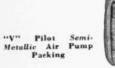
EAST CHICAGO, IND.

BOILER and STRUCTURAL RIVETS COUPLER and AIR BRAKE PINS



### PILOT PACKINGS...









Pilot Fibrous Air Pump Packing



### for Railroad Service

Genuine "V" Pilot Semi-Metallic Packing. Presents an allmetal bearing surface to the rod. Assures long packing life because its structure is rugged and durable, steam . . air . . and water tight. Furnished in sets or spiral form, handily boxed, for quick application to:

Air Pumps Throttle Stems Stokers

Booster Ball Joints Elesco Feedwater Pumps Power Reverse Gears Locomotive Valve Stems Worthington Feedwater Pumps Steam Hammers . . . . . And Other Stationary Machinery

Genuine Pilot Fibrous Packing. Made of high-grade crude asbestos and high-grade steam-resisting compound, and incorporating a resilient rubber core of the same high quality. Gives exceptionally good packing service because it contains inherent packing qualities which far exceed those of ordinary fibrous packings. Furnished in sets or spiral form, handily boxed, for quick application to:

Air Pumps Booster Ball Joints Power Reverse Gears Steam Hammers Slip Joints

Worthington Feedwater Pumps Booster Ball Joint Filler Rings Locomotive Feedwater Pumps Throttle Stems Cabcocks

And All Stationary Machinery

The long life and dependable service of "V" Pilot Semi-Metallic and Pilot Fibrous Packings (in sets or in spiral form) help eliminate frequent packing replacements, and consequently, help reduce maintenance costs. Good reasons why you should continue to USE only PILOT brand packings.

### PILOT PACKING CO., INC.

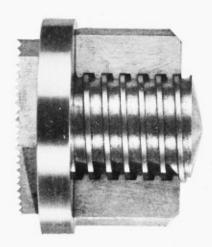
Ioseph Sinkler, General Manager

PEOPLES GAS BUILDING, CHICAGO

One Water Street New York

Monadnock Building San Francisco





## DARDELET

THE SELF-LOCKING SCREW THREAD

# A VITAL FACTOR IN MODERN LOCOMOTIVE CONSTRUCTION

THE Dardelet Self-Locking Screw Thread is so designed that when the nut is tightened against the work with an ordinary wrench, tapering thread faces come in contact with a wedging action and this wedging action is sufficient to lock the nut securely against every service force.

Dardelet threaded fastenings hold absolutely tight under all operating conditions without pins, lock nuts, jam nuts or other auxiliary locking devices. They simplify construction and assure dependable operation with lower maintenance cost.

### MORE CLEARANCE

Since no lock nuts or jam nuts are required, shorter bolts may be used, thus leaving more clearance and permitting compact design.

### LOCOMOTIVE APPLICATIONS

SIDE ROD KNUCKLE PINS SU WRIST PINS MOTION WORK PINS LO VALVE GEAR PINS

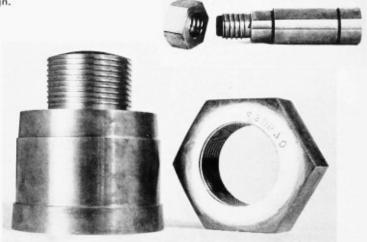
SUPERHEATER HEADER BOLTS
SADDLE BOLTS
LOCOMOTIVE FRAME BOLTS
CROSSHEAD GIBB BOLTS

PEDESTAL JAW BOLTS

### GENERAL RAILROAD APPLICATIONS

By reason of its simplicity and efficiency as a fastening, the Dardelet Self-Locking Screw Thread effects material economies in the construction and maintenance of both rolling stock and track. Dardelet threaded bolts and nuts for crossing frogs, turnout frogs, guard rails, and track are now in use on fortyone railroads.

WE SHALL BE PLEASED TO SEND YOU ENGINEERING AND OTHER DATA

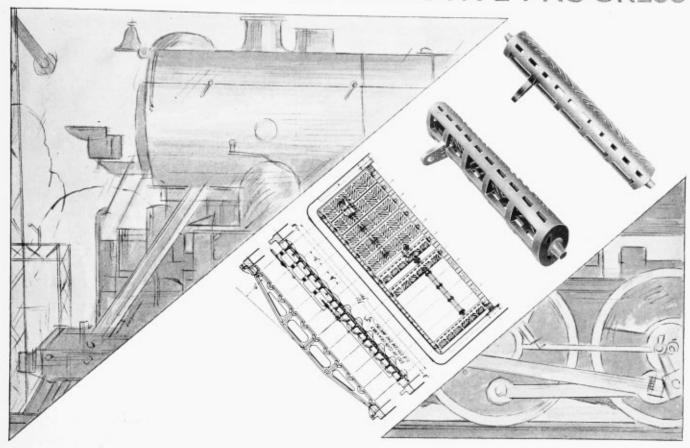


Dardelet threaded main side rod knuckle pin as installed on 2-10-2 heavy freight locomotive. Upper right—Dardelet threaded valve gear pin. In these applications, use of the Dardelet Thread eliminates slotting the castellated nut, drilling hole in pin for cotter key, and the cotter key itself.

THE DARDELET SELF-LOCKING SCREW THREAD IS PROTECTED BY PATENTS AND IS MANUFACTURED IN THE UNITED STATES UNDER LICENSE FROM THE DARDELET THREADLOCK CORPORATION

DARDELET THREADLOCK CORPORATION
120 Broadway
New York, N. Y.





## Thomas Grates Keep Pace With Locomotive Progress

Thomas WSD (Wiggling-Shaking-Dumping) Grates are as modern as new modern Power. Compare them with ordinary table or finger grates.

Efficient—rugged—dependable; correctly designed and made of high grade, heat resisting, material—they last longer and cost less. They eliminate grate bar troubles and mishaps. Double structure with air openings thru their sides prevent equalization of heat thru the unit—therefore no warping and sagging. They stay straight.

Semi-elliptical in shape, Thomas Grates slip beneath the burning fuel to sift ashes into the pan and do not tear it into holes and streaks for admission of excess air. More efficient fires insure increased steam—worthwhile fuel savings.

Suitable for hand or stoker firing. Style and size air openings varied to suit all kinds and classes of locomotive fuel.

For complete information and price, write



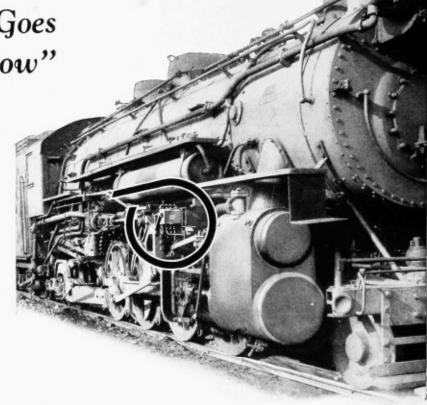


"Where the Air Goes the Oil Must Follow"

An achievement which has solved the problem of wheel flange lubrication.

# The HOOFER FLANGE OILER—

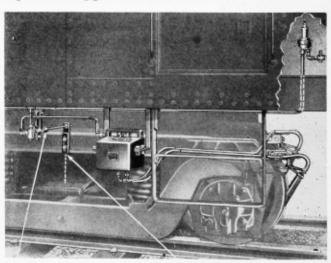
has oil shoes hollow—therefore, where the air goes the oil must follow—





A slight vent of air exhausting with the oil, through the oil shoes, as they are held firmly against the flanges, serves to overcome the centrifugal force at high speed, and assures positive application of the oil.

Low Grade oil used in this device with equal success summer and winter, positively prevents flange and rail wear.



Oscillating Control type applied to trucks

HOFER MFG.CO.

