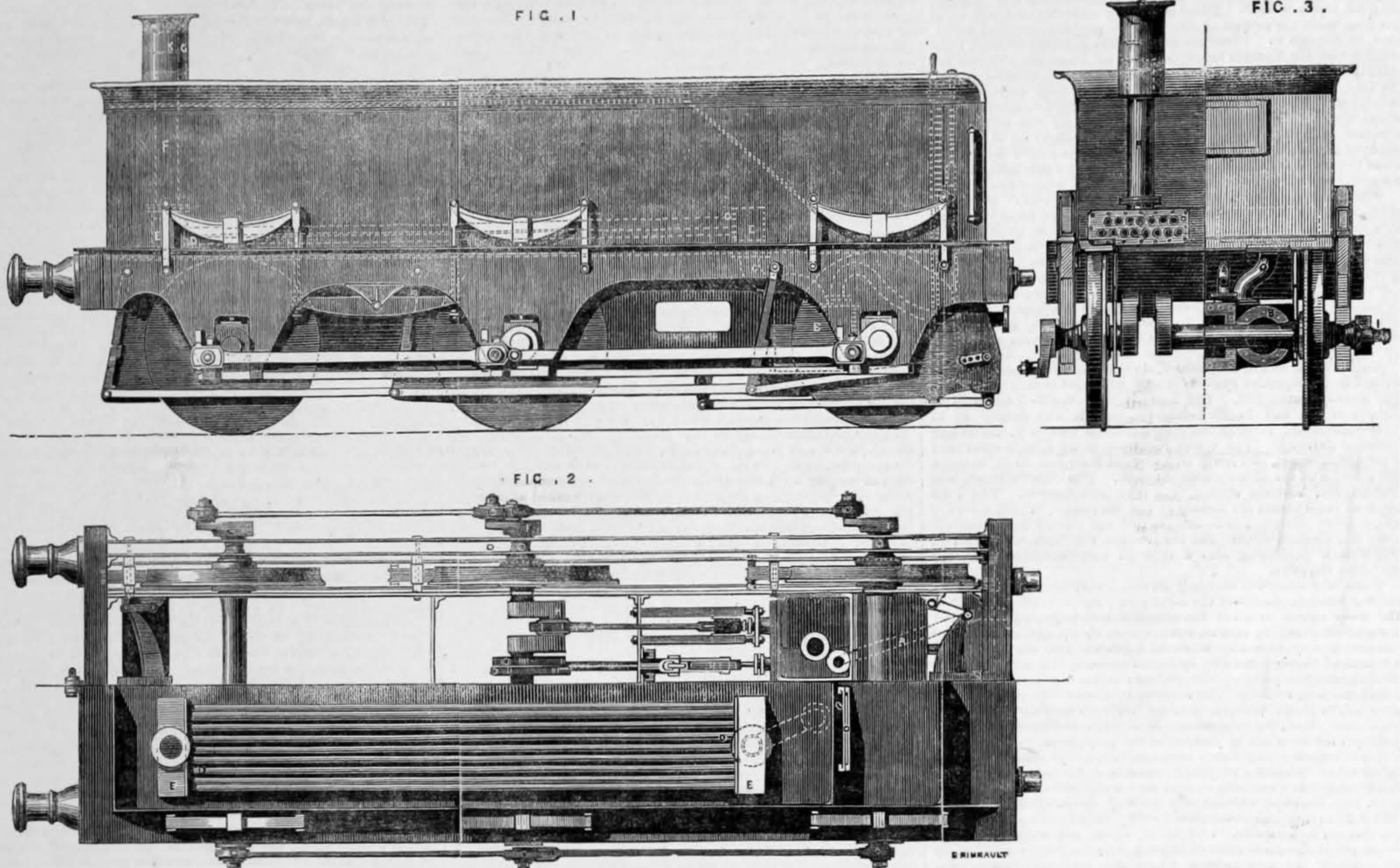


## STURROCK'S LOCOMOTIVE ENGINES AND TENDERS.



The main object of this invention, by Archibald Sturrock, Locomotive Superintendent of the Great Northern Railway, Doncaster, is to utilise the adhesion derived from the weight of the tender as a power to propel the train in addition to that of the engine proper instead of the engine, as under present circumstances, having the dead weight of the tender to draw.

