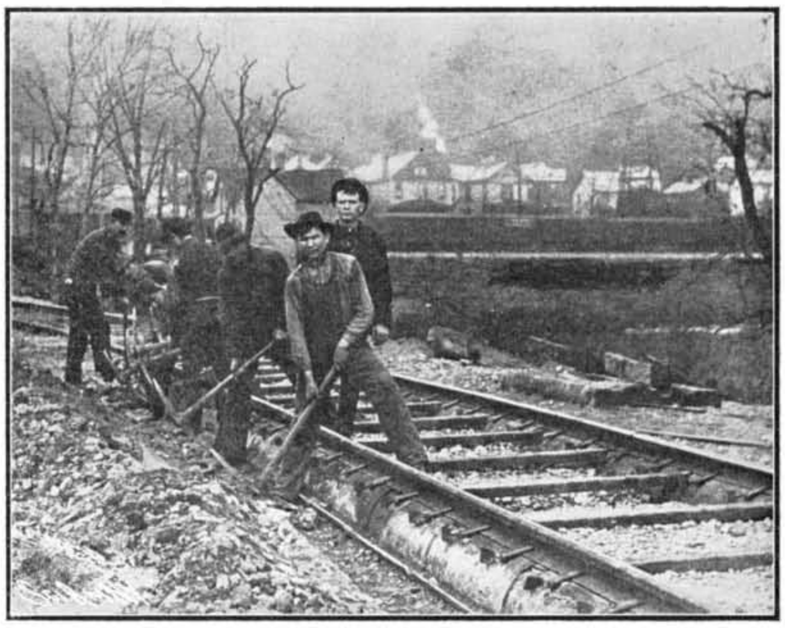
IMPROVED RAILWAY SUBSTRUCTURE.

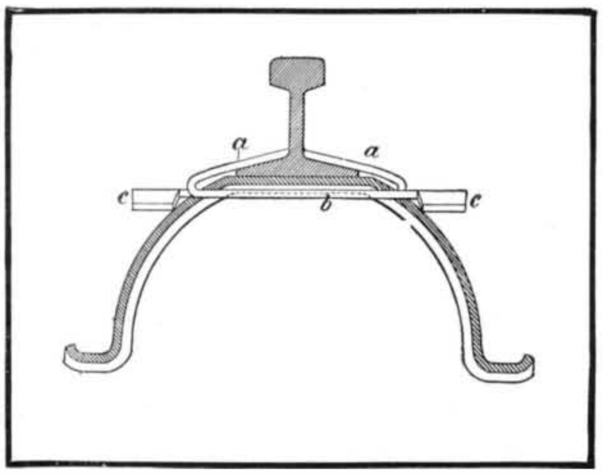
We illustrate herewith a novel support for the rails of a railway, which is so designed as to evenly distribute upon the roadbed the concentrated weight imposed thereon by the wheels in passing over the rails. Aside from thus distributing the load and affording a continuous support for the rails, this improved railway construction provides a simple but rigid fastening for the rails, which holds them in place without the use of bolts and nuts. The rail support or girder, it will be observed, has the form of an inverted steel trough, with its two edges curved upward to form flanges on which the girder rests. The rail is held in place on the flattened top of this girder by means of steel clips arranged in pairs to grip the base flange of the rail on opposite sides. Each clip consists of a metal plate, *b*, formed with an ear *c* at one end, and a hook *a* at the other, the latter being adapted to fit over the base flange of the rail. The plate or main body of the clip passes under the rail through openings in the steel girder, and is held securely in place by the ear *c*, which is bent down on the outside of the girder. The hook portion of the clip is preferably formed with a rib, which serves to greatly strengthen it and prevent it from bending open. The girders are formed with inset portions at regular intervals to receive the tie pieces, by which they are held and accurately spaced apart. These tie pieces consist of inverted metal channels having their side walls cut at the ends to form ears, which are bent outwardly through slots in the girders, thus firmly securing the tie pieces to the girders. Each girder is formed with a reduced portion at one end, which serves as a slip joint for the overlapping end of the next adjacent girder.