4710 Armitage Avenue, Chicago, Ill.





# Carey 85% Magnesia Lagging is Stronger

Carey 85% Magnesia Lagging is 50% to 60% stronger than other laggings. This extra strength is due to the quality of the asbestos fibre used, and to our method of distributing it through the block.

The insulation value of any locomotive lagging depends on the block remaining intact when subjected to traffic vibration Because of its greater strength, Carey Lagging resists vibration which shatters weaker materials. When the locomotive is overhauled, a larger percentage of Carey Lagging can be re-used.

Offering this definite extra value at no extra cost, Carey 85% Magnesia Lagging is being increasingly specified by leading railroad companies. Samples, prices and complete data will be supplied on request.

RAILROAD DEPARTMENT

THE PHILIP CAREY COMPANY & Lockland, Cincinnati, Ohio

Branches in Principal Cities

BUILT-UP ROOFS
ASPHALT PRODUCTS
ELASTITE EXPANSION JOINT
WATERPROOFINGS
ROOF PAINTS



HEAT INSULATIONS
ASBESTOS MATERIALS
CAREYSTONE CORRUGATED SIDING
ASFALTSLATE SHINGLES
BUILDING PAPERS





# Modern Protection Against Wear With ROL-MAN ROLLED MANGANESE STEEL

### RAILROADS USING ROL-MAN

Boston & Maine Chesapeake & Ohio Denver & Rio Grande Western Erie Hocking Valley Inland Steel Co. Long Island New York, New Haven & Hartford Pennsylvania Reading St. Louis & San Francisco Boston Elevated Brooklyn & Manhattan Brooklyn Queens Transit Chicago Aurora & Elgin Chicago North Shore & Milwaukee Chicago South Shore & South Bend Cleveland Rys Eastern Massachusetts Houston Electric Hudson & Manhattan Illinois Terminal Los Angeles Ry. Pacific Electric Philadelphia Rapid Transit Philadelphia Broad St. Subway Third Ave. System, New York City Terre Haute Indiana & Eastern Virginia Public Service Washington Baltimore & Annapolis



and others.

ROLMAN is the brand of quality on wear plates, pins and bushings. They are guaranteed against breakage during the life of the equipment.

Frisco Locomotives shown above have ROL-MAN Pedestal Liners where indicated. The high speed Chicago North Shore and Milwaukee Trucks shown below have ROL-MAN protection at all points including brake pins and bushings.

ROL-MAN is used for:-

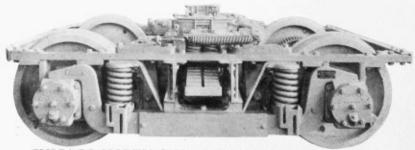
Pedestal & Journal box wear plates. Bolster & Transom chafing plates. Bolster Hanger pins & bushings. Buffer & Coupler chafing plates.

Brake gear chafing plates. Brake pins & bushings. Spring Hanger pins & bushings. Driving wheel hub & Box liners, etc.

### MANGANESE STEEL FORGE COMPANY

Manufacturers of

ROL-MAN Rolled and Forged Manganese Steel Products Richmond St. and Castor Ave., Philadelphia, Pa.



CHICAGO NORTH SHORE AND MILWAUKEE TRUCK "ROL-MAN" IS STANDARD ON THIS SYSTEM



# Up To and Beyond Today's High Standards of Boiler Tube Quality

NEW-GLOBE STAINLESS

EARLY in the 19th Century, locomotive flues were crudely fashioned from gun barrels. Later came lap welded tubes of wrought iron. Nowadays, only the best of seamless steel tubing satisfies the exacting demands of locomotive builders and boiler

makers.

Keeping pace with advanced ideas in boiler construction throughout the last twenty years, Globe mills are today regarded by the industry as beadquarters for quality boiler tubes.

### Why this preference?

Backed by four years of experiment and development, 1931 is the first year of cultume production of Globe Statinless Steel Tubes. Today, orders are being filled for ornamental stainless-jacketed steel tubes for railway coaches, tubes for hat water heating coils in electric lacomotives and for many other uses where appearance, corresion resistance, or ability to withstand high temperatures and pressures are important. Address your stainless tubing inquiries to the attention of our subsidiary—GLOBE STAINLESS TUBE CO., Milwaukee. What underlies the popularity of Globe Seamless Steel Tubes among railroad executives the world over? Two important reasons, we believe:

First, the man in the shop likes to use Globe tubes. He finds them true to size so that they are easy to roll in. Moreover, he easily expands and beads the tube ends, because the steel is ductile—soft, not springy... Second, the man who keeps the cost records knows that Globe tubes have an unexcelled service life. Complete temperature control throughout Globe mill processes gives the

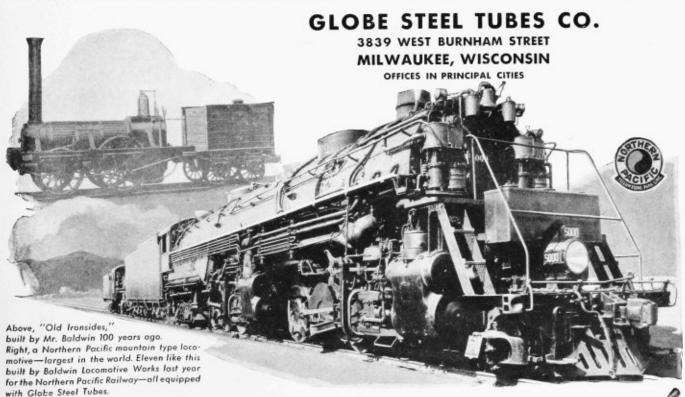
steel a uniform grain structure. No areas of different electro-chemical potentialities to cause pitting, scaling or corroding. Globe tubes last!

### A wide tubing service

Boiler tubes, any shape, of open hearth steel in popular analyses. Hot finished, 2" to 6" diameter. Cold drawn, 1/2" to maximum. Also tubing of nickel content, copper content or stainless steels, to

meet your most exacting chemical specifications. Accurately held to close tolerances.

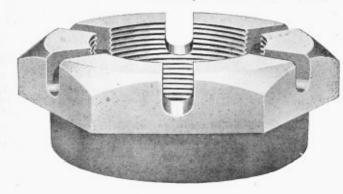
All Globe tubes are seamless (no welded area of potential weakness). Pierced from billets of solid steel! Send us your specifications for estimates today.



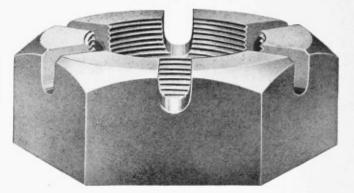
QUALITY IS ROUND



All Styles and Sizes, 1/4" to 8" dia. Bolts or Larger.



Collar Nuts Slotted Nuts Castellated Nuts



Knuckle Pin Nuts Piston Rod Nuts Crank Pin Nuts

The sterling qualities of "Milton" Locomotive Nuts do their full part in assisting you to obtain the utmost SECURITY.



Cold Punched C & T Nuts **Heat Treated Nuts** Special Nuts





Semi-finished Nuts Case Hardened Nuts **Expansion Staybolt Nuts** 

Also manufacturers of

Bolts Machine, Carriage, Hanger, Stud, Lag, etc.

The Milton Manufacturing Co., Milton, Pa.

