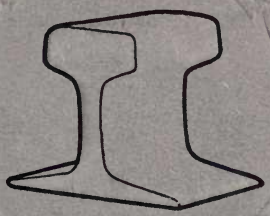
THE RAILWAY RAIL



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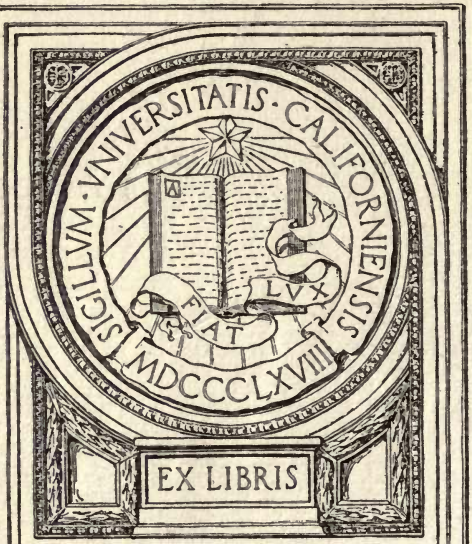

Origin and Development of THE RAILWAY RAIL

English and American Wood, Iron and Steel

By
G. P. Raidabaugh

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THE RAILWAY RAIL

INTRODUCTION

THIS article is condensed from a much larger work which I began a number of years ago for the purpose of finding the cause of the large number of different rail sections in use, and with the thought that we might learn something of the rail and its service that would be of advantage in the designing of rolls.

Since the very beginning of man's existence he must, of necessity, have had some means of transporting both himself and material for his use. This at first consisted of what he was able to do by the aid of his body and physical exertion. No doubt the first effort to improve this condition came 'way back in the ages, long before the written history of man, when some primitive man in his efforts to make for himself and mate a home, conceived the plan of placing a round section of a small tree under a stone or other obstruction to lighten the burden of its removal. Thus was made the first step toward the production of the wheel and axle, the basis of all successful land transportation.

The next step was taken by some prehistoric genius who, in an effort to still further lighten his burdens, with infinite patience and labor, produced a pair of rough wheels by either burning or cutting them from the trunk of a large tree and piercing them with holes for an axle. Thus, step by step, improvements have been made from the roller and primitive cart and rough trails of our cave ancestors to the wonderful railroads and palatial cars of today. We have become so accustomed to their use and presence that few stop to consider their origin and history and the influence they have contributed to the progress and happiness of mankind.

THE RAILWAY RAIL

Today we are more in need of transportation facilities than at any other time in the history of the world.

As is well known, all the products of nature do not exist at the place where they are consumed, but must be transported to and from the place of manufacture before they can be used for man's wants. This makes man dependent upon the means of transportation at his command.

This is probably best illustrated by the late Otis Tufton Mason, Curator of the Department of Ethnology, U. S. National Museum, who in one of his reports on primitive travel and transportation describes the first sleeping car by a picture of an Indian woman with a sleeping baby slung upon her back. When we compare this picture with our modern sleeping cars, we have a most vivid and lasting impression of what the rail and railway have accomplished for the welfare of man.

This great advance is the aggregate of many years' thought, labor, ingenuity, and inventive skill of man. And the rail, which is no doubt the most potent factor in this great advance, has passed through many changes in form and methods of manufacture. From the very beginning of railway development, the railway men have never been able to make any great or permanent advance until the rail had first been improved to a point where it would withstand the additional work imposed upon it by the increased speed and traffic. Today the need of still further improvement in the way of heavier sections and improved form is more acute than at any time in its history.

In this brief history of the rail I have not attempted to enter to any great extent into why and how the changes in the form of the rails were made, space not permitting.

There are no doubt many who could have gotten this history up in a much better form than I have done, and my only excuse is, they have not done so.

I am very thankful to the many friends who have so willingly aided me in obtaining the desired information.

GEORGE P. RAIDABAUGH.

THE RAILWAY RAIL

RAILWAYS as we know them, first came into use about two hundred years before the introduction of the steam locomotive, or about the year 1600. The collieries in the north of England made use of wooden rail tram or wagon ways for the purpose of reducing the labor of hauling coal from the pit's mouth to the place of shipment.

They consisted at first simply of rough pieces of timber imbedded in the roadway in such a manner as to make a tolerably smooth track for the wheels of the carts or wagons. Later sleepers with wooden rails were used, as shown in Fig. 1, R-1.

With this arrangement, the removal of a broken or worn-out rail injured the sleeper in consequence of the peg holes

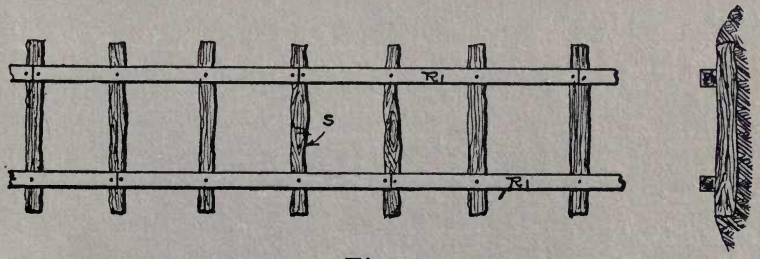


Fig. 1

becoming too large. This condition was improved by nailing an upper rail, Fig. 2, R-2, on the lower rail, R-1, so

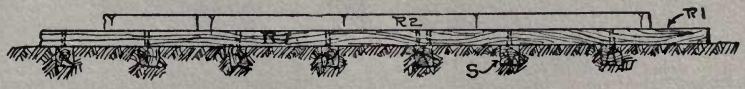


Fig. 2

the upper rail could be frequently renewed without injury to the sleepers, S.

From descriptions that have come down to us of these old tramways, we learn that the benefit to be derived from the use of iron as track was known as early as 1600, as the following abstract from an early writer proves: "When the draft was harder than usual in consequence of a steep ascent or a sharp curve in the line, friction was diminished by nailing to the wooden rails thin strips or plates of malleable iron." (See Fig. 3.) But we should remember

Fig. 3

that at that time these strips could not have been other than roughly forged, such as today would be consigned to the scrap pile.

Another writer in 1672 describes a wooden railway which he had seen at Newcastle, England, as follows: "The manner of the carriage is by laying down rails of timber from the colliery to the river, exactly straight and parallel, and bulky carts are made with rowlets fitting these rails whereby the carriage is so easy that one horse will draw 4 or 5 chaldrons of coal" (8 or 9 tons).

These old wooden tramways continued in use for more than 150 years without any further improvements, and it promises to be a very interesting study to trace the development of the railway rail from these crudely forged plates of malleable iron which went into use over 250 years ago, to the highly finished and well shaped rail of today.

During the period that intervened between these wooden tramways and the introduction of iron rails there were several attempts made to use stone rails instead of the wooden ones. It was soon found, however, that what the stone ways gained in durability they lost in smoothness.

THE RAILWAY RAIL

The first great advance toward our present system of railways was by the introduction of cast iron plates upon the wooden rails. This advance, one of the early writers tells us, was the result of accident rather than of design: "About the year 1767 when the price of pig iron was very low, it occurred to the proprietors of the Colebrook-Dale Iron Works, as a means of keeping their furnaces at work, to cast bars in such a form as to admit of their being laid down on a wooden railway in use at the works. This, it was thought, would save the expense of repairs to the railway, but if a sudden rise should take place in the price of iron, the rail (see Fig. 4) could be taken up and sold as

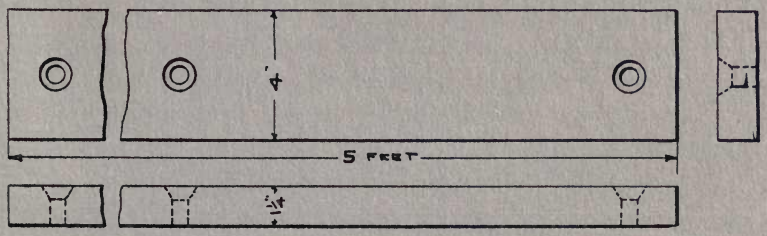


Fig. 4

pig iron. These plate rails were 5′ long, 4″ wide and 1¼″ thick. They were cast with three countersunk holes in them for convenience in nailing them to the wooden rails."

The road was said to be successful, and it was pointed out as an advantage (which we would now consider to be a great misfortune), that vehicles could be turned off the track with great ease in consequence of the absence of a guiding flange.

Plate rails later, when wrought iron came into use, were called "strap rails," and continued in use, to some extent at least, for about 100 years.

About 1776 the Colebrook-Dale rail was improved by the addition of an upright flange (Fig. 5) rising 3″ above the path of the wagon wheels. These rails were laid upon cross sleepers with the flanges turned inward. The design was

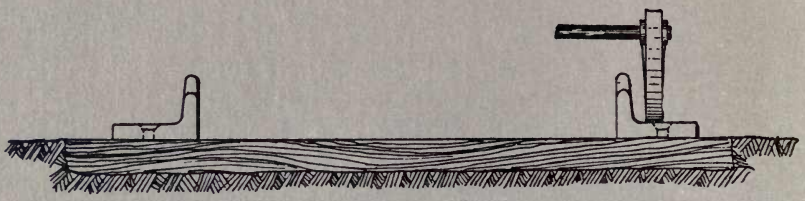


Fig. 5

still further improved in 1793 by the addition of brackets to support the flange, and ribs or beads cast upon the under side of the rail, to strengthen it between the stone supports. These stone blocks were 18″ to 20″ square and 8″ to 10″ deep. Fig. 6 shows end view of the rail as improved, also the manner of securing the rails to the blocks. This was

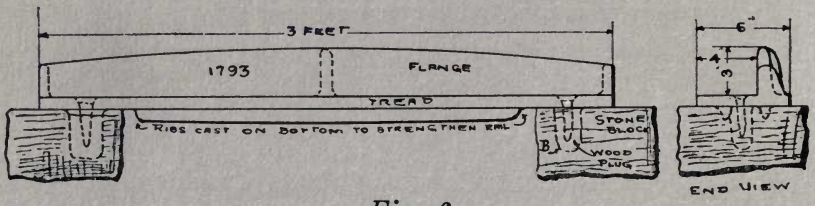


Fig. 6

done with spikes driven into hard wooden plugs which were inserted in the holes B in the stone blocks. However, rails of this construction did not prove to be satisfactory, as stones and dirt would accumulate upon the tread of the rail. This caused much friction and when higher speeds were required, tended to throw the carriage off the line.

A number of these old rails are in the Baltimore and Ohio Railroad Company's collection of old railway appliances.

