AN EXPOSITION OF THE DANGER AND DEFICIENCIES OF THE PRESENT MODE OF RAILWAY CONSTRUCTION WITH SUGGESTIONS FOR ITS IMPROVEMENT

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BY C. H. GREENHOW.

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DANGER AND DEFICIENCIES

OF

RAILWAY CONSTRUCTION.

One of the truest tests of civilization is when, by the application of science to the production of the necessaries or comforts of life, they are made more abundant, and easy to obtain; whilst, at the same time, they are rendered capable of performing the various functions required of them in the most simple and efficient manner.

In a country like England, where science has been so extensively applied, that many of the most common household utensils are in themselves practical illustrations of some great truth; and where the mighty genius of man has almost "annihilated both time and space," by rendering the mode of transit so easy and expeditious, that we may now pass from one end of our island to the other in less time than our grandfathers would have taken to prepare for the journey;

is it not surprising that those great machines, by means of which this power of locomotion is obtained, are allowed to remain in unsafe and imperfect condition? no attempt apparently having been made to discover that mode of construction by which security would be given, and the many disgraceful accidents, which are now daily occurring, might be prevented.

I shall proceed to point out the dangers attending the present system of railway construction, beginning at the foundation of the superstructure, *the Rails;* and will, at the same time, show how I conceive those dangers may be best avoided, and perfect security given to the carriage moving on the railway.

The wheels, rails, and carriages are only parts of one great machine, on the proper adjustment of which, one to the other, entirely depends the perfect action of the whole. And as the velocity given to the moving parts increases, so does the necessity for perfect adjustment increase also, because the imperfect action, which, at moderate speed, would only cause a *jolt*, will, when moving at high velocity, gain sufficient force to cause an overthrow. Therefore, from this cause it becomes necessary, in order to secure safety when moving at great speed, to have the parts in contact adjusted to each other in such a manner as at all times, and under varying circumstances, to

preserve a true relationship one to the other, at the same time having a tendency to resist and counteract the impulses which would otherwise destroy their equilibrium, and endanger the safety of the moving body.

The relationship between the running surface of the rail and the tire of the wheel, has been allowed to remain much in the same state as it was many years ago in the north of England, when, moving only at moderate speed, and before the introduction of locomotive power, the coal was thus conveyed from the mines to the place of shipment; few modifications having been attempted, all resting apparently quite satisfied that it is the "ne plus ultra" of perfection, or ignorant that on the true action between those two parts entirely depends the perfect working of the whole machine.

Take any piece of mechanism, simple or complicated, and disarrange its parts, so that they do not act in unison with each other, what will be the consequence?—The machine will cease to perform its functions, or the ill-according parts will destroy each other.

So it is with railways, and the carriages intended to run on them; it is imperatively necessary that a perfect adjustment should exist between the different parts, not only as regards their close accordance one to the other in shape,

but also in weight and dimensions. And I may add, until such precision is introduced, at all times will they be obnoxious to the disgraceful accidents which are now so frequently occurring.

I shall now proceed to point out why the mode at present pursued, of applying the wheel to the rail, I consider to be extremely dangerous, when the speed exceeds a very moderate limit.

When a body is moving at very high velocity, it then, to all intents and purposes, becomes a projectile, and is subject to the laws attending projectiles; therefore, in obedience to the influence of the impellant force, its tendency is to proceed in a directly straight line; and in an exact ratio to the increase of the distance or space passed over, in a given portion of time, does this tendency predominate; consequently, the difficulty and danger of diverting it increases in similar ratio to the speed.

Now, the rails being the directors of the course to be taken by the locomotive and vehicles attached to it, it becomes necessary that any deviation from a straight line should not be sufficient to destroy the adjustment between the wheel and the running surface of the rail, because should it do so, the moving body, in obedience to the vehemence of the impulse, the resistance to its straightforward progress being diminished, will pass off the rails, doing great

mischief before its energy can be overcome. It having been proved that the greater the speed, so is this tendency to move in a directly straight line strengthened, the consequence is, curves which at moderate speed may be passed with safety, become highly dangerous when the velocity is great. A similar effect takes place from any other cause which may occur to disturb or divert the course of the moving body, such as by a sinking of the permanent way; the sustaining point on that side being lower than the other, the centre of gravity inclines to the low side in a degree equal to the angle formed by the relative level of the rails, imparting to the body an inclination to move in that direction in an exactly similar ratio, whilst at the same time the wheel on the lower rail not being able to adjust itself to the running surface, rests on the extreme edge of the tire, diminishing the resistance offered by the flange to lateral displacement, in an exact ratio to the increase of the angle formed between the running surface of the rail and the face of the wheel tire, as explained by angle A in the accompanying figure 1. Great part of the weight also rests on the extreme edge of the flange at B; it therefore follows, that the points sustaining the weight being at unequal distances from their axis, are revolving at different velocities, causing great friction and destruction

between the parts in contact, and giving the wheel an inclination to rise over the rail, and so allow the carriage to run off the line; a loose chair, or any inequality in the running surface, will have a like effect.

Another cause which may occur to divert this tendency to move in directly straight lines, and if sufficiently strong will throw the carriage off the rails, is the resilience occasioned by the elasticity of the rails causing the wheels to rebound, when, on account of the mal-adjustment of the angular flange with the edge of the rail, a space being obliged to be left between them, allowing a play of above an inch; the resilient action, therefore, causes a rebound from one side to the other, the motion then becomes a compound of the original straightforward effort and the direction of the resilience, partaking of each in exact proportion to their relative force, the momentum resisting the resilence until the latter, gaining strength from the accumulated force added by each succeeding blow, is enabled to divert its course sufficiently to overcome the slight resistance offered by the flange of the wheel, its adjustment to the rail being destroyed by the rising of the opposite side, as I have before shown. This I consider to be the cause of a greater part of the accidents which occur, and which, although inquired into by the officers appointed by government, still re-