# High Efficiency...Low Maintenance

IN HEATING LONG PASSENGER TRAINS

# Vapor Steam Heat Specialties on Locomotives

Renewable cylinder-walls and pistons

2-inch Outlet



No. 238 Locomotive Pressure Reducing Value Maintains desired volume and pressure

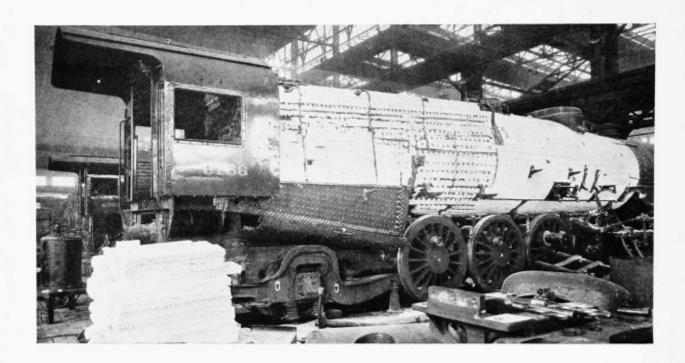
2-inch Inlet







# MAINTAIN NEEDED STEAM PRESSURES WITH K&M LOCOMOTIVE INSULATIONS



### "Featherweight" 85% Magnesia

The highest grade insulation known for conserving heat and maintaining necessary steam pressures!

K&M 85% Magnesia Lagging, furnished in flat blocks 3" or 6" wide, is doing yeoman service on hundreds of locomotives, on trunk lines from the Atlantic to the Pacific.

And boiler lagging is but one of the many Ambler Asbestos Products used by railways. At the right are listed a few of the railroad specialties we manufacture. It will pay you to ask for samples and quotations.

A new railroad catalog is now being printed. May we send you a copy?

KEASBEY & MATTISON CO., AMBLER, PENN.



#### Ambler Asbestos Railroad Products

#### THROTTLE PACKING-

Made of highest quality asbestos cloth wound over a rectangular rubber cushion. Made in ring form, one complete set to a carton, to fit exact dimensions of stuffing box.

#### CAB COCK PACKING-

Braided asbestos packing, graphited on outside made in sizes from  $\frac{1}{8}$ " to 1/2", sold in 1 and 5 lb, spools.

#### LOCOMOTIVE & CAR TAPE-

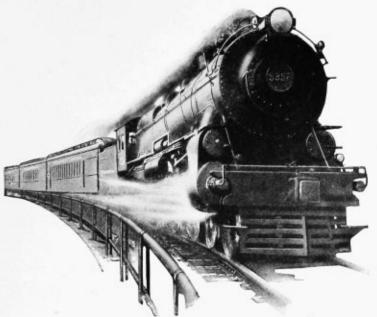
For wrapping cab and train steam pipes. Made in practically any size.

#### AIR PUMP PACKING-

Braided asbestos metallic rings, lubricated and graphited. Furnished in boxes containing 4 rings, for Steam End and 4 rings for Air End.

#### CAB CURTAINS-

Made from tightly woven Asbestos Cloth, treated to make waterproof. Will not ignite from firebox, nor rot nor deteriorate due to gases. Furnished complete according to blueprints, or in rolls ready to make up in Railroad Shops.



# Helping to maintain the reliability of Baldwin Locomotives

View of General Refractories plant specializing in the manufacture of locomotive arch brick.



N meeting rigid schedules, high speeds and extreme reliability are required of modern locomotives. Boilers must be pushed to the limit—refractories of the highest quality must be used.

General Refractories products are helping to maintain the reliability of Baldwin locomotives, including those on "crack trains"—convincing evidence of their merit.

With large stocks of high grade locomotive arch brick maintained at our plants, prompt service is insured.

Your refractory requirements in the shops, too, can be met by General Refractories. The service is complete.

General Refractories Engineers, with over 20 years of experience in designing, testing and improving locomotive arches and fire boxes, are at your service.

### GENERAL REFRACTORIES COMPANY

General Offices: 106 South 16th Street, Philadelphia, Pa. Railway Dept: 420 Lexington Ave., New York, N. Y.

District Offices: Birmingham, Boston, Buffalo, Chicago, Cleveland, Detroit, Indianapolis, New York, Pittsburg, St. Louis, San Francisco



# Carbon - Vanadium Steel Main Rods and Side Rods

#### On New Power for the Lehigh and New England

LAST year, the Lehigh and New England Railroad Company ordered two 2-10-0 type locomotives and three 0-8-0 type locomotive Works. Like two 2-10-0 types and three switchers previously built for this road in 1927 by Baldwin, the new locomotives are equipped with main rods and side rods of Carbon-Vanadium Steel.

In service on the Bethlehem branch of the Lehigh and New England where operating conditions are unusually difficult, the 2-10-0 type locomotives are reported to have proved highly satisfactory. They have demonstrated marked economy in fuel consumption, and their use has solved a number of troublesome problems. The Carbon-Vanadium rods, with which all of the locomotives are equipped, have served continuously without maintenance or failure.

Containing only the one alloying element, Carbon-Vanadium is the forging steel of simple structure. Its maximum physical properties are developed by a simple normalizing
—no quenching and tempering are
necessary. Hence, Carbon-Vanadium
Forgings are readily handled in the
railroad shop equipped for forging

Carbon-Vanadium Forgings possess useful strength fully 50% in excess of carbon steel forgings of the same section, with correspondingly higher shock-resistance and antifatigue qualities. If you are not fully familiar with the advantages that accompany the specification of Carbon-Vanadium Forgings on new power and for replacements, we will gladly send you complete data. Write us.

#### VANADIUM CORPORATION OF AMERICA

120 BROADWAY, NEW YORK, N. Y.

CHICAGO PITTSBURGH DETROIT Straus Bldg. Oliver Bldg. Book Tower

Plants at Bridgeville, Pa., and Niagara Falls, N.Y. Research and Development Laboratories at Bridgeville, Pa.



FERRO - ALLOYS
of vanadium, silicon,
chromium and titanium; silico - manganese, tungsten
and molybdenum,
produced by the
Vanadium Corporation of America, are
used by steel makers
in the production of
high - quality steels.

# VANADIUM STEELS

for strength, toughness and durability



# ROLLER BEARING PERFORMANCE To Match Railroad Needs

Chicago & Northwestern Class "H" locomotives for fast freight and passenger service. Baldwin Locomotive Works, builders. Twenty-five Class "H" locomotive tenders are Shafer Roller Bearing equipped.

Consistent, dependable performance in long, fast runs under heavy loads demonstrates that Shafer concave roller-convex raceway self-aligning design is fundamentally correct for railroad service.

The generous capacity for shock and thrust loads as well as radial loads is maintained undiminished by the Shafer self-aligning action, even under the severest operating conditions involving shaft deflection or misalignment.

Shafer Roller Bearings are setting an enviable performance record in regular service on 15 prominent roads, on all types of equipment from suburban cars to Pullmans and the heaviest of locomotive tenders. Investigate the exclusive Shafer design and the details of Shafer performance.

SHAFER BEARING CORPORATION

6501-99 W. Grand Avenue

Chicago, Illinois





# BETTENDORF and PROGRESS

These achievements reflect the spirit of the Bettendorf organization, a spirit which embodies the courage of the pioneer, the thorough soundness of the engineer, and the craft pride of the jealous artisan.

Since 1897 many of the most important improvements in freight car construction were Bettendorf conceived and Bettendorf developed.

Among the outstanding achievements credited to this pioneer in freight car construction are the steel balster, the steel underframe from commercially rolled shapes, and the cast steel side frame.

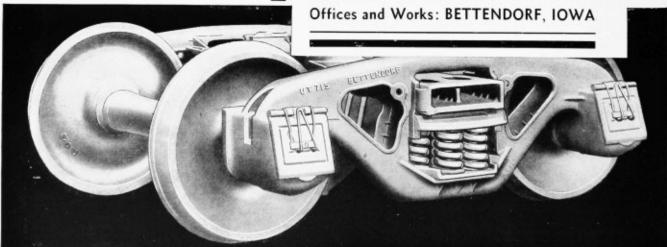
Bettendorf introduced the first commercially successful cast steel side frame in 1903. By 1910 the demand for Bettendorf side frames grew to such proportions that the capacity of outside foundries was insufficient to produce the required volume. It became necessary for Bettendorf to build its own steel foundry in order to augment the outside foundry production.