The defects of the Colebrook-Dale rails were remedied by the introduction of edge rails. Fig. 7 shows one of the earliest types patented in England in 1789 by William Jessop. This is a "fish-bellied" rail and was supported

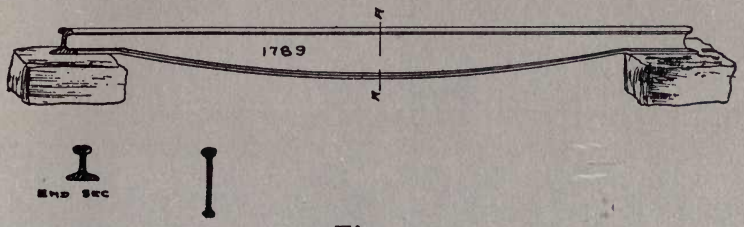


Fig. 7

upon stone or wooden blocks, the rails having a flat base for a short distance at each end where they rested upon the blocks to which they were secured in the same way as the plate rail.

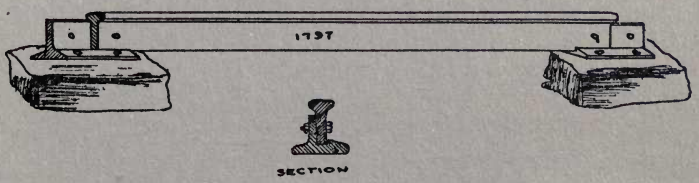


Fig. 8

A cast iron rail used in 1797 (Fig. 8) was supported by cast iron chairs, which are said to be the first chairs adopted. The rails were secured by bolts through the stem of the rail, while the chairs themselves were spiked to the stone blocks or sleepers.

Another type of cast iron rail introduced in 1802 was cast 4′ 6″ long, and was of an oval section, the large diameter being vertical. (See Fig. 9, No. 1.) Beneath each end of the rail a dovetailed block, A, was cast, which fitted into

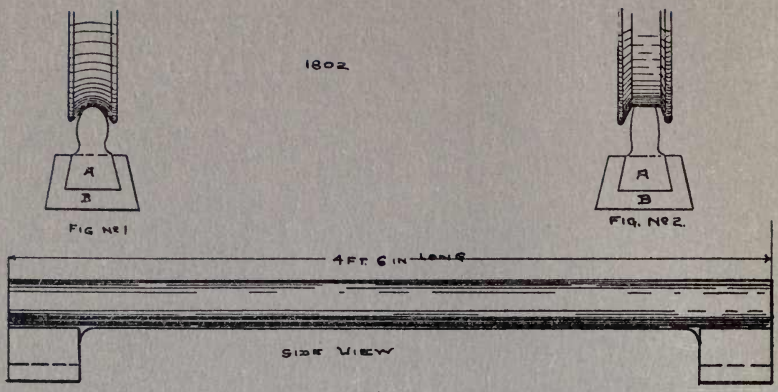


Fig. 9

a cast iron chair or sill, B, imbedded in the roadway. The wheel had a grooved tire fitting loosely on the rail. It was soon found, however, that the groove became so deepened by wear as to fit the rail tightly, thus causing much friction. An attempt was made to remedy this fault, by making the bearing surface of the rail flat and the wheel to correspond. (See Fig. 9, No. 2.)

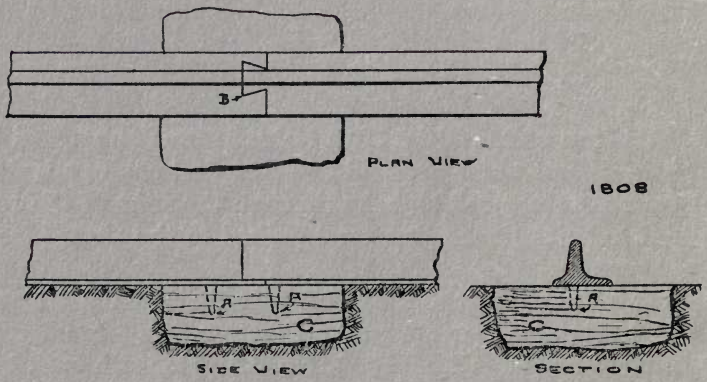


Fig. 10

Fig. 10 shows a cast iron rail designed in 1808 to be laid without the use of bolts or spikes. Pins at the point A were cast on the under side of the rail, at the ends where they rested upon the stone blocks C, in which holes were drilled to fit the pins. The joints between the ends of rails were made in a dovetailed form as shown at B, thus doing away with the necessity of bolts and spikes.

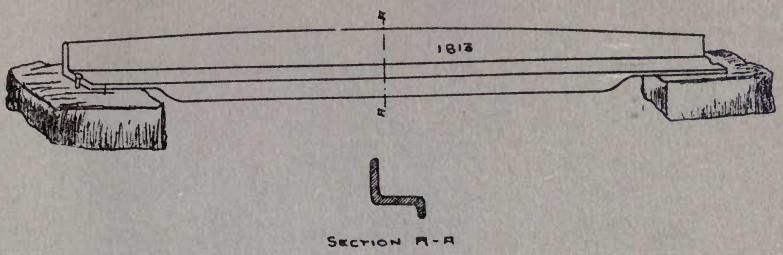


Fig. 11

A cast iron plate rail (Fig. 11) designed in 1813 had a curved flange with a bead cast on the under side and was secured to the stone blocks in the same way as shown in Fig. 6.

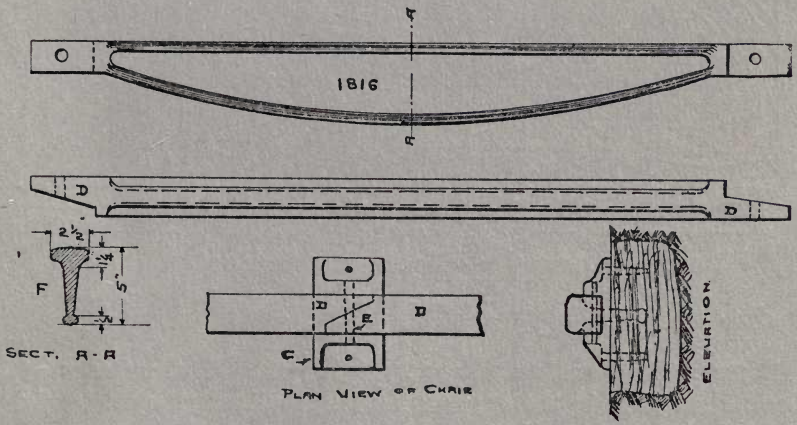


Fig. 12

In Fig. 12 we have a cast iron edge rail patented in England in 1816 by George and Losh Stephenson. Wm. Strickland, a prominent engineer of his day, describes this rail in 1826, after his return from a visit to England, as a "cast iron rail 4′ long, fish-bellied, 5″ deep at the center A, and 2″ deep at the ends D, D, where they rest in the chairs C. The ends were cast solid and formed to make a half lap joint D, secured in the chairs by pin E," which in some of the old prints of this rail and chairs, is shown to be wooden.

Cast iron rails were used for many years after this time. A patent was granted to John W. Bay, of Harrisburg, Penna., in 1844 for a cast iron rail to be cast with a bar of wrought iron in the head for strength.

About the year 1846 the three cast iron rails shown in Fig. 13 were proposed for use upon American railroads.

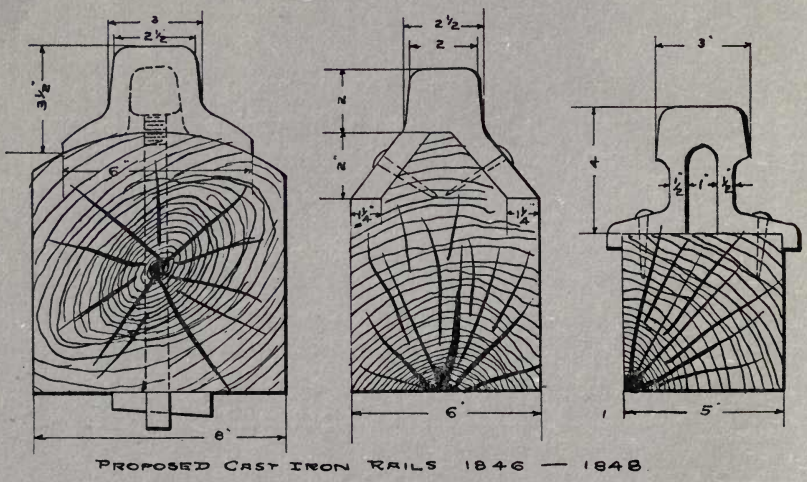


Fig. 13

These rails were to be cast 10 feet long. The manner of securing them in the track upon longitudinal sills is clearly shown by the drawing.

THE RAILWAY RAIL

We have not found that there were a great many of the cast iron rails used by our early American railroads, but we do know that a part of what is now a branch of the Northern Central Railway, running from Sunbury to Shamokin, Penna., was first laid with them.

The cast iron rails, however, were not without strong advocates, for as late as some time between 1846 and 1850, J. C. Trautwine, a prominent railway engineer of that time, recommended the use of cast iron rails upon a hundred miles of railway he was then constructing.

Rails of malleable iron of the square or flat form were first made and used in the years 1808 to 1811, this being the only form the rolling machinery of that time could produce. (See Fig. 14.)

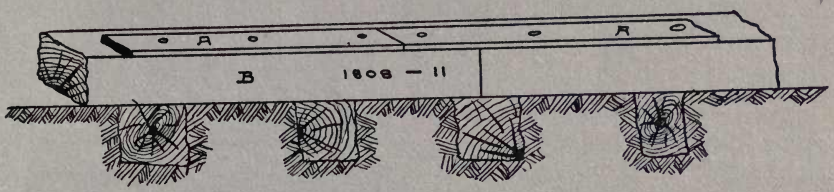


Fig. 14

These rails were flat or square bars of iron, shown at A, and were 2″ to 3″ wide and ½″ to ¾″ thick with holes drilled and countersunk for nailing them to the wooden rails B. Rails of this form continued in use in this country for many years, and are known in history as the "strap rail." One of our old folk-lore stories says, "If when hunting up the history of our ancestors we will go back far enough we will, no doubt, find one of them on a gallows." So with many of our great railroad systems of today, if they go back they will find a "strap" rail at the beginning of their history.

Fig. 15 is a section of track on the Baltimore & Ohio Railroad in 1831, showing long granite slabs substituted for the

wooden rails. These slabs were dressed to shape and the holes B drilled for securing the "strap" rails A. The rails were 2½" to 4½" wide and ½" to ⅝" thick. The granite stringers were laid in trenches partly filled with broken

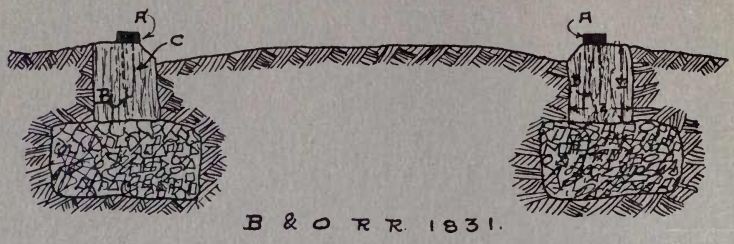
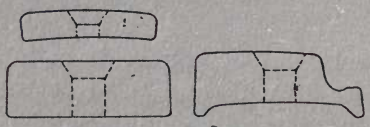


Fig. 15

stone. Several of these old stone stringers with the strap rails spiked to them may be seen at the National Museum, Washington, D. C.