In laying a track with these girders, the roadbed is first prepared, as in the usual way, for wooden cross-ties, and is covered with ballast to a depth of about three inches. The girders are then placed in position, and spaced to the proper gage by the tie pieces. As each girder is placed in position, as much ballast as possible is crowded under it from the end. Each girder overlaps the preceding one for a distance of six inches. The girders are each 7½ feet in length, or one-quarter the length of an ordinary rail; and it is, therefore, possible, on laying the rails on the girders, to bring the rail joints in each case at the center of a girder. After the rails have been securely gripped by the rail clips, the ballast is tamped under the sides of the girders, to give them a firm and even bearing, and also to bring the track to the required elevation and alinement. The roadbed is then completed by laying ballast between and outside of the girders.

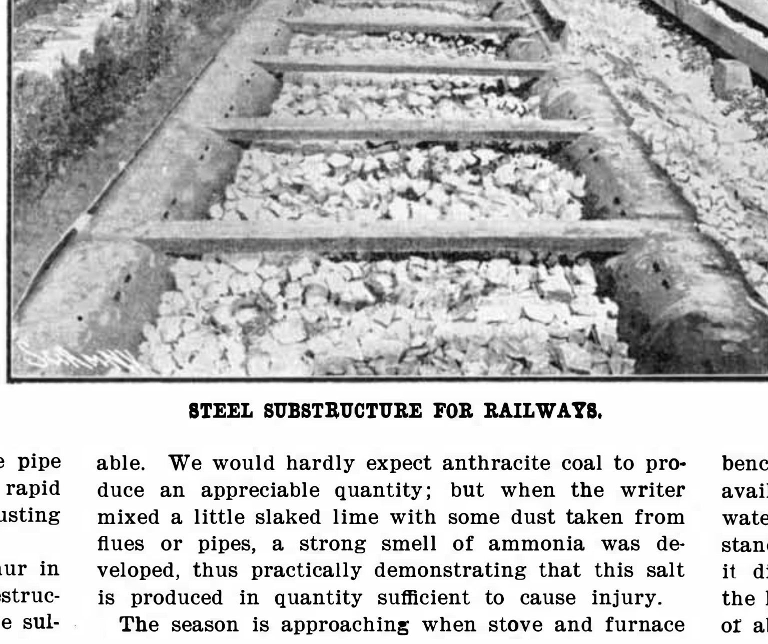
Mr. Samuel E. Duff, of Allegheny, Pa., who is the inventor of this track construction, has laid several experimental sections, both of steam railways and street railways, which have given great satisfaction. Practical men who examined the girders made the criticism that it would be impossible to tamp the ballast perfectly under them, and that the girders would spread out at the bottom under the loads they had to support. This criticism was dispelled by an experiment, in which a short track section was set up with the girder flanges resting on oiled steel plates, and then subjected to a load of 100,000 pounds, which failed to produce any perceptible vertical deflection. When the load reached a weight of 25,000 pounds, it was observed that the girder had spread five-sixteenths of an inch at the flanges, after which scarcely any change was noticeable as the load was increased to 100,000 pounds. This remarkable showing under the worst conditions possible speaks well for the rigidity of the girders, and makes it virtually certain that no deflection would occur in practice when they were partially supported by the ballast of a roadbed.



TAMPING THE BALLAST UNDER THE GIRDER FLANGES.



CROSS-SECTION OF THE GIRDER.



STEEL SUBSTRUCTURE FOR RAILWAYS.

The Rusting of Stove Pipes—Its Cause and Prevention.

BY JOHN M. BLAKE.

The ruinous rusting of stove pipes is a matter that is often forcibly brought to the attention of users of anthracite coal stoves. Pipes which have been in use for two or three years will sometimes become so eaten by rust that little metallic iron is left, and the pipe will crush in the hand. This destruction is more rapid and complete than with the ordinary weather-rusting of sheet iron.