In 1920 Bettendorf placed another noteworthy improvement on the market—the "l" section single piece cast steel truck side frame.

The Bettendorf Company has produced thousands of the finest steel and composite freight cars in their modern plant which occupies 100 acres, 21 acres under roof. We congratulate Baldwin upon a long and splendid record of accomplishment; we congratulate the railroads upon the scientific progress which Baldwin and other great organizations made available to them; and we congratulate American business upon the impetus which the great network of American railroads has conferred upon national progress.

We believe in the future of the railroad industry as much today as we have in the past. The traditional sense of fairness which is inbred in the American people will combine with intelligent public self interest to insure fair play and deserved consideration for rail transportation. This belief enables us to look upon the coming years with a feeling that the true greatness of the American railroads is still to be realized.

THE BETTENDORF COMPANY
Offices and Works: BETTENDORF JOWA





# MAGNUS

The NAME of a PRODUCT — a COMPANY and the

STERLING MARK of CAR and ENGINE BRASSES

## SATCO

the new bearing metal

This company is highly gratified at the success in again having kept pace with locomotive progress by having introduced "SATCO METAL" the new bearing metal for lining of wearing metal castings and journal bearings.

WHERE RECORDS ARE MADE YOU WILL FIND MAGNUS PRODUCTS

Write Magnus in Your Specifications

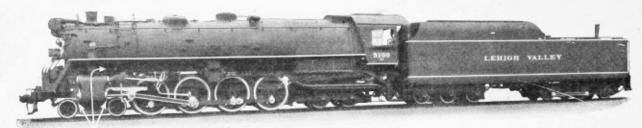
# **MAGNUS COMPANY**

**NEW YORK** 

INCORPORATED

**CHICAGO** 





One of the latest locomotives built by Baldwin. Equipped with ARDCO Drifting Valve and ARDCO Cylinder Cocks.

## PROTECTION

for the

# VALVES, CYLINDERS SUPERHEATER UNITS and MANY OTHER PARTS

A MONG the outstanding devices which are contributing to the efficient and economical operation of modern power are the ARDCO Automatic Drifting Valve and the ARDCO Safety Cylinder Cock.

Both of these devices are used by many of the leading railroads in North America.

The ARDCO Automatic Drifting Valve helps to insure maximum locomotive efficiency. It protects the valves, cylinders and superheater units. It prolongs the life of packing and reduces wear on all reciprocating parts.

The ARDCO Safety Cylinder Cock also helps to protect some of those highly expensive and extremely vital parts. It opens automatically whenever cylinder pressure exceeds boiler pressure due to compression or condensation, thus preventing damage to the heads, packing, rods, etc.

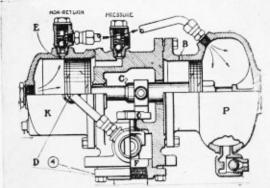
Why take chances with your modern power when it can be protected against many expensive failures and excessive maintenance costs for less than 1/3 of one per cent on the investment?

Blue prints and detailed information upon request

ARDCO MANUFACTURING CO.

1 Newark St.

Hoboken, N. J.



ARDCO AUTOMATIC DRIFTING VALVE



# Ardco Railway Devices



# On Modern Power in America



A heavy Mikado recently built by Baldwin. Tender equipped with DAVIS Solid Truss Brake Beams.

THE very fact that DAVIS Solid Truss Brake
Beams are used on the tenders of modern
power is sufficient evidence of their great strength,
high capacity and low maintenance cost.

Their ability to stand up under the heavy braking loads without failing has been thoroughly proven. Performance records show that they insure safer operation and give many years of service without failing.



DAVIS SOLID TRUSS BRAKE BEAM

## and Abroad



Three cylinder, Pacific type locomotive built by Baldwin for the F. C. Central de Brazil. Tender equipped with DAVIS Solid Truss Brake Beams.

DAVIS Solid Truss Brake Beams have been standard tender equipment for many years in Africa, Central America, South America, Cuba, Porto Rico, Hawaii, Australia, Philippine Islands, China and in other countries where transportation problems have been solved with locomotives built by Baldwin.

Where design permits the use of brake beams you can depend upon the DAVIS Solid Truss type to meet all requirements. To insure 100% safety be sure they are supported with DAVIS Brake Beam Supports.

#### Davis Brake Beam Co.

Johnstown, Pa.

Chicago Office: 122 South Michigan Ave. Boston Office: 1109 Boylston Street Richmond, Va.: 1221 Mutual Bldg.



Solid Truss Brake Beams



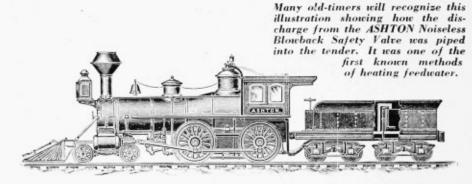
# Meeting the Requirements For 60 Years



Exterior view of the famous ASHTON Noiseless Blow-back Safety Valve, which solved a big problem during the early periods of locomotive development,



Ashton Locomotive Duplex Back Pressure Gage with Electric Light Attachment—No. 62 BAI Style



W AY back in 1871, Henry G. Ashton founded a business which has been closely associated with the development of the steam locomotive up to the present time.

During all these years every product manufactured by the ASHTON VALVE COMPANY has successfully met all the exacting railroad requirements.

ASHTON Valves and Gages have always been recognized as being absolutely dependable and are also noted for their long service life and low cost performance.

The ASHTON Duplex Gage is fitted with an electric light attachment. The illumination of the dial is accomplished by an electric light enclosed in a special hood which prevents the diffusion of the light rays over other parts of the cab. Electric light attachment may also be applied to other style gages.

THE ASHTON NO. 28 MM OPEN POP and the NO. 30 MM MUFFLER SAFETY VALVES are constructed strictly in accordance with the recommended practice of the Committee on Safety Valves of the American Railway Master Mechanics' Association. They require no special wrenches, there are no rings or sieeves to be raised or lowered. They have no outside casings to move that may be damaged by wrenches in removing or applying the valves.



Ashton No. 30 MM Style Muffler Safety Valve

The Ashton Valve Company

BOSTON

NEW YORK

CHICAGO

SAN FRANCISCO



PROGRESS

When the Baldwin Locomotive Works began building locomotives a hundred years ago, the crude brake shoes used were sufficient for the purpose.

With the modern train, fast and heavy, the best of brake shoes are needed to perform efficiently.

Diamond Perfecto Driver Shoes meet the operating conditions of today-plus economy per locomotive mile.

Substantial savings can be made by using Diamond Perfecto Driver Shoes on locomotive equipment.

The American Brake Shoe and Foundry Company 230 PARK AVE., NEW YORK

332 SO. MICHIGAN AVE., CHICAGO

aKICH like this



KICKING" cars is a necessary switching operation, but it often causes damage that the Purchasing and Claim Departments are concerned about. New couplers, knuckles, followers, siding, roofing, damaged or destroyed lading, etc. cost money.

The obvious remedy is to provide real protection from switching shocks. In other words, to replace inadequate draft gears with Cardwell and Westinghouse Draft Gears.

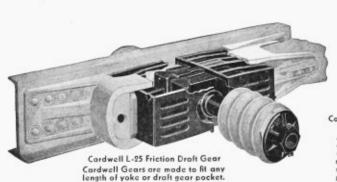
CARDWELL WESTINGHOUSE CO.

332 S. Michigan Ave.

Chicago, Illinois

PITTSBURGH, PENNSYLVANIA MONTREAL, QUEBEC, CANADA

GOOD DRAFT GEARS MAKE CARS GO FARTHER



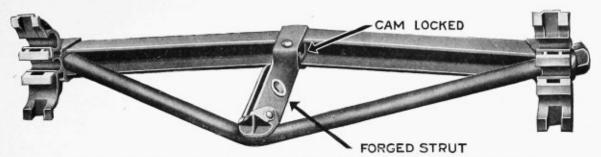
Cardwell and Westinghouse Draft Gears

Are made in sizes and capacities to meet all modern and A. R. A. requirements for locomotives, freight and passenger cars.