In Fig. 16 are shown sections of some of the strap rail used on the Amboy Division of the Pennsylvania Railroad in 1831, previous to the introduction of the Stevens section,



STRAP RAILS USED ON AMBOY DIVISION 1831-1832

Fig. 16

now known as the "tee" rail. These drawings were made from sections of the rails preserved by the Pennsylvania Railroad Company at Broad Street Station, Philadelphia.

The flat or "strap" rail was the only form of rail that could be rolled upon American mills up to 1844, at which time there were probably more miles of track of this type laid in the United States than all others combined. These

rails were very imperfect and difficult to keep in the track, as will be seen by the following abstract from a New York paper of May 20, 1844. See Swank's "Iron in All Ages."

"RAILROAD CALAMITY

"The cars on the railroad a short distance east of Rome, New York, came in contact with a snake head on Saturday morning, which threw several of the passenger cars and the mail car off the track. * * * The crash was tremendous and the cars were torn to splinters."

When, owing to the constant wheel pressure, the "strap" rails would tear loose from the wooden sills (see Fig. 14) and follow the wheels, frequently with sufficient force to penetrate the car floor, they were called "snake heads."

As late as 1868, there were 4 miles of these rails laid upon wood stringers, on a branch of the Marietta and Cincinnati Railroad between Westborough and Hillsborough, Ohio, which, I believe, is now a part of the Baltimore & Ohio System.

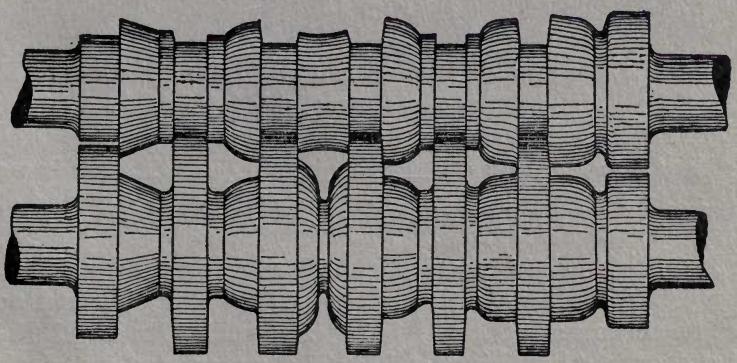


Fig. 17

Many attempts were made to form a cheap and durable rail by the combination of wrought and cast iron, but no plan was successful until about 1820, when the method of rolling iron into any required shape was introduced. With this improvement in the method of rolling, began the development of the wrought iron edge rail, the "Birkenshaw" being the first one rolled, a patent for which was granted to John Birkenshaw, of the Bedlington Iron Works, England, by the English Government, October 20, 1820, Patent No. 4503. The drawings here shown in Figs. 17 to 19 are copies from the plates accompanying the patent specifications which may be seen at the Patent Office, Washington, D. C. The set of rolls, Fig. 17, is no doubt the first ever made and used in the manufacturing of shaped wrought or malleable iron rails.

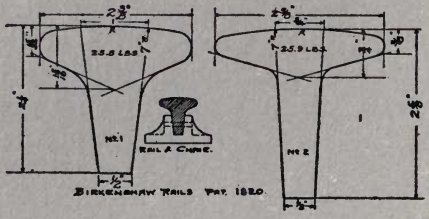


Fig. 18

Mr. Birkenshaw desired to roll the rails 18′ long to obviate the evils of the great number of joints in the line, and further proposed to weld the ends of the bars together as they were laid down. However, I do not think this was done, as I have found no mention of it in any of the old descriptions of this rail.

Mr. Birkenshaw showed considerable ingenuity in the designing of this, the first set of rail rolls, as it could not be much improved upon today for rolling bars of that shape on a "two high" mill. The upper surface of the rail was to be made slightly curved to reduce friction, and

was to be supported upon stone blocks and chairs, the joints to be secured with a pin. (See Fig. 18, Rail and Chair, No. 1.)

Figs. 18 and 19 show the four different sections of shaped rails as covered by the Birkenshaw patent. He says the wedge-shaped rails as shown by Nos. 3 and 4 are made in that shape because the strength of a rail is always proportioned to the square of its breadth and depth, hence the

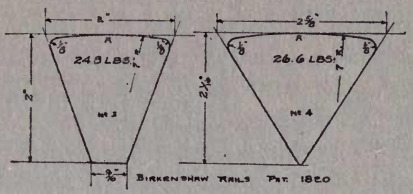


Fig. 19

wedge form of rail possesses all the strength of a cube equal to its square, but that the weight of metal used may be reduced still further and sufficient strength retained by forming the bars or rails as shown by Nos. 1 and 2. He further states in his specifications that he prefers the form as shown by No. 1. This rail (No. 1), which is the first rail ever rolled, was made some time between 1820 and

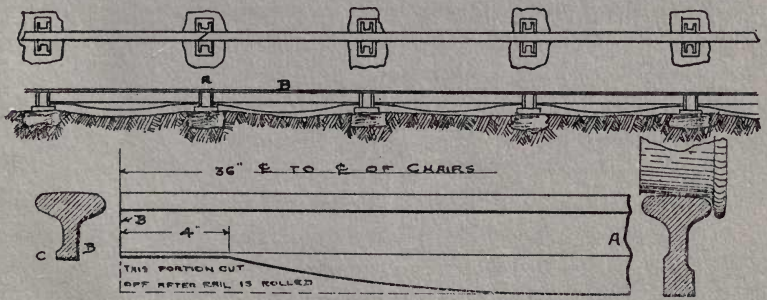


Fig. 20

1825. It was first used on the Stockton & Darlington Railroad, England.

By 1830 the Birkenshaw rail had become changed to the "fish-bellied" rail as shown by Fig. 20. These rails were 15′ to 18′ long, divided into 3′ fish-bellied spaces. They were rolled parallel and the metal sheared out to form the "fish-bellied" spaces. The lower drawing shows one-half of one of the spaces and section of rail at A and B.

When looking up the history of this rail the thought uppermost in my mind was why did they make the rail in this form, as it is a very difficult one to roll. From what I have learned about them there is no doubt that the "fish-bellied" rail came into use through the views held by some of the railway engineers of that day—that a railway should be of equal solidity at all points on the line, and because they believed the rail would be stiffer and more unyielding at the points where it rested in the chairs and was supported upon the stone blocks. For that reason it would be necessary in order to equalize the stiffness of the line to take some of the metal from the rail at those points.

Wm. B. Adams in a book published in 1862 states that the "fish-bellied" rail was a "mechanical error"; that it was a false basis to assume the sleeper and stone supports to be an unyielding fulcrum instead of a yielding point. This was soon discovered and the rail made parallel again.

In 1830 the Boston and Lowell Railroad was laid with this rail. One of the original rails laid upon that road with the cast iron chairs and wrought iron wedges for securing the rail in the chairs, is in the possession of the estate of the late Rufus K. Wood at Sparrow's Point, Md.

The next rail to come out was known as the "Clarance" rail. (See Fig. 21.) This is also an edge rail and was rolled as early as 1830. A number of our early American railroads were laid with this rail, among them the Boston & Lowell (one track), the Germantown and Norristown, and the Allegheny Portage. The rail here shown was taken

from a piece of one of the rails laid upon the latter road. A short section of this rail has been preserved by the Pennsylvania Railroad Company at Broad Street Station, Philadelphia. I also have a short piece of the rail that was laid on the Germantown and Norristown road in 1831.

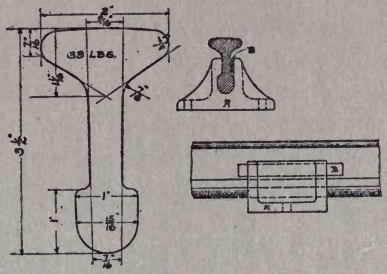


Fig. 21

This rail was said to be an improvement on the first Birkenshaw rail, as it could be secured in the shoes or chairs without the use of pins at the joints. The small drawing to the right shows the rail and chair. The rail was held in a vertical position by the thin iron wedge B, the lower projections on the rail preventing it from lifting.

It was later found that the driving of the iron wedge broke a great many of the chairs. This was remedied by changing the wedge side of the chair to take a wooden wedge about 1¼" thick, which soon became the permanent practice.

Between the time this rail came out and the year 1840 quite a number of designs and modifications of this rail were made and used. (See Fig. 28.)

THE ORIGIN OF THE TEE RAIL

The "tee" rail now in general use is an American invention. In September, 1830, the directors of the Camden and

Amboy Railroad instructed Robert L. Stevens, president and chief engineer of that road, "to visit England and report on railroad matters there," and directed him "to purchase all iron rails, which they preferred to the wooden rail plated with strap iron." (See Fig. 16.) A short time later Stevens sailed, and during the voyage he designed the first "tee" rail (see Fig. 22) with a base. It is said that Stevens designed this rail by whittling it out of wood until he got one to suit him. He was familiar with the English rails, saw that they required expensive chairs to hold them in the track, and knew that they were not adapted for use in this country, where iron was scarce and expensive.

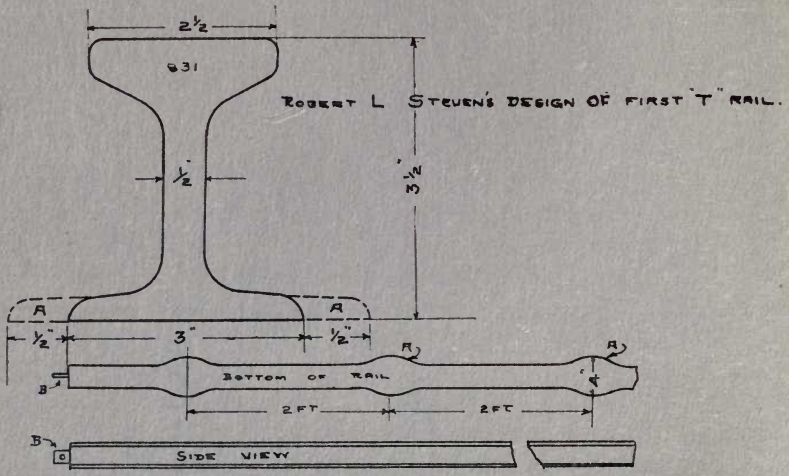


Fig. 22

Stevens added the base to the English "tee" rail (see Birkenshaw and Clarance rails) which dispensed with the expensive chairs. He also designed the hook-headed spike and the tongue B which have since developed into the railroad spike, and splice bar of today.

