VANDERBILT LOCOMOTIVE BOILER.

Although the locomotive which is herewith illustrated belongs to the modern class of freight engines which is distinguished by great weight, large heating surface, big cylinder capacity and high tractive force, this particular locomotive does not derive its claim to distinction from any of these features, but from the fact that it makes a radical departure from previous systems of construction in the design of its boiler.

To everyone who has even a casual acquaintance with locomotive boiler design, the broad difference between this locomotive and the standard type will be evident at first sight, the ordinary, rectangular, box-like structure for holding the fuel being here replaced by one whose cross section presents the form of a true circle, the boiler shell also being changed from the rectangular to the cylindrical form to accommodate the firebox, which lies eccentrically within it.

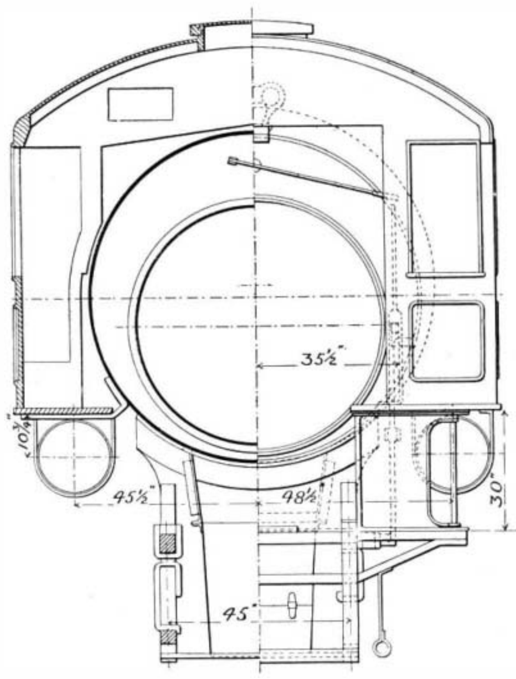
The term "firebox," as applied to that portion of the boiler which contains the fuel, has a historical value as showing that the rectangular form was the one adopted in the earliest locomotives; for it is a matter of fact that in Stephenson's first locomotives, the "furnace," as it was frequently called, was to all intents and purposes identical in construction with those in use to-day. The fact that the box-shaped form is, in spite of its many limitations, the prevailing type to-day is due rather to the conservative instincts of the locomotive builder than to any proved superiority over other forms of construction. Had Stephenson's "Rocket" been built with a firebox of the cylindrical type, it is probable, judging from the excellent results which the cylindrical type, as herewith illustrated, is showing in practice, that we should now be using the term "fire-cylinder," or some name suggestive of its circular form, to designate this part of the boiler.

It is likely that the reluctance of locomotive builders to raise the center of gravity of the locomotive conduced in earlier years to the popularity of that type, since its rectangular form permits it to be carried down between the frames, utilizing the considerable amount of space between the driving wheels.

Of late years it has been found that the center of gravity may be raised considerably without impairing the stability of the locomotive, and the success which has attended the Wootten firebox, and other types which are carried above the frames, has removed any possible objection, on this score, to the large diameter which is necessary if we are to secure, with the cylindrical firebox, an adequate amount of heating surface.

The chief structural objection to the square firebox is that it is a form which is poorly adapted to resist the stresses to which it is subjected, the flat surfaces necessitating a vast number of stay-bolts (as many as from 1,400 to 2,000 in large American locomotives), which have to be inserted between the firebox and the boiler shell to prevent distortion. Under the rather complicated strains due to variations of temperature, it is difficult to keep these stays at all times water-tight, or even, in the case of boilers not of the very best design, to prevent fracture of the bolts themselves. There is also the disadvantage of the flat surfaces tending to assist the deposit of scale, with its accompanying loss in evaporative power, and trouble and cost of cleaning. The rectangular form, moreover, is an expensive form of construction, both as to first cost and subsequent maintenance; and, lastly, it is not favorable to that free circulation of the water which is necessary to high evaporative efficiency.

The locomotive which we herewith illustrate represents a very successful attempt on the part of the inventor, Cornelius Vanderbilt, to remedy these defects by adopting the cylindrical form; the main objects aimed at, as stated by himself, being simplicity and strength of construction, freer water circulation, the prevention of scale, and decreased cost of maintenance.