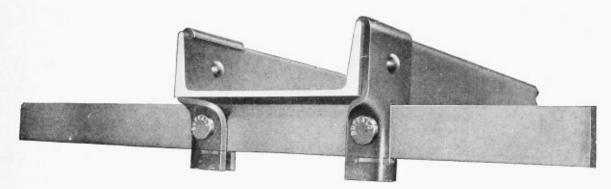


Westinghouse NY-11-D Friction Draft Gear Westinghouse Draft Gears can be applied with any type of attachments.

### BUFFALO BRAKE BEAM COMPANY

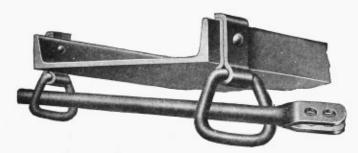


BRAKE BEAMS FOR ALL CLASSES OF RAILWAY EQUIPMENT



## AUXILIARY SUPPORT FOR BRAKE BEAMS WITH SELF LOCKING—HEAT TREATED PINS

Meets all conditions and tests.
Slidably removable bar.
Pin locked in position
Bracket flanged over channel.
Single riveted to channel.
Made to fit any channel or bolster.



#### THE "BUFFALO" BOTTOM ROD SUPPORT

Meets all conditions and tests.
Loop held by friction.
Obstructions swing it clear.
No bending or binding.
Permitting free brake movement.
Folds up for channel removal.
Made to fit any channel or bolster.

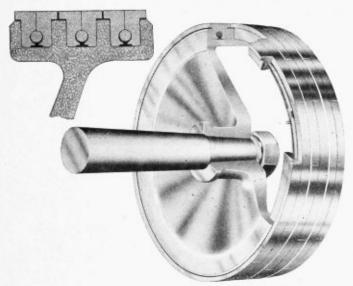
**NEW YORK** 

BUFFALO

HAMILTON, ONT.



#### THE UNIVERSAL SECTIONAL BULL RING AND PACKING RING

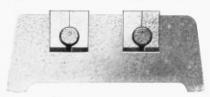


This is a section ring of "T" or other cross section which performs the double function of carrying the weight of the piston as well as furnishing the packing element. The ring is expanded by a high temperature heat resistant alloy steel spring. These rings may be made of electralloy metal or of alloy bronze, the latter being particularly effective under adverse cylinder conditions commonly found in "bad water" districts. The piston is of high tensile steel.

This type of piston is the standard piston on the largest railroads in the country.

#### The advantages of this design are:

- Reciprocating weight of the conventional piston is reduced by nearly one half.
- 2. Elimination of the riveted connection between piston and bull ring in the conventional piston.
- 3. Simplicity of renewal.
- 4. Bull ring and packing ring maintenance reduced some 50%.

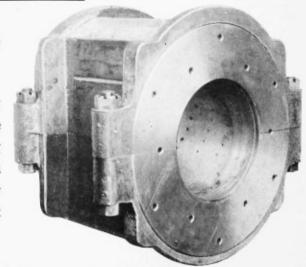


#### THE UNIVERSAL CYLINDER PACKING RING

This is a sectional ring of electralloy metal adaptable to any piston. It wears three or four times as long as a snap ring and is tighter.

## FLOATING BUSHING, DRIVING AND ENGINE TRUCK BOXES

The floating bushing principle applied to driving boxes increases mileage and reduces maintenance as the bearings may be renewed without dropping wheels and a full circle bearing is provided. On engine truck boxes, the bearings run infinitely longer than conventional bearings and the cost of lubrication is much less.



## THE LOCOMOTIVE FINISHED MATERIAL COMPANY

ATCHISON, KANSAS

## PRECISION OPERATION

# ESSENTIAL WITH IMPROVED DESIGN

THE benefits of increase in size and improvement in detail and design of locomotives are largely lost unless accompanied by greater nicety of operation.

For a century locomotive design progressed but the old methods of locomotive operation remained unchanged.

The

# OCO VALYE PILOT

by the application of scientific principles, has brought the art of locomotive operation to a par with one hundred years of advance in locomotive design.

#### VALVE PILOT CORPORATION

230 Park Avenue

New York, N. Y.

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IN 100 YEARS OF LOCOMOTIVE PROGRESS



# is speeding up the NEXT Century of Progress

THE Egyptian line of Railroad Lacquers fits your schedule, budget and working conditions like a glove.

For instance—Take our No. 32 Railroad Lacquer Enamel Black. It is a glossy jet black ideally suited for locomotive finishing when used over the proper Egyptian undercoats.

It wears longer than an oil base locomotive paint—is easier to clean at terminals—and frequent cleanings tend to increase the gloss.

It is easy to spray and dries for re-

coating in one hour and it cuts finishing schedules in half.

We make a complete line of finishes for interior and exterior use on all types of railway equipment including Pullman Green and all standard shades for passenger cars. The durability of Egyptian has been proved under the most severe tests of weather and temperature.

When building new equipment or refinishing old, try doing it in half the time —with Egyptian. The services of one of our finishing experts is at your disposal.

#### THE EGYPTIAN LACQUER MANUFACTURING COMPANY

90 WEST STREET, NEW YORK

Branches in charge of practical men maintained in:

ATLANTA CINCINNATI KANSAS CITY SAN FRANCISCO BOSTON CLEVELAND LOS ANGELES SEATTLE BUFFALO DALLAS PHILADELPHIA SPOKANE CHICAGO DETROIT PORTLAND, ORE. ST. LOUIS

The Maker Who is PROUD of What He Makes, USES EGYPTIAN LACQUER.



# The Edna Universal Locomotive Lubricating System

T HIS mechanical lubricating system, developed by The EDNA Brass Manufacturing Company, provides for the automatic, forced-feed lubrication of almost every working part of a locomotive from one central location!

Note the accompanying illustration. Valves, cylinders, air-pump, feedwater pump, stoker and booster engines are supplied with valve oil, while hubs, shoes and wedges, guides, front end main rod bearings, chaffing irons, boiler pads, flanges and other parts are furnished with a suitable heavy lubricant—all from one EDNA Duplex Forced-Feed Lubricator.

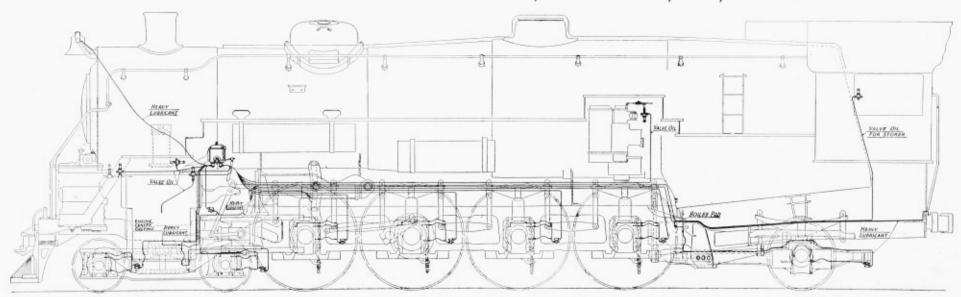
Valve oil and heavy lubricant are positively and automatically supplied to the exact points where needed as shown below, or if so desired, separate lubricators—one for valve oil and one for heavy lubricant—can

be applied with equal success. Either arrangement insures the continuous and thorough lubrication of working parts under all operating conditions.

