Addressed: Maj Douglass Esqr
Civil Engineer
Brooklin L + L [or possible J]

New York May 1st 1838

Dear Sir

I again take the liberty of addressing you in regards to the mode of ascending and descending inclinations upon Rail-roads with locomotive power. After reflecting upon the subject for some time I have come to the conclusion that the locomotive engine can be so constructed that its power may be successfully applied to ascend inclinations of from 3 o 6 feet per 100 ft and so used as to prevent the to great velocity upon descents of the same angle.

Let us suppose a load of 100 ton engines (included) with cylinders 12 inch diameter stroke 18 inche large wheels 4 ft 6 in diameter, and some small wheels for ascending the inclinations 12 inches diameter the elevation to be ascended 5 feet per 100 ft = 264 ft per mile. Effective pressure 55 pounds per sqr inch.

Tons 90* 8 = 720 lbs friction of load tender included.

Tons 10*14= 140 lbs friction of engine without load.

310 lbs additional friction owing to the load

10.000 lbs gravity of 100 tons upon 5 ft per load.

11.170 lbs total resistance upon the inclination.

7854*12 = 113* 2= 226 area of the pistons in square inches.

226* 55 = 12430 lbs of force applied on the pistons

18*2 = 36 inches. Thus we have a force of 12430 lbs through 36 in of space each double strothir of the engine at the same time the load or resistance passes through 37.5 inches. 12430(force), 11140 (resistance) = 1260 lbs.

Thus we have 1260 lbs of force over all the resistance, the load must move up the plane with a velocity in proportion as the force is greater than the resistance.

Mr Johnson in his report to the president and directors of the N.Y and Erie Rail-road Company says an engine weighing 13 tons evaporating power 55 cubic feet, cylinders 1.16 feet diameter and 70 lbs total pressure per square inch in the boiler, will draw 149 tons up a grade of 50 feet per mile, if the wheels of the engine for ascending the inclination were made ¼ as large and so made that they would not slip the engine would draw the same load up an elevation four times as great or 200 feet per mile providing the friction remains the same. The same engine according to the report will draw 138 tons at the rate of 20 miles per hour upon the level, the above I think shows that an engine can be so constructed that it will draw the same load up an elevation of 200 ft per mile that it will draw at the rate of 20 miles per hour upon the level.

Mr Morris states that one of his engines [using hing] 18 ,725 lbs diameter of cylinders 10.5 inches length of stroke 18 inches, draw upon the Columbia road 241.275 lbs up a grade of 52 feet per mile at the rate of 10 miles per hour. I have conversed with Mr Morris and other makers of engines as to the practical difficulty that might prevent the use of my plans and I am informed that there is little or no objection in practice to descend inclinations of the above angle under all circumstances is a difficulty that I think may be overcome with ease by the power of the engine. I send a sketch[1] of what I shall

1 Sketch attached separately. See image file named letter 001.

denominate a steam brake which is one among a variety of plans by which I think the steam can be successfully used to prevent the to great velocity of the loads upon the descending inclinations.

In the centre of the track a rail may be placed for the purpose of creating friction. *A* represents the foundation for the rail, *B* represents the rail which is to be of cast iron or wood faced with iron. *CC* represents levers that are to be so attached to the engine that they will pass each side of the rail B. *DD* represents a cylinder placed between the upper ends of the levers, and by which the brake is to be worked by steam- the cylinder is to have two pistols, the rod of each is to be attached to the upper ends of the levers in such a manner that the ends will slide up as the levers are pressed outwards. The steam is to be let into the center of the cylinder between the pistons, in this manner the levers may be forced out with a pressure equal to the force of the steam or by a double set of valves any required degree of pressure may be given to the brake that may be desired. There are other combinations more simple than the above by which I think the steam can be effectually applied to lower loads down inclinations.

In conclusion, I must say that I can see no good reason why inclinations of from 3 to 5 feet per 100 ft cannot be ascended and descended by the power of the Locomotive Engine.

Respectively yours [unidentifiable signature]

Maj. Douglass E.F. Aldrich

Brooklin L.L. [or possibly J.]