Fig. 22 shows his proposed rail, which was to be rolled with the projections A on the base of the rail at every

two feet where it rested on the supports and the tongue B on the end to join the rails together. He did not find it practical to have the rails rolled as originally designed with the projections and tongue as shown, so they were omitted before he could find anyone who would undertake to roll them. When Stevens found that it was not practical to have the rail rolled as first designed, the section was changed. It has been somewhat of a task to determine what the cross section of the first "tee" rail was, but after a careful study of all the evidence found at this late day, we know that one of the two sections in Fig. 23 was the first "tee" rail rolled, with the preference largely in favor

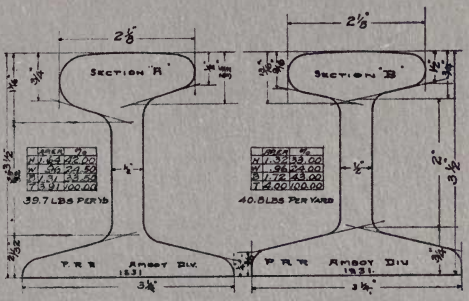


Fig. 23

of Section B. This corresponds more fully to the descriptions of the rail laid on the Camden and Amboy road, as given by the historians of that time, than any other rail we have found.

The section B conforms very closely to a description of the "tee" rail laid on that road in 1831 in Woods' Treatise on Railroads published in 1832, which says: "The rails were of rolled iron 16′ long, 2⅛″ wide on top, 3¼″ at the bottom, 3½″ deep, the neck ½″ thick, the weight 204 pounds." This was equivalent to 39.18 pounds per yard. The slight difference in weight could easily come through the reproduction of the rail from the badly worn and rusted

section B-1 in Fig. 24, which was the only piece of the rail I could find, and is in the possession of the Pennsylvania Railroad Company.

Tanner, in a book called "Canals and Railroads of the United States," published in 1841, in describing the Camden and Amboy Railroad, says of the rail used upon it, "The rail was the H pattern and weighed 41 pounds per yard." He gives the height at 3½".

The sections A-1 and B-1 in Fig. 24, badly worn and rusted as they are, were used to reconstruct section A and B in Fig. 23. By their aid and through the descriptions

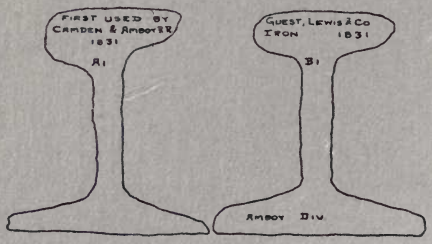


Fig. 24

I found of them, some of which I have given, I believe that the sections A and B in Fig. 23 are as near accurate as can be made at this late day, of the first "tee" rails made and used. The tracings of the two rails here shown were kindly sent to me by Mr. G. W. Whiteman, of the Pennsylvania Railroad Company. These two and several others preserved by that company and one or two sections at the National Museum, are all that I was able to find of the first "tee" rails, and they were all badly worn and rusted.

The first shipment arrived at Philadelphia on the ship Charlemagne, May 16, 1831.

The following is an abstract from the letter written to the English iron masters by Stevens:

> "Gentlemen: At what rate will you contract to deliver at Liverpool, say from 500 to 600 tons of railway of the best quality iron rolled to the above (see Fig. 22) pattern in 12 to 16 foot lengths, to lap as shown in the drawing with one hole at each end, and the projections on the lower flange (base) at every two feet, cash on delivery."

Stevens met with much trouble in finding anyone who would undertake to roll the rails and did not succeed in finding one until he put up a money forfeit which should cover any damage to the mill while rolling them. The limits of this brief sketch will not permit taking up that side of the subject.

Some time between 1831 and 1835 the "U" rail, now known as the "bridge" rail, came out. The name "bridge" rail coming from the custom of generally laying this rail on longitudinal sills, the sills resting upon sleepers, which gave to the track somewhat the appearance of an extended bridge.

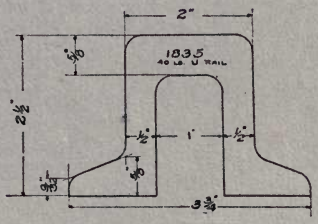


Fig. 25

This section, shown in Fig. 25, is a copy of a drawing sent to the Franklin Institute by J. C. Trautwine in 1835 and marked "In use on the Wilmington and Susquehanna Railroad." This section is of interest, as it fixes the early date at which the design came out.

I have not been able to find out positively where this rail first originated, but from what I have learned of it I think it was at the Dowlais Iron Works in Wales.

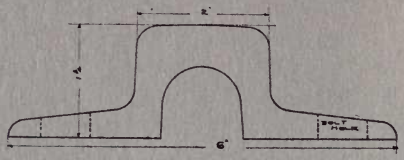


Fig. 26

The "bridge" rail shown in Fig. 26 was in use on the Great Western Railroad, Massachusetts, in 1835.

There were a great many patterns of this rail in use during the early years of American railroads, and a considerable mileage was laid with them.

In 1837 the "Lock" rail (Fig. 27) came out. At first it was known as the double "tee" rail, but now known as the double head rail. This, unlike the Stevens rail, did not come into existence at the first attempt, but is a development of the Birkenshaw rail. As it was found that the Birkenshaw rails, with the narrow base where they rested in the chairs,

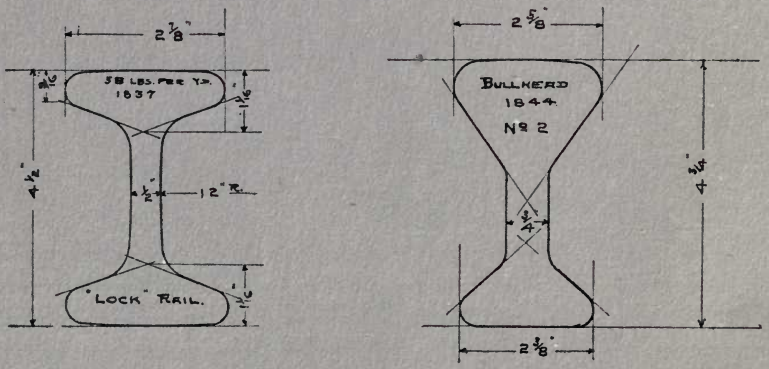


Fig. 27

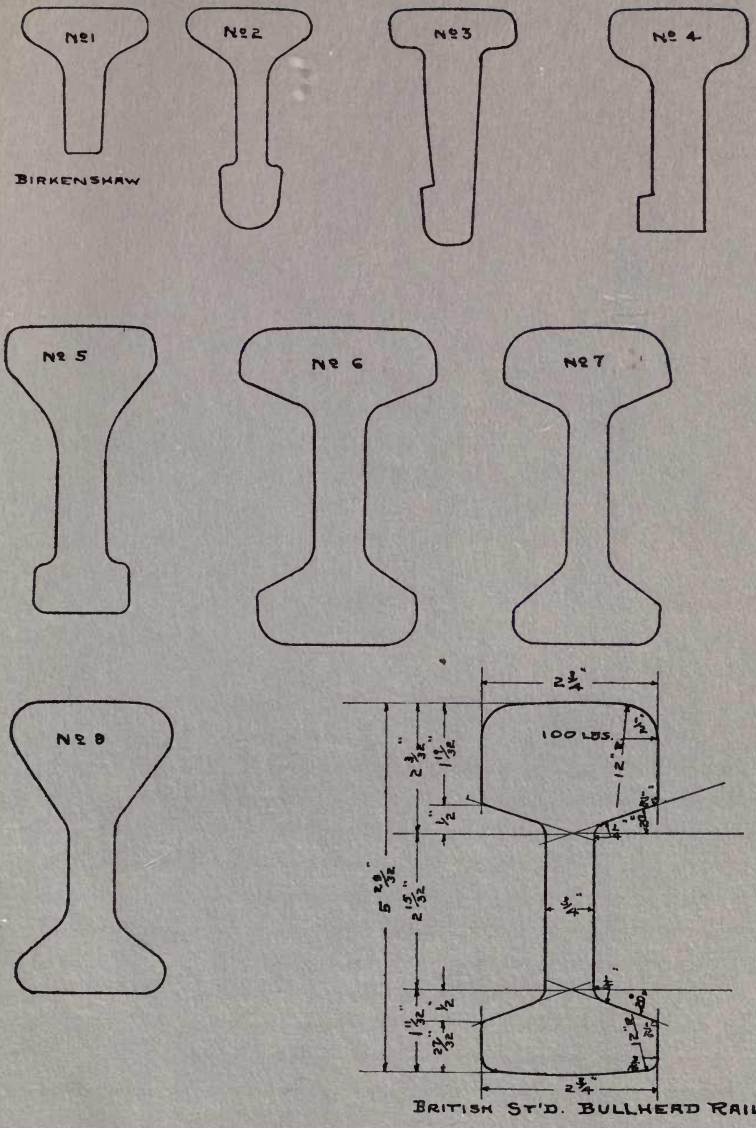

No 1
BIRKENSHAW
No 2
No 3
No 4
No 5
No 6
No 7
No 8
100 LBS.
BRITISH STD. BULLHEAD RAIL — 1905

Fig. 28

quickly destroyed both the rail and chairs at these points, the "Lock" rail was devised to overcome this fault by increasing the width of the lower head.

It was thought at first that the increased width of the lower head would not only remedy the fault, but would permit of reversing the rail, when the top, or working head, became worn out. It was soon found this could not be done successfully, as the rails still wore badly at the points where they rested upon the cast iron chairs. This resulted in the adoption of a rail similar to No. 2 (Fig. 27), known as the "Bull Head" rail, with the lower head the smaller, which permitted of using more metal in the top head for traffic wear.

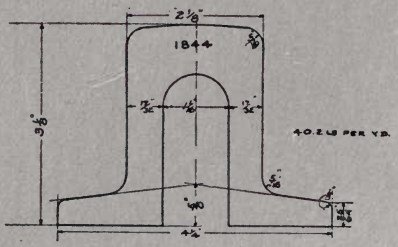


Fig. 29

These two types of rails are still very popular with English railroad men and are largely used at this time.

We have now shown all of the different types of rails that were used upon steam railroads prior to 1844, when we began to roll heavy shaped rails in America. All of them, except the Stevens double head and "bull head" rails, have since gone out of use.

Fig. 28 shows a few of the many changes through which the original Birkenshaw rail went, while developing into the British Standard Bull Head rail of 1905.