Numerous locomotives, in all classes of service, are now equipped with the EDNA Universal Lubricating System. Each installation provides unquestionable proof that maintenance savings of outstanding importance are effected. One EDNA-equipped Santa-Fe type engine has made 75,000 miles and its lateral is still well within allowable limits. Furthermore, 7,000 miles were covered before it was necessary to close the front end main rod bearing, and then only to the extent of 1/32 inch.

All reports demonstrate conclusively that the EDNA Universal System reduces engine failures, eliminates many expensive maintenance jobs, and greatly assists in keeping locomotives in continuous service.

### THE EDNA BRASS MFG. CO., Cincinnati, O., U. S. A.



# Years add experience not age

This year the Baldwin Locomotive Co. is completing its hundredth year of service to railroads.

Few are the American industries that can trace a lineage so long. Fewer still are those that have played so vital a role in making the America of today out of the uncharted wilderness of 1831.

A full century! In the life of a man it is a long time, but not in the life of a great industry when each passing year—instead of bringing closer the threat of decay—adds experience, knowledge, and larger resources with which to translate them into greater achievements.

Perhaps, better than most, Crane Co. can appreciate the full significance of this. Last year it completed its seventy-fifth year of service. Time enough to realize in its own growth the value of years when the spirit born of the founder, conceived of a passion for progress and dedicated to the maintenance of the highest standards is preserved from generation to generation . . . When the achievements of the past form a firmer foundation for the determination of carrying on the same high traditions in modern times and in the future.

Values & CRANE & Fittings

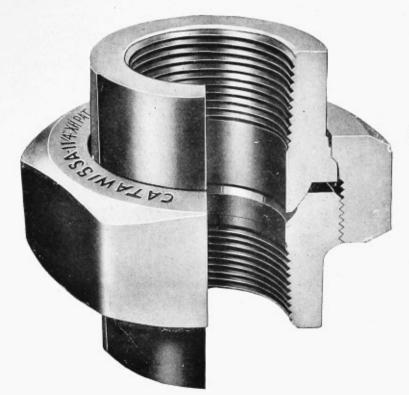
PLUMBING AND HEATING MATERIALS

CRANE CO., GENERAL OFFICES: 836 SO. MICHIGAN AVE., CHICAGO NEW YORK OFFICES: 23 W. 44TH STREET

Branches and Sales Offices in Two Hundred Cities

## "CATAWISSA" FORGED STEEL UNIONS

Forged from solid steel bars



Withstand highest pressures and temperatures



Inserted Seats Are Locked In

### FORGED STEEL FOR SAFETY AND EFFICIENCY

Strengthen the Weak Links In Steel Pipe Lines

Catawissa Forged Steel Unions Are Masters of the Highest Pressures and Temperatures and Are the Logical Connection for the Extra Heavy Pipe Used in the Construction of Modern Locomotives.

Sold Throughout the World

MADE BY



"Catawissa"

THE CENTRAL FORGING COMPANY CATAWISSA, PA., U. S. A.

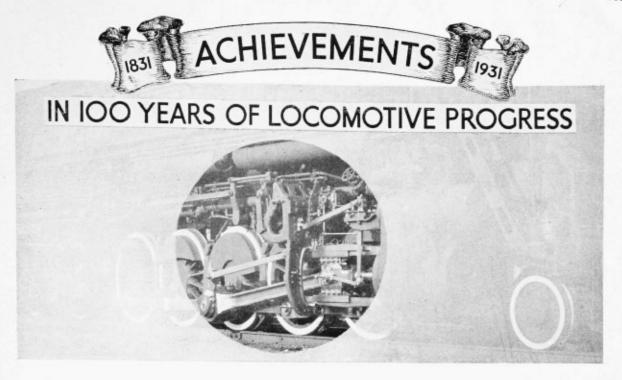
Pioneers of the Forged Steel Union



"Catawissa"







# BAKER VALVE GEAR

Increases Locomotive Efficiency Reduces Fuel Consumption Lowers Maintenance Costs. Over 14,000 In Service On All Types of Power Including Some of The Largest and most Powerful Locomotives Ever Built.

## THE PILLIOD COMPANY

VALVE GEAR SPECIALISTS

MANUFACTURERS OF BAKER, SOUTHERN & YOUNG GEARS

30 CHURCH ST.

NEW YORK, N. Y.



### For Lower Operating and Maintenance Costs

BECAUSE one modern Crosby Locomotive Safety Valve, with more capacity than several valves of the older types, can be maintained in perfect working order at a fraction of the upkeep cost of one older valve—

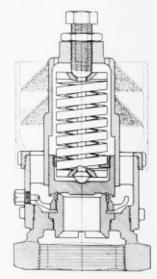
Because low blow-down assures the highest possible operating economy—

Because Crosby Locomotive Safety Valves, with their renewable seats and discs of forged chrome-nickel steel are practically indestructible—

Because every part is interchangeable, permitting the highest type of equipment standard-

ization in your shops-

And because these modern valves are always dependable in operation, there is ample reason for their adoption on new equipment and as replacements on existing locomotives.



Sectional View of Crosby Locomotive Safety Valve,

#### CROSBY STEAM GAGE & VALVE COMPANY

Indicating Gages, Blow-Off Valves, Chime Whistles, Indicators, etc. for Locomotives

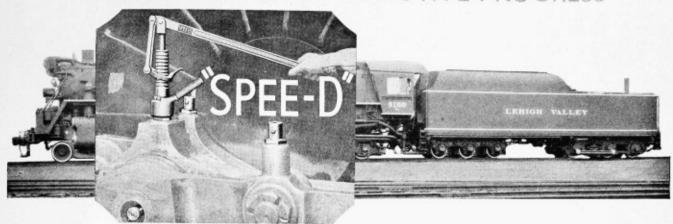
BOSTON, NEW YORK, CHICAGO, LONDON

CROSBY



**SAFETY VALVES** 





# High Pressure Lubrication of Locomotive Side Rods

THE lubrication of connecting rod bearings was for many years a problem. The old screw plug method was unsatisfactory and very expensive. Failures, delays and costs increased with the development of the locomotive.

The "SPEE-D" High Pressure Method was introduced five years ago. How well it solves the problems of lubricating rod bearings on modern power is best answered by the fact that today it is used by 40 leading railroads.

Maintenance records show a big savings in engine terminal preparation costs. One large terminal is saving \$10,000.00 per year on labor alone.

The loss of grease plugs has been eliminated, also the frequent re-tapping of rod cups. Hot bearings have ceased to be a problem. The big savings in maintenance costs justify application to every locomotive worth operating.

Has your road made a test?

RELIANCE MACHINE & STAMPING WORKS, Inc.

Agents and Representatives

11. C. MANCHESTER, 3736 Grand Central Terminal, New York City CONSOLIDATED EQUIPMENT COMPANY, Montreal MUMFORD MEDIAND, LTD., Winnipeg INTERNATIONAL RAILWAY SUPPLY COMPANY, 30 Church St., New York City A. L. DIXON, 325 W. Onto Street, Chicago, Ill.

Saves Time, Labor, Grease and Plugs"

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# 100 Years of Publishing Ser

## Back in 1832 . . .

A T the time Matthias W. Baldwin was building "Old Ironsides," the publication that is now Railway Mechanical Engineer published its first edition. This publication, then known as the "American Railroad Journal", was one of the earliest chronicles of railway activity.

In its January 19, 1833, issue, this publication gave an account of Mr. Baldwin's activity and the performance of "Old Ironsides", which follows in part:

"The extraordinary speed and power of the locomotive on the Germantown Railroad, should excite more attention than it has obtained from the enlightened community in which it has been made. It is the more remarkable because it is in many points original, and because it is the very first working engine of the locomotive kind made by Mr. Baldwin, and yet it has surpassed in fleetness and proportional working power, any engine of whose performance we have been able to find any authentic account."