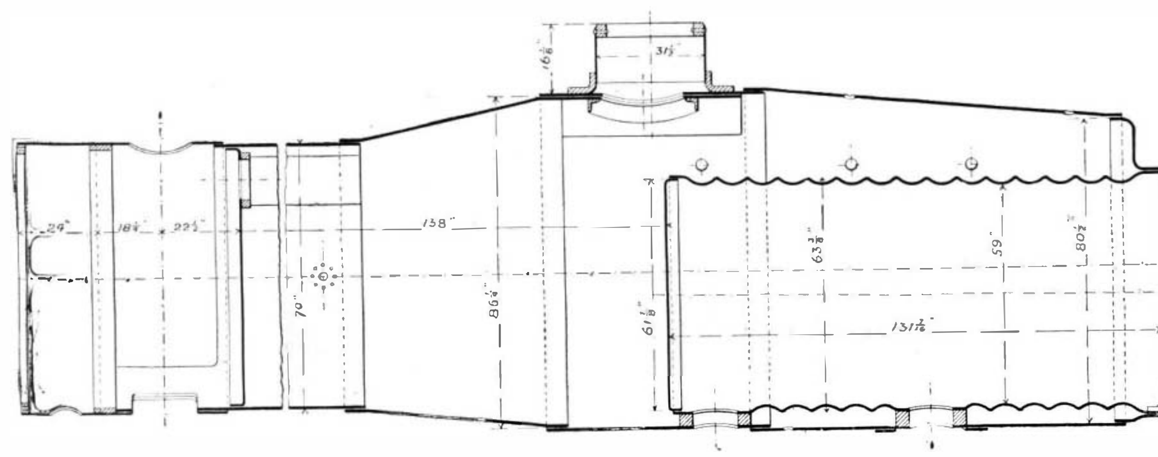


CROSS SECTION THROUGH FIREBOX.

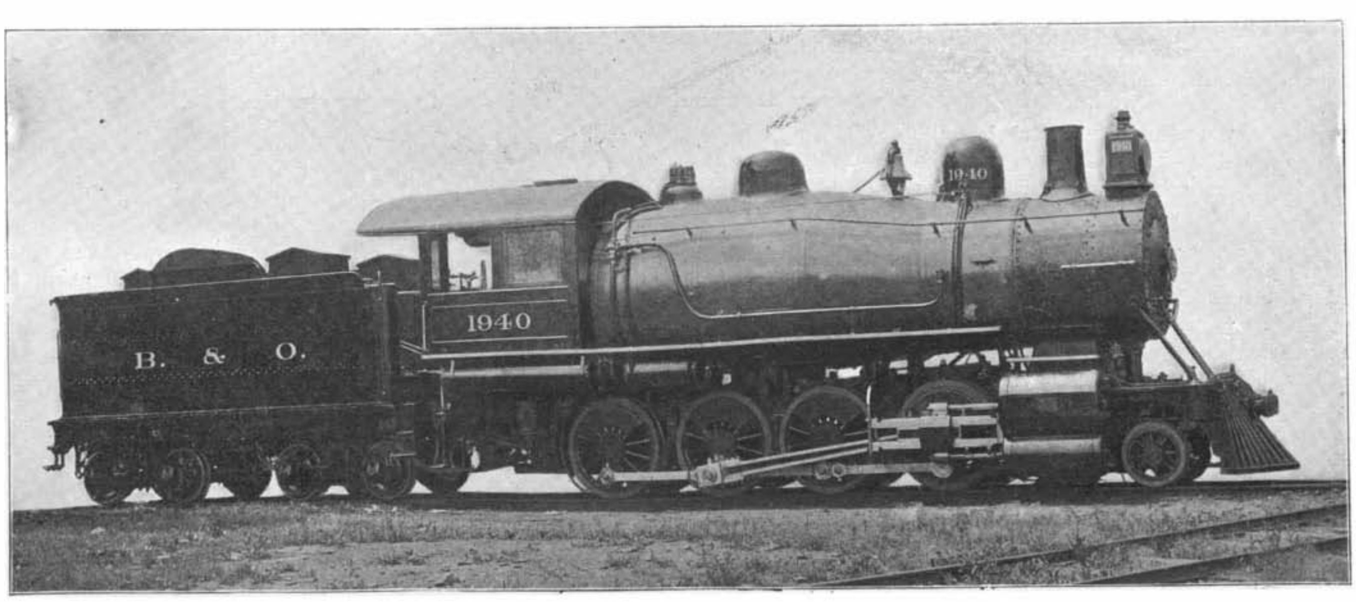
The boiler was not designed, as has been frequently stated, with the object of securing larger heating surface, the heating surface of the old and new types, in locomotives of equal weight, being approximately the same; although it should be noted that the greatly increased efficiency shown by the Vanderbilt locomotives now in operation amounts in its practical results to the same thing as an increase of heating surface.