At the beginning of 1844 there were 4185 miles of railroads in America. All the rails used upon them, except "strap" rails and a few cast iron rails, were imported

from England. The manufacture of heavy wrought iron rails in this country was commenced in that year at the Mount Savage Rolling Mill, Allegany County, Md. There, at some time between April and November, were rolled the first edge rails ever made in America. They were of the "U" or bridge section known as the "Evans" pattern of the Dowlais Iron Works and weighed 40 pounds per yard. This rail was awarded a silver medal by the Franklin Institute at St. Louis in November, 1844. The following is a copy of the proceedings of the Institute, Exhibit No. 2705:

> "A bar of railroad iron of the "U" form rolled by the Mount Savage Iron Works near Frostburg, Md., and forwarded by Col. Young, manager. This bar is 18½ feet long and weighs 40 pounds per lineal yard. It is part of a lot of several hundred recently rolled there for a branch of the Baltimore and Ohio Railroad leading to the works. This bar is among the first early rails yet rolled in the United States and it demonstrates beyond the reach of cavil that edge rails can be well manufactured in America.
>
> "This bar is well proportioned, sound and well finished. It is the first ever exhibited here of American makes, and we hail it with pleasure as the beginning of a new manufacture, and award it a silver medal.
>
> "JOHN WEIGAND,
> *"Chairman of Committee."*

Fig. 29 shows the rail as reconstructed from descriptions found of it. The tracing in Fig. 30 and one other piece of the rail equally as badly worn and rusted, are all I could find of the first edge rail rolled in America, as we know the section shown in Fig. 29 to be.

We cannot help but wonder what Mr. Weigand would say if he were living today and could see the wonderful

"manufacture," as he called it, that has grown up from the first shaped rail rolled in America.

Swank states, "About 500 tons of this pattern, weighing 42 pounds per yard, were laid in 1844 on a part of the road then being built between Mount Savage and Cumberland" (Baltimore & Ohio R. R.). Soon afterwards, rails weighing 52 pounds per yard were rolled at Mount Savage Rolling Mill for the road leading from Fall River to Boston.

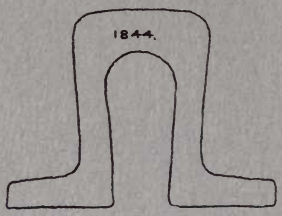


Fig. 30

This 52-pound rail has been given the credit, by some writers, of being the first rail rolled in this country. This is evidently a mistake, as all the evidence points clearly to the rail shown in Fig. 29 as being the first heavy shaped rail rolled in America.

The first "tee" rails made in America were rolled at the Montour Rolling Mill, Danville, Penna., in October, 1845.

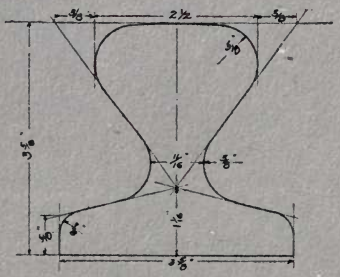


Fig. 31

This mill was built especially for rolling rails. The first rail rolled was a section of the "tee" rail known as the

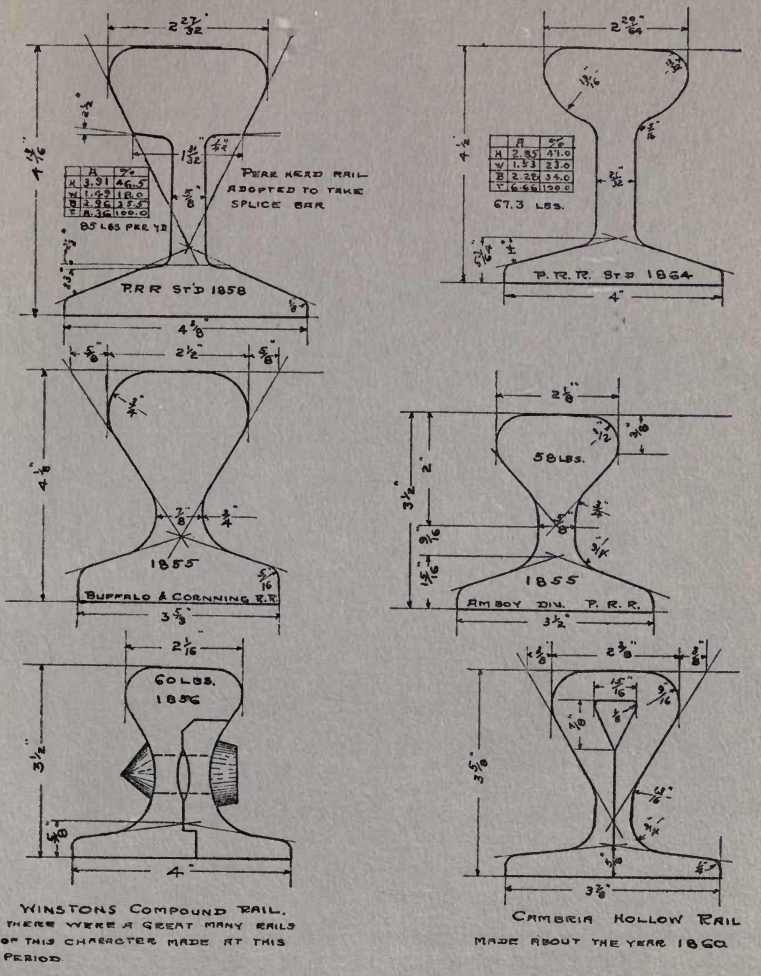


Fig. 32

"pearhead" type. We know that the rail shown in Fig. 31 is not a correct section of this rail, as all records of it

have been lost or forgotten, but I learned from some of the men who worked in the mill when it first started, that it was a "pearhead" rail with the ends of the flanges ½" to ⅝" thick, and a very heavy web. The rail which I have shown above corresponds more closely to this description

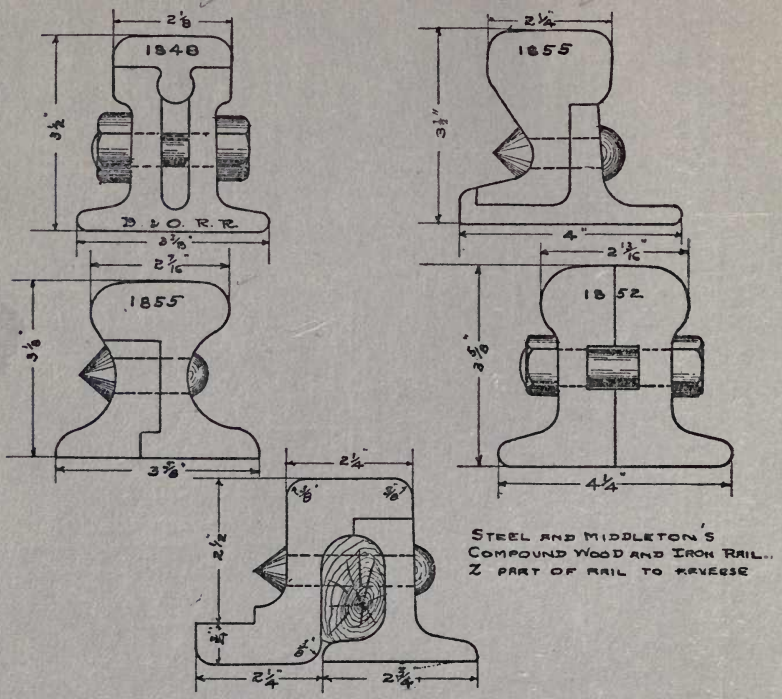


Fig. 33

than any other of the old "pearhead" rails I have found, and therefore I have shown it as a type of the first "tee" rail rolled in America.

Rails of this pattern were very popular during the first twenty years of American railmaking, during which period a great many different patterns were rolled and laid upon

our railroads. The principal cause for this was that the designing of the rail sections was left largely to the mill men, who would naturally design only such sections as were easy to roll.

I have not found that our railway engineers were taking any great interest in the improvement of the rail section previous to 1865, about twenty years after we began to roll rails.

The sections shown in Fig. 32 are several of the various shapes the "tee" rail assumed in the twenty years following the beginning of their manufacture in this country.

The period between 1844 and 1865 was very prolific in the production of compound rails. (Fig. 33.) These rails were laid in the track with the several parts arranged to break joints. When new they made a splendid track, but it was soon found that the several parts of the rail could not be kept tight, the bolts and rivets which held them together wearing out very rapidly. A considerable mileage of these rails was laid, but as they could not be made to stand the test of service, they have long since gone out of use, and for this reason I have not given them much attention. Not so with the inventors, however, who have not yet given up all hope of making a compound rail that will stand the test, as many useless patents have been and are still being granted.

The period of the greatest importance in the history of the rail was between the years 1844 and 1854, as during that time the Bessemer process of making steel was perfected. It is a remarkable fact that this, the second great epoch in the history of the railway rail, like the first, was largely the result of accident rather than of design (see Fig. 4), as neither of the two men who were most prominent in the development of the Bessemer process began to experiment with the thought or expectation of making steel.

William Kelly, a resident of Pittsburgh, Penna., began his experiments at Eddysville, Ky., in 1844, with the idea

in view of refining and decarbonizing melted cast iron with the use of an air blast, and by that means saving the fuel required in refining the iron for his forge.

Henry Bessemer began his experiments in 1854 after holding a conversation with Napoleon III, who had lately become Emperor of France. Napoleon in the conversation complained to Bessemer about the poor quality of metal used in making cannon. At his suggestion, Bessemer at once began experimenting in London on making a better quality of iron. In 1855 Bessemer says "the idea struck me of making malleable iron by introducing air into the fluid metal." We see from the above that neither Kelly nor Bessemer began with the thought of making steel. Kelly worked with the expectation of developing a process of refining iron without the use of fuel, and Bessemer with the end in view of making a better grade of iron cannon. But the ways of Providence are beyond the ken of mortal mind. That these experiments which practically began on the part of Bessemer (whose name the process now bears) in the interest of war, should result in the one invention of the ages, that of making cheap steel, which has probably done more to promote the peace and happiness of mankind than any other one invention in the history of the world, further emphasizes the fact, "there is a Divinity that shapes our ends, rough hew them how we may."

Kelly and Bessemer both failed to obtain any successful results in making steel up to the beginning of 1857, when the third man, Robert F. Mushet, of England, supplied the missing link in the chain by the invention of a process for recarbonizing the melted, desiliconized and decarbonized iron, as produced by the Bessemer process at that time. This perfected the Bessemer and Kelly process, and from that time we can say cheap steel became a commercial product. Early in 1857 Mushet completed his invention and made the first Bessemer steel rail. (See Fig. 34.)

Pending the publication of Mushet's patent early in 1857, and during the erection for him of a blowing apparatus and small converter, Mushet obtained from the Ebbw Vale Iron Company a small supply of Bessemerized hematite cast iron. This he melted in ordinary steel melting pots, adding to the 44 pound charge of each pot, when melted, 2 pounds of melted spiegeleisen. From this mixture, ingots of 600 to 700 pounds were cast. One of the ingots was sent to the Ebbw Vale Iron Works and rolled into a double-headed rail, which was sent to the Derby Railway Station on the Midland Railway.