It further stated, with regard to the trial trips, "Mr. Baldwin made the engineer cut off the steam entirely, to check a career which he feared might become too great for the strength of the road, or the tenacity of the parts of the locomotive . . . . No inconvenience was felt by the passengers; but a stiff breeze was produced by the quick motion through the air so as to endanger the security of the hats".

From that early day, the locomotive steadily improved, and in 1856, Mr. Baldwin built the "Tiger", a passenger locomotive with link motion valve gear. In this year, the publication that is now the Railway Age first came into existance as the "Western Railroad Gazette", a name which was later changed to the "Railroad Gazette". Then, in 1876, another publication, the Railway Age, was started, to meet the growing needs of the railway industry for information and news. Both of these publications developed steadily and in 1908 were con-

# Simmons-Boardman

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Railway Age Railway Engineering and Maintenance Railway Signaling Locomotive Cyclopedia Car Builders'

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# Ser vice to the Railway Industry

solidated under a combined name, which in 1918 became the present Railway Age.

With the continued growth and the departmentalization of the railway industry, the need for a specialized publication for each branch of railway activity became apparent. For some time the Railway Age had devoted certain issues each month to specialized departmental railway problems, and finally during the years 1910 to 1916, the present Railway Service Unit was developed, comprising five railway publications, each devoted to a definite phase of railway activity . . . Railway Age, Railway Mechanical Engineer, Railway Engineering and Maintenance, Railway Electrical Engineer and Railway Signaling.

Coordinated with this century-old publishing service to the railway industry are three railway reference volumes. The oldest, the Car Builders' Cyclopedia dates back to 1879; the Locomotive Cyclopedia was started in 1906; and the Railway Engineering and Maintenance Cyclopedia was first published in 1921.

Thus, from the beginning of steam railway history, Simmons-Boardman railway publications have served the railway industry. Of their many notable contributions to railway progress, some now historic, others more recent or still being made, the following will long be remembered: the fight for the standard gage track; the fight for the automatic car coupler; the fight for the return of the railways to their owners prior to the enactment of the Transportation Act of 1920; and the present fight for fair treatment for the railways.

It is through this conscientious, specialized service, that these publications have become recognized the world over, as the outstanding authorities on railway matters.

> Simmons-Boardman Publishing Company New York 30 Church Street,

105 West Adams Street, Chicago Washington, D. C.

Terminal Tower, Cleveland San Francisco

Railway Age Railway Engineering Maintenance Railway Electrical Engineer Railway Signaling Railway Mechanical Engineer

# Railway Publications

Cyclopedia Railway Engineering and Maintenance Cyclopedia

Railway Mechanical Engineer

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ALL A.B.P.

intenance

nan

Builders

### INDEX TO MANUFACTURERS

#### (THIS SECTION)

American Arch Company-98

Amer. Brake Shoe & Fdy. Co.-153

American Steel Foundries-96-97 Clasp Brakes, Castings, Couplers, Roller Bearing Units, Springs

American Throttle Co.-73

Ardco Mfg. Company—150 Cylinder Cocks; Automatic Drifting Valves

Ashton Valve Co.-152

Armco Railroad Sales Co.-74

Iron and Steel Bars Locomotive Jacket Sheets Wrought Steel Wheels

Baldwin Locomotive Works-11 to 33

Baldwin-Southwark Corp —50 to 55 Presses & Hydraulic Machinery Testing Machines

Baldwin-Westinghouse-34 to 41 Electric Locomotiv

Barco Mfg. Company—94-95
Engine Tender Counctions
Flexible Joints
Low Water Alarms
Power Reverse Gear

Bettendorf Co., The-148

Steel Bolsters Steel Castings Steel Truck Side Frames Tender Trucks

Bethlehem Steel Co.-126

Auxiliary Locomotive Steel Castings Boiler Charcoal Iron Tubes Locomotive Wheels

Bird-Archer Co., The-127 Blow-Off Cocks Boiler Chemicals Feed Water Heater Systems Locomotive Water Conditioners

Bradford Corporation-128

Bolsters Drait Gears Throttle Valves

Buffalo Brake Beam Co.-155 Brake Beams Bottom Rod Supports & Brake Pina

Byers Co., A. M.—107 Wrought Iron Pipe Wrought Iron Products

Cardwell-Westinghouse Co.-154

Carey Co. Philip-139 Lagging Pipe Coverings

Central Forgings Co.-161

Forged Steel Unions Champion Rivet Co.—134

Coffin Jr., Co., J. S., The-120 Feed Water Heater Systems

Crane Co.-160 Locomotive Fittings Valves

Crosby Steam Gage & Valve Co .- 164

Dardelet Threadlock Corp.-136

Davis Brake Beam Co.-151 Brake Beams Brake Beam & Bottom Rod Supports

Edgewater Steel Co.-99

Strel Tires Rolled Steel Wheels Draft Gears

Edna Brass & Mfg. Co.-159

Egyptian Lacquer Mfg. Co.-158

Elec. Storage Battery Co.-112-113 torage Batte

Ewald Iron Co.—106 Iron & Steel Bars Iron Staybolts

Firebar Corp.-88-89

Flannery Bolt Co.-132 Staybolts Staybolt Testers

Franklin Railway Supply Co.-84-85

Boosters
Lateral Motion Driving Box
Driving Box Lubricators
Pneumatic Firedoor
Tandem Main Rod Drive
Automatic, Adjustable Wedge
Power Reverse Gears
Limited Cut-off

Garlock Packing Co.-104-105

Fibrous, Sheet & Metallic Packings Front End Tape

General Railway Signal Co.-100-101 Cab Signals Train Control Systems

General Refractories Co.-145

General Steel Castings Corp.-62-63

Steel Castings Engine, Trailer & Tender Trucks Integral Locomotive Bed Water Bottom Tender Frame Globe Steel Tubes Co.—141

Steel Boiler Tubes Seamless Steel Tubing

Griffin Wheel Co.-103

Hanna Stoker Co.-122

Hoofer Mfg. Co.-138

Hunt-Spiller Mfg. Corp.-108-103

Gun Iron & Castings Cylinder & Valve Ring Packing Sectional Packing International Nickel Co.-123

Johns-Manville, Inc.-92-93

Lagging Packing Pipe Covering

Keasby & Mattison Co .- 144

Cab Curtains Lagging Packing Pipe Covering

Loco. Finished Material Co.-156 Driving and Engine Truck Box Bushings

Castings Cylinder & Valve Ring Packing Locomotive Firebox Co.—80-81 Spark Arresters Locomotive Boiler Syphon

Magnus Company—149

Journal Bearings

Brass & Bronze Castings

Manganese Steel Forge Co.—140 Rolled & Forged Steel Products Midvale Co., The—56 to 59

Axles Steel Castings

Milton Mfg. Company-142

Miner, Inc., W. H .-- 79

Nat. Malleable & Steel Castings Co. -114-115

Couplers Draft Gears Extended Floor Pockets Journal Boxes

Neely Nut & Bolt Co.—129

Ohio Steel Foundry Co.-124

Steel Castings Bolsters, Crossbeads, Cylinders, Driving Wheels, Main & Side Frames

Okadee Company-118 Okadee Company—110
Automatic Cylinder Cocks
Hose Couplers
Blow-Off Muffler
Valves
Water Glass Protectors
Okonite Co., The—125
Insulating and Friction Tape
Wire & Cables
The—16

Pilliod Company, The-163

Pilot Packing Co.—135 Semi-Metallic & Fibrous Packing Drifting Valves

Prime Mfg. Co., The —162 Drain & Cylinder Cocks Oil & Grease Cups

Lubrication Systems
Washout Plugs
Tank Hose Strainers
Cab Windows & Windshield Wings
Pyle-National Co.—133

Electric Headlights Turbo Generators Wiring Appliances

Q & C Company—116-117 Grate Bars

Lubricator Railway Steel Spring Co.—110-111 Journal Box Lids Springs Steel Tires Steel & Steel Tired Wheels