The locomotive herewith illustrated is one of the two consolidations for the Baltimore & Ohio Railroad, which were delivered last August and have been used in regular freight service since that time. The locomotive has a total heating surface of 2,750 square feet, of which 2,615 square feet is in the tubes and 135 square feet in the firebox. There are 500 tubes, 1¾ inches in diameter and 11 feet 6 inches in length. The boiler pressure is 190 pounds to the square inch; the total weight of the engines is 193,900 pounds, 170,800 being on the drivers and 23,100 on the trucks. The engines are of the Vauclain compound type, with cylinders 15½ and 26 inches in diameter by 30 inches stroke. The drivers are 54 inches in diameter and the total wheel base is 23 feet 8 inches. All the reports thus far received of these locomotives are highly satisfactory. Two consolidations of very similar dimensions and power were delivered last July to the Union Pacific Railway, and altogether ten locomotives of this type have been constructed and put in operation. The first boiler of the kind to be constructed was placed in a freight locomotive built at the New York Central & Hudson River Railroad shops at West Albany for the New York Central Railroad, which has now been in service for about eighteen months. As showing the good effects of freer circulation in preventing boiler scale, it may be mentioned that at the end of one year's service of this locomotive it was found that there was less than 1-32 of an inch of scale formed on the outside of the firebox; whereas in locomotives of the standard type on this road, performing similar work, it was found that from 1-16 to 1-8 of an inch of scale had invariably to be taken off at the close of a similar term of service. This freedom from scale is to be attributed in some degree to the corrugated form of the firebox, which by its concertina-like movement as it expands and contracts under changes of temperature, tends to crack and loosen the scale.

In the discussion which followed the reading of a paper by Mr. Vanderbilt on his boiler at the last meeting of the American Society of Mechanical Engineers the opinion was expressed that if the new form of construction continued to show such good results in every-day service, a most important advance will have been made in the art of locomotive construction.



LONGITUDINAL SECTION.



BALTIMORE AND OHIO CONSOLIDATION LOCOMOTIVE WITH VANDERBILT BOILER.

Cylinders, 15½ and 26 inch by 30 inch. **Boiler pressure,** 190 pounds. **Heating surface,** tubes 2,615 square feet, firebox 135 square feet. **Total weight,** 193,900 pounds.

The Survival of Toads in Rocks.

Some experiments were recently made in England to test the belief that toads can live for long periods in rocks without air or food. The Rev. W. Buckland took a large block of coarse oolitic limestone and prepared twelve circular cells in it, each about one foot deep and five inches in diameter. A groove or shoulder was cut at its upper margin so as to receive a circular plate of glass and a circular piece of slate was in turn to protect the glass. He then prepared twelve smaller cells each six inches deep and five inches in diameter in a large block of silicious sandstone, these cells also being covered with glass and slate and luted around with soft clay. The object of the glass cover was, of course, to permit of the toads being seen without having to remove the lids. One live toad was placed in each cell and the covers cemented on. The weight of the toads was ascertained before sealing up the cells. Both stones were buried under three feet of earth for thirteen months. All of the toads in the sandstone cells were found to be dead and their bodies were decomposed, showing that they had been dead for a long period. The majority of the large toads in the block of limestone were alive, says The Engineering and Mining Journal, and in every instance the glass covers were cracked. The toads were weighed, and it was found that they had decreased in weight. The conclusions drawn by the naturalists were that the toads cannot live a year totally excluded from air, and cannot live two years if totally deprived of food.

A BUST of Charles H. Haswell, the first Engineer-in-Chief of the United States Navy, has been placed in the Union Club, New York. Haswell was the first officer in the navy to introduce scientific methods of engineering. He organized the Engineer Corps of the service. He was also known as the author of the first table-book for engineers. He is now in his ninety-second year.