The cause is generally attributed to the sulphur in the coal. There is not much doubt that the destruction of the mortar in chimney tops is due to the sulphur acids; but some experiments made by the writer a number of years ago, resulted in showing that the sulphur has little to do with this injury to pipes. The true cause is the production of ammonia compounds during combustion. Both the chloride or sal-ammoniac and the sulphate are formed in the pipe, and mix with the ashes and soot. It remains harmless during the dry, cold weather, but readily absorbs moisture by contact with damp air as warm weather comes on, when its action begins, and continues so long as the cause remains. The effect of sal-ammoniac to induce rusting in iron is well known. It is also well known that bituminous coal gives off ammonia when distilled—the supply obtained at the gas works being considerable. We would hardly expect anthracite coal to produce an appreciable quantity; but when the writer mixed a little slaked lime with some dust taken from flues or pipes, a strong smell of ammonia was developed, thus practically demonstrating that this salt is produced in quantity sufficient to cause injury.

The season is approaching when stove and furnace pipes will be put away for the summer; and knowing the cause of this vexatious rusting, we must look for the remedy.

The removal of the ammonia salt is a matter involving difficulties. If we start with a new pipe, and brush out every particle of dust before the dampness has been absorbed, the removal will be complete, and no harm will ensue. This, however, is an exceptional case. In our climate, we are often obliged to keep up our stoves and furnaces through the first warm, damp days of May, and sometimes early June. When rust has once commenced, and particularly in the case of neglected pipes, the crust of rust persistently holds the ammonia salt.

Two ways seem to effect its removal from the pipes. First, by immersing and thoroughly soaking the separated sections for several hours in water—running water, if possible; and second, by roasting the pipes over a fire to a red heat. In my experiments, both methods were tried with equally satisfactory results. The pipes, however, in the second method, must be heated to a dark red to completely drive off the ammonia compounds. A stove that could be heated throughout by a brisk wood fire just previous to removal for storage, might be made immune—as well as its pipe—so far up as the intense heat had reached; and it has been found of advantage to soak and wash the removable parts of a kitchen stove, before leaving the same unused for the summer. In the instance tested, this course prevented the rusting that previously had regularly taken place.

The accumulation of ammonia salts seems to be slow. Just a few fires in a stove do not appear to leave the destructive element in serious quantity. The rusting effect on cast-iron furnace flues is to form a scale to a limited depth every summer, which gradually thins the cast iron. Under the same conditions, wrought-iron pipes or flues would be penetrated, unless of good thickness.

After testing a number of samples at different times, the ammonia compound was found to be in some cases the chloride alone. Sometimes it was a mixture with sulphate, and in one instance there was present only the sulphate.

The dust from furnace flues has considerable value as a fertilizer. The ammonia will show its effect very noticeably in the increased vigor of the growth of grass on parts of a lawn where the experiment is tried.

Many Methods of Carrying Mail.

The many methods of carrying the mail in the past and present are shown by the United States post office department in the Government building at the World's Fair. The exhibit contains pictures and models and a real Alaska dog sledge used for carrying the mails in the far North. To this sledge are attached a train of Alaska dogs, mounted and harnessed, looking as natural as if alive. This train doubtless has covered many miles over the bleak and frozen territory in the far North, carrying Uncle Sam's mails.

The cowboy mail carrier on his trusty steed, galloping across the plains with his letter pouch, the footman carrying mail through the dense forest, and the mail carrier on snowshoes in the great timber districts of the North, are also shown in this exhibit, and there is a horse sled and an old-style buckboard, a reindeer sledge and an Esquimaux driver.

Coming closer to civilization, the rural mail wagon and city mail wagon, the electric mail car and the postal car, as used on the great railways of the country, are exhibited, giving World's Fair visitors an idea of the magnitude of Uncle Sam's mail-carrying business.

J. R. Freeman, of the Metropolitan Water Board of Massachusetts, is the authority for the statement that Boston is sinking into the sea. He asserts that the present datum plane, to which all elevations are referred by the engineering department of the city of Boston, and which is commonly known as Boston base, probably coincided almost exactly in the year 1830 with the mean low water at the Charlestown navy yard. To day, after a lapse of seventy-two years, the same datum plane, as defined by numerous bench marks on solid ground, according to the best available determination is 0.79 foot below mean low water. This comparison shows that the land now stands about 0.79 foot lower relatively to the sea than it did about seventy-two years ago, and shows that the land in Boston and vicinity is sinking at the rate of about one foot per hundred years.