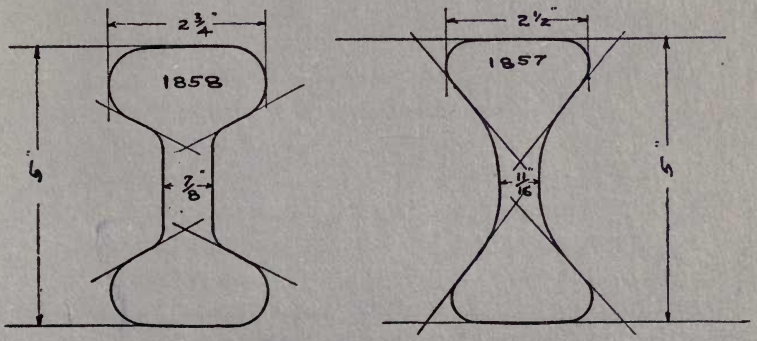


Fig. 34

This rail was laid there early in 1857, and was in use for sixteen years. History tells us that in that time more than 1,125,000 trains and a like number of detached engines and tenders passed over it. I have made several unsuccessful efforts to obtain a cross section of this rail. The two rails in Fig. 34, however, are iron sections that were being rolled in England at that time, and it is quite possible that the first Bessemer steel rail was like one of them, or nearly so.

Shortly after the first Bessemer steel rail was produced in England, Bessemer steel rails were manufactured in

commercial quantities, and the steel rail industry came into existence.

It was not until seven years later that there was any Bessemer steel made in America. The first Bessemer steel in this country was produced at a small experimental plant established at Wyandotte, Mich. The first steel was made in 1864, and the first Bessemer steel rails rolled in America were rolled at the North Chicago Rolling Mill on the 24th day of May, 1865, from ingots cast at the experimental works, Wyandotte, William Durfee, superintendent. The following is an abstract from a letter of O. W. Potter, of the Chicago Works, to Durfee, two days after the first rails were rolled:

"Office of the
"Chicago Rolling Mill.

"May 26, 1865.

"My Dear Durfee:

"I regret very much you could not have been here, particularly to see how well your steel behaved, and you should allow me to congratulate you upon its entire success. The hammer was altogether too light, of course, and it took more time than otherwise would to draw the ingots down, yet all the pieces worked beautifully, and we made six good rails from the ingots sent over, not one bad in any respect.

"Yours, etc.,

"O. W. Potter."

I met with considerable trouble in my efforts to obtain a cross section of this, the first Bessemer steel rail rolled in America. (See Fig. 35.) After writing to a number of the men who were prominent in the early development of the Bessemer process in this country, I finally succeeded,

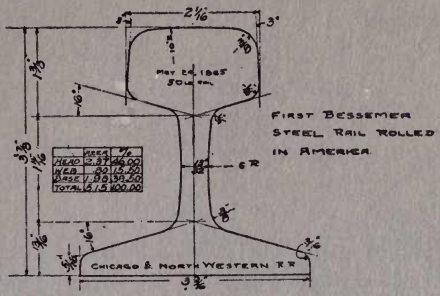


Fig. 35

through the courtesy of D. S. Mathias, of the Illinois Steel Company, who in reply to a letter of inquiry, wrote:

"ILLINOIS STEEL COMPANY.

December 8, 1908.

"Your very interesting letter of November 22nd received, and contents noted. I have prepared a blue print giving dimensions of the Delano and McLure rails made by us for the C. B. & Q. R. R. in 1888. The other section on the blue print is the iron section that they were rolling at the North Chicago Mill when they rolled the six rails you speak of in 1865. They did not turn special rolls to roll the steel rails, but just used the same rolls that they rolled the iron rails in at that time. The rails were rolled at the North Works. I was rolling at the Union Works at the time and know the above to be facts.

"Yours truly,

"D. S. MATHIAS,

"Superintendent."

James M. Swank, in his history of "Iron in All Ages," says: "The first Bessemer steel rails rolled upon order in

the United States were rolled at the Cambria Works, in August, 1867."

R. W. Hunt, in an address delivered before the American Society of Mechanical Engineers, said: "I have already placed upon record in a lecture before the Franklin Institute, Philadelphia, January 21, 1889, that the first commercial rolling of steel rails was at the Cambria Works in August, 1867, on an order for the Pennsylvania Railroad

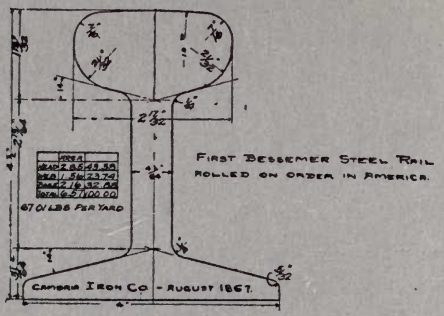


Fig. 36

Company from steel made by the Pennsylvania Steel Company at their Steelton plant. These rails were rolled on a 'three high' 21″ train."

At first the steel ingots were drawn into blooms under steam hammers. George Fritz, superintendent of the Cambria Works, concluded that this was not the proper manner of treating the material and A. L. Holley, then in charge of the Pennsylvania Steel Works, sustaining Fritz in his experiments, had ingots cast 8½″ square, which were bloomed in a set of blooming rolls prepared by the latter, and placed in one set of the 21″ rail train housings. The ingots were rolled to 6½″ square, recharged in the heating furnaces, wash heated, and then rolled into rails. This practice was successful, and I believe this was the first cogging or blooming mill.

The section shown in Fig. 36 is of the first Bessemer steel rail rolled on order. This was secured through the courtesy of H. H. Weaver, assistant to the general manager of the Cambria Steel Company, and is their old section No. 29.

With the rolling of this rail in August, 1867, began what in a few years was destined to become a great industry. The growth was slow at first. In that year there were rolled 2550 tons; in 1868—7225; 1869—9650; 1870—34,000; 1871—38,250; 1872—94,070 tons. It was not until 1873 that we reached a production of over 100,000 tons, rolling in that year 128,000 tons, but by 1880 the annual production reached almost 1,000,000 tons. In this short sketch

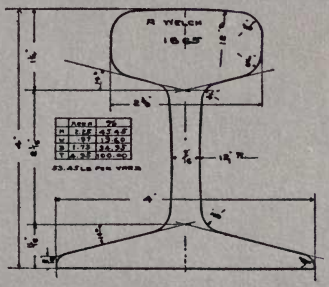


Fig. 37

of the steel rail industry, we have not space to speak of the many heartbreaking experiences and failures met with by the men who were prominent in the work of developing the Bessemer process in this country. R. W. Hunt in his history of the Bessemer manufacture sums them all up in one sentence: "But I do know from the Wyandotte, to say nothing of later experiences, that it required faith made perfect to carry one through the sea which seemed to be bounded by no shore."

On the preceding pages we have endeavored to show the gradual development of the rail from the beginning to the advent of Bessemer steel in 1867. The American develop-

ment of the rail section really dates from that time. Before that only a few efforts had been made in that direction, some by A. L. Holley, almost alone among the steel men, and by Ashbel Welch, who was among the first to take a belated interest in this matter. In 1865 he designed a rail very much like that in Fig. 36, and a few years later, the rail shown in Fig. 37, the first of the thin flanged type.

Welch says of this rail: "That previous to 1867 the steel rails laid down in this country, made like the iron rail sections then in use, were unnecessarily heavy, and so proportioned that much of the metal did no good, and I determined to try a section in which all the metal possible should

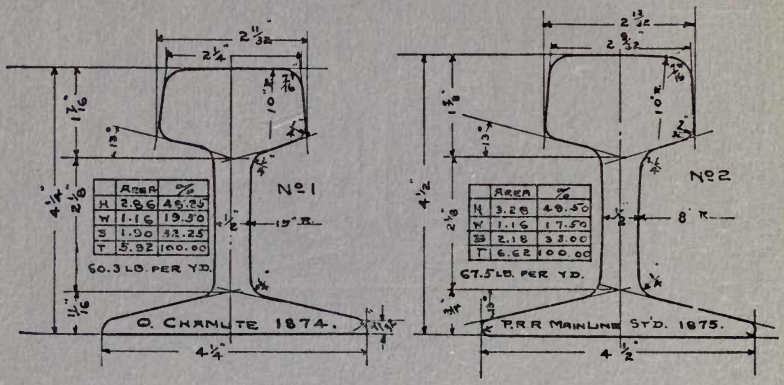


Fig. 38

be in the head." He further says in his Memoir attached to the report that he met with considerable trouble to place a contract for these rails as the rail makers were not inclined to risk the rolling of them on account of the extremely thin flanges, and that after five or six years of use none of them have failed in the base. He also stated at this time that he would be in favor of placing 50 per cent. of the total metal of the rail in the head.

By 1874 the idea advanced by Welch a few years previously, that all the metal possible should be placed in the

head of the rail, began to take hold of our railroad engineers, and in that same year Octave Chanute published the rail shown as No. 1 in Fig. 38. This type soon became very popular and we find that there were many different patterns of this rail rolled and used in the next twenty years. No. 2 in this figure is a later development and I have found some of the "Chanute" rails with as much as 53 per cent. of the total metal in the head.

In a short time rails of this type were widely used and became known as the "Chanute" rail. But they were not

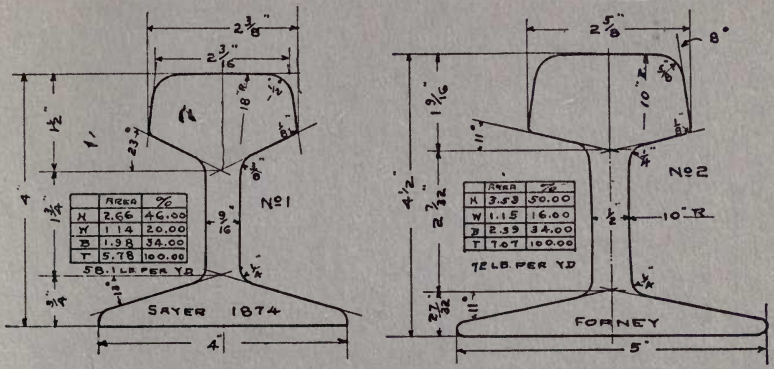


Fig. 39

without opposition, as these large headed and thin flanged rails soon started a controversy between the railroad engineers and the rail makers as to their merits and demerits, which continued for many years, and in fact, at this time is not finally settled. Notwithstanding the opposition to this design many thousand tons have been made and put in the tracks since 1874, and there are many still in use. The No. 1 rail shown is undoubtedly a development of that shown in Fig. 35, as the first Bessemer steel rail rolled in the United States, with its flanges somewhat thinner.

When once the railroad men began to improve the rail, they went at it, as the old saying is, "with hammer and

tongs," as we find among the old templets and section books in our possession over 60 different sections of the "Chanute" rail alone, to say nothing of the many other types.

At the same time Chanute brought out his rail, R. H. Sayer designed the rail shown as No. 1, Fig. 39. The "Chanute" and "Sayer" rails were of the very few made to this time with a bevel to the sides of the head.