Reading Iron Co.-170

Bar Iron
Wrought Iron Pipe
Charcoai Iron Boiler Tubes
Reliance Mach. & Stamp. Wks.—165
High Pressure Rod Cup Lubricating Systems

Republic Steel Corp.-86-87

Alloy Steel Boiler Tubes Steel Castings Staybolts

Ryerson & Son, Jos. T .- 102

S K F Industries, Inc.-75 to 78 Ball Thrust Bearings Journal Roller Bearings Sellers & Co. Inc., Wm.—68-69

Sellers & Co.
Steam Injectors
Check & Regulating Valves
Exhaust Feedwater Heater
Shafer Bearing Co.—147

Standard Steel Works Co .- 42 to 49

Steel Castings Forgings Springs

Steel Tires Steel & Steel Tired Wheels Sunbeam Electric Mfg. Co.—131

Electric Headlights Turbo Generators Wiring Appliances Superheater Co .- 70 to 72

Feed Water Heater Systems Exhaust Steam Injectors Superheaters

Standard Stoker Co., Inc.-82-83

Thomas Grate Bar Co.-137

Timken Roller Bearing Co.-90-91 Journal Roller Bearing

Union Asbestos & Rubber Co.-130 Asbestos & Rubber Packing Pipe Covering

Union Steel Casting Co.-121 Steel Castings Crossheads, Cylinders, Frames & Driving Wheel Centers

Union Switch & Signal Co.—66-67 Cab Signals Train Control Systems

Valve Pilot Co.—157 Speed Indicators & Recorders

Vanadium Corp. of America-146

Vapor Car Heating Co.-143

Steam Fittings Heating Systems Flexible Joints Regulating Valves

Viloco Railway Equipment Co.-119 Bell Ringers Exhaust Pipe

Packing Sanders & Railwashers Pneumatic Whistle Operator

Westinghouse Air Brake Co.-64-65 Air Brake Systems Air Brake Packing

Westinghouse Elec. & Mfg. Co .-34 to 41 Electric Locomotives

Whitcomb Locomotive Co., The-60-

Gas-Electric Locomotives Worthington Pump & Mchy. Corp. -169

Diesel & Gas Engines Feed Water Heater Systems

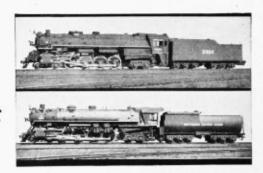


# The 1930 Story of WORTHINGTON HEATERS



Four representative road locomotives built during 1930 by The Baldwin Locomotive Works and fitted with Worthington Open Type Feedwater Heating Equipment

## on Baldwin Locomotives



91% of the road locomotives built by Baldwin in 1930 were equipped with feedwater heaters. Here is convincing evidence that exhaust steam heating of feedwater is recognized as essential in modern locomotive practice.

65% of the locomotives so equipped were fitted with Worthington Open Type Feedwater Heaters. And *here* is significant proof of the acceptance of the open type principle and of the position that Worthington equipment and Worthington service have earned in this field.

Bulletin W-220-B2 contains interesting data on the performance of the heaters. May we send you a copy?

WORTHINGTON PUMP AND MACHINERY CORPORATION

Works: Harrison, N. J. Cincinnati, Obio Buffalo, N.Y. H Executive Offices: 2 Park Avenue, New York, N.Y. GENERAL OFFICES: HARRISON, N. J.

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H-52

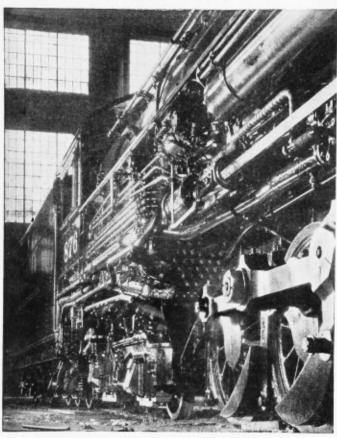
#### PUMPS All Sizes... All Types For All Services Any Capacity ... Any Pressure COMPRESSORS Stationary and Portable CONDENSERS and Auxiliaries DIESEL ENGINES GAS ENGINES FEEDWATER HEATERS WATER, OIL and GASOLINE METERS MULTI-V-DRIVES ROCK DRILLS AUTOMATIC HEAT TREATING MACHINES FOR DRILL STEEL FORGING FURNACES FOR DRILL STEEL DRILL STEEL ACCESSORIES

CHROMIUM PLATING

Citerature on request

WORTHINGTON

# An 83-Year-Old Youngster Salutes a Century-Old Comrade!



A New Baldwin Locomotive Piped by Reading

#### READING PRODUCTS

Reading Puddled Iron Pipe, Nipples and Couplings, Reading Charcoal Iron Boiler Tubes, Reading Old Hickory Bar Iron and Blooms, Reading Cut Nails.

We recommend Old Hickory Bar Iron and Blooms for:

Staybolts

Engine Bolts

Stud Bolts

Spring Bands Equalizers

Draw Bars

Coupler Yokes

Brake Rods

Hand Rails and Steps

Chain

Rivets

CINCE the days of high "smokestacks" and primitive "cow-catchers", the Reading Iron Company has been proud of its part in the marvelous panorama of locomotive progress.

For 83 years, Reading has marched side by side with the development of rail transportation. For 83 years, Reading products have helped to make such transportation safer, more dependable and more economical, riding the rails as part of those iron steeds that have carried the name of Baldwin around the world. Today, Reading Puddled Iron Pipe, Reading Old Hickory Bar Iron and Reading Charcoal Iron Boiler Tubes are increasingly first choice wherever metal must endure.

Reading salutes Baldwin, its 100-year-old comrade, offering hearty congratulations on a century of high achievement.

#### READING IRON COMPANY

READING, PENNSYLVANIA

Atlanta, Baltimore, Boston, Buffalo, Pittsburgh, Cincinnati, New York, Detroit, Houston, St. Louis, San Francisco, Seattle, Chicago, Philadelphia, Tulsa, Los Angeles, Kansas City.

Old Hickory Bar Iron is furnished in the following sizes: Rounds 1/2" to 41/2" in diameter. Squares 1/2" to 4". Flats 1" x 1/4" x 2". Half rounds %" to 1½". Hexagons %" to 1¾" inclusive.

## READING IRON COMPAN

Science and Invention Have Never Found a Satisfactory Substitute for Genuine Puddled Iron

# ANNOUNCEMENT

THE Baldwin Locomotive Works has acquired the subsidiaries of Cramp-Morris Industrials, Inc. Included in the purchase are:

I. P. Morris and De La Vergne, Inc.; De La Vergne Engine Company; Cramp Brass and Iron Foundries Company, all of Philadelphia; Federal Steel Foundry Company, of Chester, Pa., and Pelton Water Wheel Company, of San Francisco. This acquisition marks another step in the Baldwin program of diversifying its activities.

The policies of conducting extensive research and experimental work which have always been important factors in the development of the products of these companies will be carried on with increased facilities under Baldwin management. Where practicable, the machinery and assets of the acquired companies will be moved to the Baldwin shops at Eddystone.

I. P. Morris & De La Vergne, Inc., represents a consolidation of the I. P. Morris Company and the De La Vergne Machine Company. It has enjoyed an international reputation for the construction of hydraulic turbine machinery. De La Vergne Machine Company was one of the first concerns in the United States to develop Diesel engines and has for many years designed and constructed refrigerating machinery.

Pelton Water Wheel Company designs and constructs hydraulic turbine machinery and valves in its plant located in San Francisco.

Federal Steel Foundry Company specializes in high grade commercial steel castings.

Cramp Brass & Iron Foundries Company operates a cupola iron foundry, an electric iron foundry, and one of the largest brass foundries in the United States.