It is a singular coincidence that Chanute and Sayer, each without any knowledge of what the other was doing, should

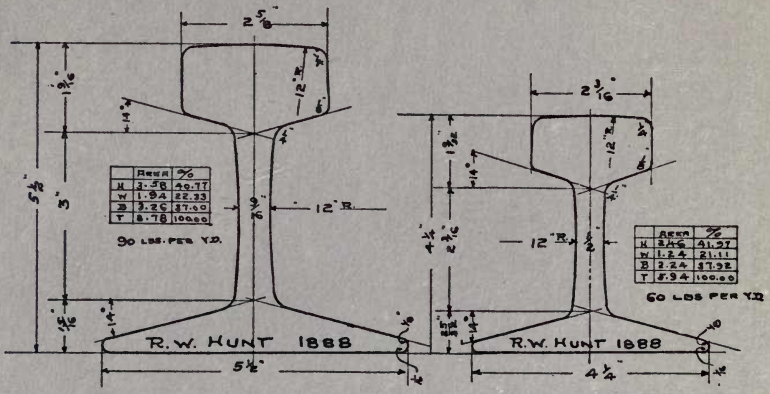


Fig. 40. Showing the 60 and 90 Pound Sections

arrive at practically the same results, so far as the wearing surface of the rail heads was concerned. The heads of these two rails were the outcome of a series of experiments and examinations of a large number of worn rail heads on the part of both men, and from these experiments and study, the two rails were designed.

Some years later M. N. Forney designed the rail shown as No. 2. This rail has more bevel to the side of the head than either the "Chanute" or "Sayer" rails. The "Sayer" and "Forney" rails never became as popular as the "Chanute" rail, although there were some 10 or 12 different sections of

them made and used, but at the present time they are not in use to any great extent.

Chanute said that at the time he designed the 60 pound rail (Fig. 39), for the Erie Railroad in 1874, there were in use on that road, 12 patterns of steel rail, 29 patterns of iron rail, and 96 different styles of joint fixtures and rail fastening devices. From this we can see how utterly impossible it would be to attempt to do more in this short sketch than to show a few of the most prominent types and patterns of rails that were in use on our railroads.

At the 1888 meeting of the Institute of Mining Engineers, Robert W. Hunt, one of the most prominent pioneers in the Bessemer steel rail trade, presented a set or series of rail sections as standard, consisting of 60, 65, 70, 75, 80, 85 and 90 pound rail. (See Fig. 40.)

The seven sections were all of the same design and with nearly the same proportion of metal in the several parts, head, web, and base. This close adherence to the one design gave to them as a series, an appearance that could not be other than attractive. This action on the part of Hunt in presenting this series of rail sections, no doubt had an important bearing upon the adoption of a series of standard rail sections a few years later. This was the first time in the history of American rail designing that a series of sections had been presented in a practical and attractive manner, and was a decided advance over anything that had yet been done toward originating a series of rail sections that could or would be accepted as standard by the railroad companies and the rail makers. Notice the close resemblance of these rails to the A. S. C. E. rails, which finally became the standard sections in 1893.

P. H. Dudley, a prominent railroad engineer, and one with experience such as comes to few men in the designing and making of rails, in 1883 designed the 80 pound rail shown as No. 1, in Fig. 41, for the New York Central and Hudson River Railroad. At the meeting of the American

Institute of Mining Engineers, in 1890, Dudley said of this rail: "It was the pioneer of the broad shallow head and thick base for heavy rails."

At the same meeting of this Institute, Dudley presented a paper on a system of rail sections in series from 60 to 105 pounds per yard, and stated when presenting his proposed sections: "According to the diagrams of several roads

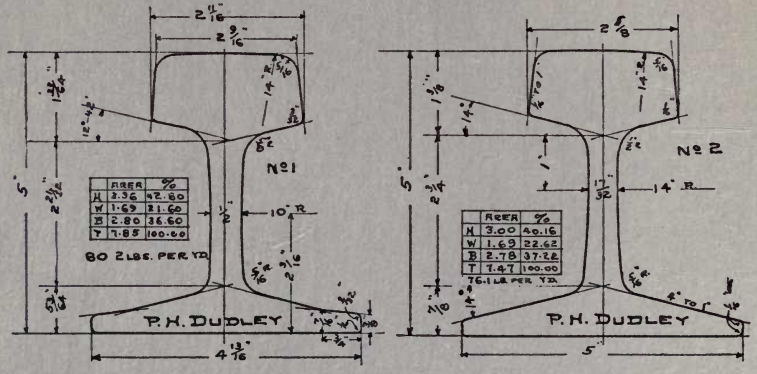


Fig. 41.

in regard to the renewal of rails, the least wear takes place, as a general rule, upon the tangents away from the stations, increasing on the gradient tangents. On curves the wear is even greater than on gradient tangents, and greatest where curve gradients occur. The wear on rails on curves is of two classes. First, the ordinary wear on the surface of the rail augmented by longitudinal and transverse slipping of the wheels; second, a severe abrasion or cutting on the inner head of the outside rail. I have designed the rail sections to which attention is here called, in series of three each to provide for the unequal wear on the various portions of the road. The rails of each series are designated by letters A, B, C, D, and E, and the weight of each section increasing 5 pounds. In the first section of the series is

the light; the second, medium; the third, heavy." This classification is shown by a prefix to the letter of each rail. In Fig. 41, No. 2, the 75 pound rail of this series is shown. The Dudley rail soon became quite popular and many of them are being made at the present time.

In 1887 the Pennsylvania Railroad Company adopted the 85 pound rail shown in Fig. 42 as their standard, and in 1892 the 100 pound rail was adopted.

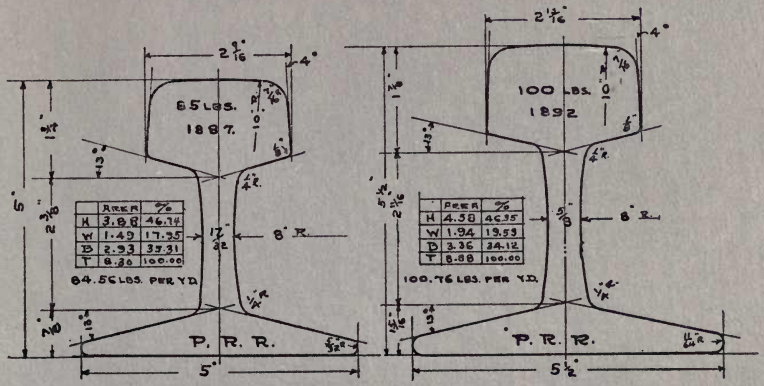


Fig. 42

In the contention between the railroad engineers, the engineering societies and rail manufacturers, as to the relative merits of the large head and of the small head rails, the sections in Fig. 42 are usually classed with the former. But when they are compared to the average rail designed and rolled in this country since 1866, I find them to be about the average, so far as the percentage of metal used in the several parts of the rail, head, web, and base is concerned. For the purpose of comparison, I took 45 different sections that have been made since 1866, including a number of each of the types then in use. These sections when figured out gave an average distribution of metal in the several parts as follows: head, 47.67%; web, 19.08%; base, 34.25%. By

an examination of the figures in Fig. 42 we find that they do not differ by more than 1 per cent. from the average of the 45 sections.

These two rails continued in use up to 1907 as the Pennsylvania Railroad standard rail, but they have now been superseded by the new sections with a heavy base.

In 1893, what probably was the most popular series of rails that ever came out was introduced by the American Society of Civil Engineers, and soon became known as the "A. S. C. E." sections. In 1885 this Society appointed a committee to consider and report at a future meeting, on

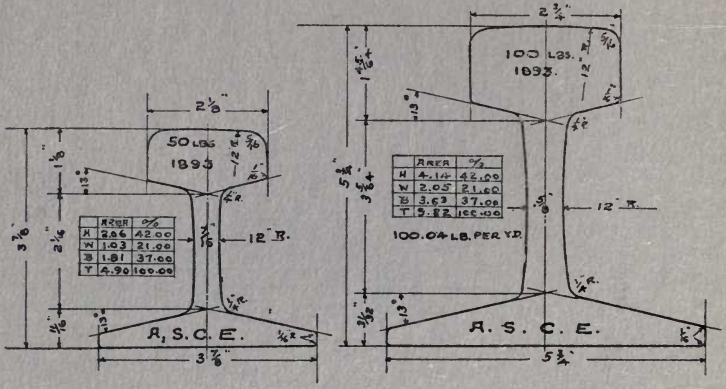


Fig. 43

the proper relation to each other of the rail head and car wheel. In 1890 this committee was supplemented by a larger one, retaining a number of the original members of the 1885 committee. This new committee was then instructed to prepare and submit a report upon a series of rail sections from 40 to 100 pounds per yard in steps of 5 pounds, which could be adopted as the American standard and by that means, in time, reduce the large number of sections in use on our railroads.

It has been a very interesting and instructive study to read over the reports of this committee as submitted to

the Society during the eight years they were at work on this problem. At the 1890 meeting, when the later committee was appointed, one of the members, S. S. Morison, moved that each member be requested to prepare a design for the series of sections, these sections to be prepared regardless of any former instructions and to be transmitted to the secretary by the first of December of that year. This resolution was adopted, and at the next meeting of the Society, ten sets of sections were presented. From these ten sets, the sections shown by Fig. 43, were designed, and they are the standard 50 and 100 pound sections of the A. S. C. E. There was considerable difference in the ten sections submitted and it would be of interest to write them out, but space will not permit. See report for the year 1893.

After the adoption of the A. S. C. E. sections in 1893 the large number of different types began to decrease, and from that time to 1907 not a great many new sections were brought out. Those that have come out are close imitations of patterns that have already been shown. For that reason I have not made any record of them, but go direct to the year 1907, when the new sections with the heavy base appeared.

This article would not be complete without some mention of the cause for this radical change in the form of the rail section. During 1900, 1901, and 1902, the railroads had a great deal of trouble with rail breakage, and with the rail wearing out very rapidly. This caused great dissatisfaction among the railroad men, and was soon taken up by the different mechanical and engineering societies, who, along with the railroad men, began a crusade about 1902 for a better rail. In that year the A. S. C. E. started this reform by appointing a committee to investigate the cause for these conditions, and similar action was taken by several other societies. These committees at once began their investigations and brought out many interesting facts in regard to the subject. To attempt to enumerate them would be an impossible task in this article, and inasmuch as they were

all published in the reports of the several societies, it is not necessary. The labors of the several committees finally resulted in the adoption of the sections shown by Figs. 44 and 45.

I have followed the work of the several committees closely, and have come to the conclusion that the situation at this time is largely a repetition of the old story that has been enacted over and over in the past history of the rail and its development. That is, the speed and weight of the railroad traffic have overtaken the enduring powers of the rail, and we must now, as in the past, improve the rail to the point where it will withstand the largely increased work imposed upon it. This improvement must come either by a better quality of material, such as when the Bessemer steel rail superseded the iron rail, or by a better disposition of the material we now have in the design and weight of the rail.

We find from reading the reports of the several committees that there was quite a diversity of opinion in regard to the change that should be made in the form of the rail, and it may be possible before this problem is finally settled to the satisfaction of all the parties concerned, we may revert to a section somewhat on the order of the bull head rail in Fig. 27. This would eliminate the broad thin base which seems to be the most serious fault found with the rail as now rolled.

The first of the new designs of rails with the heavy base was brought out by the Pennsylvania Railroad Company, who on September 20, 1907, adopted the 85 and 100 pound sections as shown by Fig. 44. These two sections were designed by the engineers of that company, and were intended to take the place of the 85 and 100 pound sections shown in Fig. 42.

The first of the new design to be rolled was the 85 pound rail (Fig. 44) at the Maryland Steel Company's Works, at Sparrow's Point, Md., on the 26th of October, 1907. On

that date a trial rolling of three heats (40 to 45 tons) was made. The rails rolled well and withstood many severe tests.

After the first of December, 1907, the Maryland Steel Company secured orders to roll 2000 tons of the 85 pound and 4000 tons of the 100 pound rail. (Fig. 44.) This order was rolled during that month. The operation was of especial interest to the railroad men and the different rail committees, nearly all of whom were at the works at some

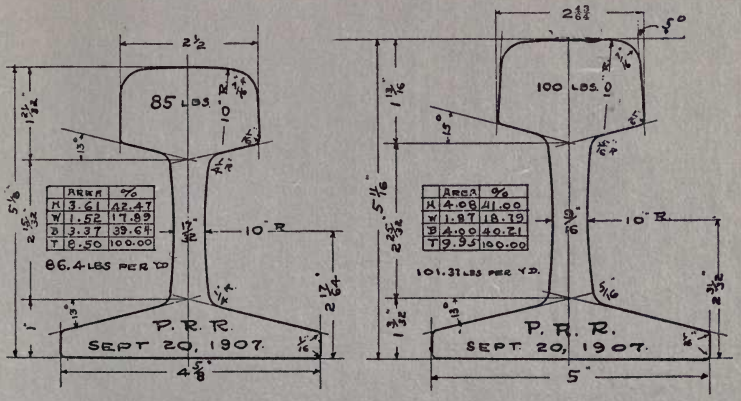


Fig. 44

period during the time they were being rolled, following the various stages of manufacture and submitted the finished rails to many severe tests. Both of the sections proved to be about all that could be expected of them in regard to their working in the mill.

In 1907 the American Railway Association appointed a committee on rails. This committee reported in October of that year, proposing two series of rail sections weighing 60, 70, 80, 90, and 100 pounds per yard, one series "A" and the other "B," as shown in Fig. 45.

These sections were adopted as recommended by the committee on April 22, 1908, and are known as the "A. R. A." Standard Rails "A" and "B." The "A" sections are a

modification of the P. H. Dudley rail No. 2, Fig. 41, the "B" sections a modification of the A. S. C. E. rails shown in Fig. 43. During 1908 there were not many of them rolled, but in the early months of 1909 they began to come into use quite freely.

These two series of sections and the two Pennsylvania rails in Fig. 44 give a fair representation of the changes which have been given to the shape of the section since the

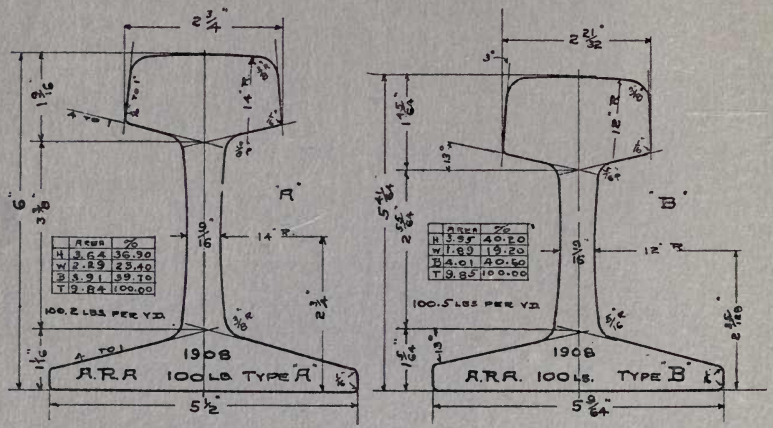


Fig. 45

railroads began the crusade for a better rail. If, however, the railway men and the rail makers do not take a firm hold upon and control the situation, we shall, no doubt, be afflicted with an epidemic of new rail sections, such as occurred previous to the publication of the A. S. C. E. rails in 1893.

I do not believe any change can be made in the design of the rail which will enable it to withstand the work imposed upon it by the increased speeds and heavy traffic of our trunk lines, except more metal is used and the weight of the rail increased to at least 125 pounds per yard.

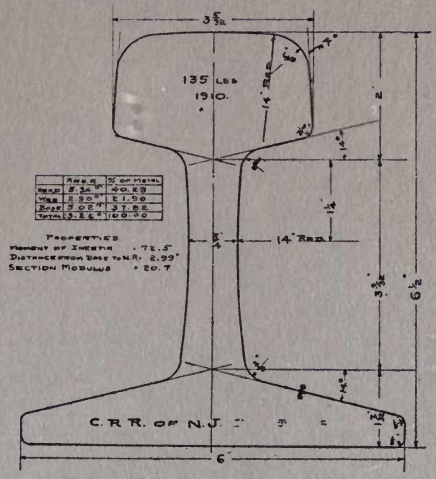


Fig. 46

During 1910 several thousand tons of 135 pound rails (Fig. 46) were rolled and laid in the tracks of the Central Railroad of New Jersey. Other roads are now beginning

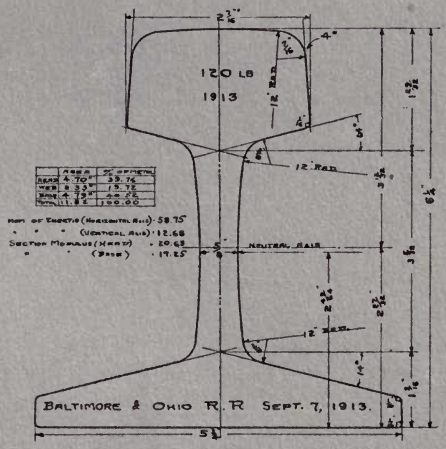


Fig. 47

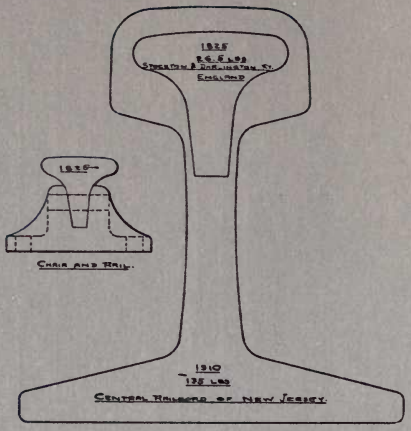


Fig. 48

Comparison of first rail rolled and the 135 pound section of the Central Railroad of New Jersey.

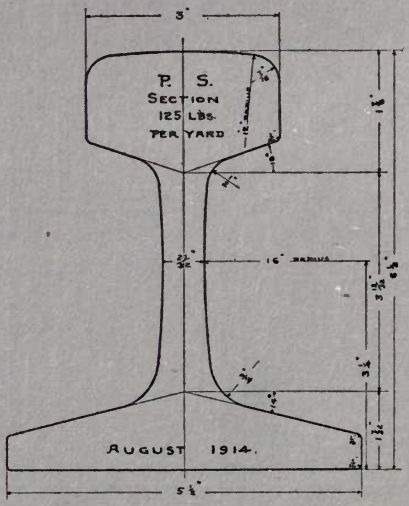


Fig. 49

to see that it is necessary to increase the weight of their sections.

As a further indication of this movement toward a heavier rail, see section shown in Fig. 47. This is a new 120 pound rail for the Baltimore and Ohio Railroad Company, and was rolled at the Maryland Steel Company's Works, Sparrow's Point, Md., on September 7, 1913. Fig. No. 49 shows the 125 pound rail which is the latest section designed by the Pennsylvania Railroad Company's engineers, and of which a considerable tonnage has recently been ordered.

SUMMARY OF NAMES AND TITLES OF THE RAILS IN THE ORDER OF THEIR APPEARANCE

It has proved quite a task to classify and give to the early rails their proper titles, as there are many conflicting statements in respect to the names given them by the early writers. I have endeavored to get the names correct as far as possible.

The first rails, as we know, were wooden. The early wooden ways were called tramways, this name coming from a Mr. Outram, who was extensively connected with the early roads, the transition from Outram being easily made.

The first iron rails were of cast iron; cast in the form of flat bars and were called plate rails, hence the English railway term, "plate layers." See Fig. 5.

Later, when flat rails were rolled from malleable iron, they received the name "strap" rails. See Figs. 15 and 17. Figs. 6, 7, 11, and 12 showing some of the early cast iron tram or flat plate rails.

The next rails to come into use were the cast iron edge rails. See Figs. 8, 9, 10, 13, and 14. Later, when edge rails were rolled from malleable iron, they were first given the shape as shown in Fig. 19, No. 1, and were named

"tee" rails. This name continued in use until the double head rail shown in Fig. 27 came out. This was at first called the "Double Tee," and to distinguish the first rails the name was changed from "tee" to the "Single Tee." The name "Double Tee" did not last very long, and the two rails in Fig. 27 soon became known as the "double head" and the "bull head" rail, which names have continued to the present time.

The rail shown in Fig. 20 is known in history as the Birkenshaw Fish-Bellied Rail.

The rails in Figs. 28, 31, 32, and 35 are examples of the "tee" rail, as we now understand the term. These are all early rails. (See Fig. 40.) When these rails first came out, and for a number of years after, they went by the name of the "H" rail. This title was frequently given to the double-head rail by the early writers, which made it quite difficult at times to distinguish to what type of rail they were referring.

Figs. 31 and 32 show some examples of what are known in railway history as the "pearhead" rail, and in Fig. 33 are some of the compound rails. These two types came under the general name of "tee" rail, as we now understand the term. In England, rails of this pattern are known as flat bottomed rails.

In Figs. 25, 26 and 29 are shown the "U" or bridge sections. These rails are now generally known as the "bridge" rail, the name coming from the custom of laying rails of this type upon longitudinal sills, which, when resting upon cross sleepers, gave to the roadway somewhat the appearance of an extended bridge.

At the present time as well as in the past we found a great variety of names given to the different rails. We find the Jessup, Stephenson, Birkenshaw, Clarance, and Stevens, and later the Welch, Chanute, Dudley, Hunt, A. S. C. E., etc. The names as given above, Wood, Plate, Strap, Edge, Single "Tee," Double "Tee," Double Head,

Bull Head, "H" Rail, Bridge Rail, and Tee rail, cover all of the various forms and types that have been in use upon the steam railroads.

At this time all of them, except the Double Head, Bull Head, and "Tee" rails, have gone out of use.

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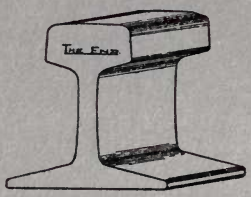

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