The invention consists in fitting auxiliary cylinders and engines on or to the tender, in connecting them through ordinary connecting rods in the usual manner to the wheels of the tender, in coupling all or some of the wheels of the tender, and in taking steam for the tender cylinders from the ordinary boiler which supplies the engine proper.

The invention also consists in forming the water tank in the tender with a false bottom, and in leading the exhaust steam from the tender cylinders into the chamber between the two bottoms. Sometimes, instead of forming the tender with a false bottom, the waste steam is made to circulate through a coil or series of pipes carried through the water in the tender; this steam heats the water in the tank, and the steam which is condensed in the chamber or pipes returns into the tender and is forced by the pumps into the boiler.

Fig. 1 is a side elevation of a locomotive tender constructed according to the invention; Fig. 2 is a horizontal section, one half showing the bottom of the tender tank, and the other half the engines; Fig. 3 is a transverse section, taken partly in front of the forward wheels, and partly through the receiver and condenser.

A is the pipe for conveying the steam from the boiler of the engine proper to the tender cylinders B; D is a condenser, which receives the exhaust steam conveyed from one of the tender cylinders by the exhaust pipe C; this condenser consists of two cast-iron boxes or chambers E, having each a wrought iron tube plate bolted on one side, and connected with each other by (say) fifteen tubes; the steam entering the chamber passes along the tubes, and is condensed therein. There are two of these condensers D in the tank, one connected with each of the tender cylinders. F, F, are pipes connected to the chambers E, to convey the uncondensed portion of the steam into the atmosphere. The upper part of these pipes enters a larger pipe G, bolted to the outside of the tank. On the tank plate, within the base of the pipe G, holes are punched to allow the water which is forced up the pipe to fall into the tank. The pipe G has a transverse baffle plate K fixed in it a little above the exhaust pipe.

## CHEAP RAILWAYS.

The chief obstacle to the extension of railways in this country is their excessive costliness. There is now no difference of opinion as to the essential importance of railways for the development of a country's resources. Viewed in relation to this day, they are what common roads—turnpike and highway—were to the last century; they have become the necessities of social and industrial life. A district without a railway is, in a manner, shut out from free intercommunication with the world at large. It is, therefore, quite natural that the population of all districts should desire to be placed *en rapport* with the main lines of communication, and secure their fair share in the benefits of this great invention.

But railways are so costly. They are costly in their projection, in their engineering, in their construction, and in their working. Before getting a line through Parliament, a host of witnesses must needs be brought to town, sometimes from a great distance, and kept kicking their heels, waiting their turn before committees of both Houses. Then comes the long array of witnesses, marshalled by counsel, who examine and cross-examine them at length, followed by the decision or indecision of the committee. The bill is won or lost at the cost of many thousands of pounds. In the case of one of the contests of last session the Parliamentary expenses of a single unsuccessful bill are stated to have amounted to upwards of £50,000.

But it is when the Act has been secured that the real costs of the undertaking begin. Owners of property, the value of which may be quadrupled by the proposed line, resort to the well-known methods of screwing the last penny from the projected company for the land required for the railway. Then the *work is done*, often much more costly than they need be, for engineers have a natural desire to execute works that will bring them credit and enhance their reputation. Architects also take a natural pride in erecting

handsome stations, though at the risk of a long terminal bill; and when, at length, all is completed, the line is often found costly to work. Very frequently the new line branches out of and forms part of some existing railway; and the arrangements which are in force upon the main line are, with a view to convenience, extended to the new branch. It may, however, happen that the arrangements which are suitable in the one case may prove very costly when applied to the other.

Hence the extension of the parent line has in so many cases been followed by a reduction in the net receipts, and the opening of new branches has so frequently been followed by smaller dividends, that the impression has gone abroad, and even become embodied in the railway maxim, that "*branches are suckers, and not feeders.*"

The fact of the unremunerative character of many of these branches must be admitted. But the question occurs—Need they be so costly? Is it not possible to construct branch lines on a more moderate scale of expenditure than has heretofore been the fashion? Why should there not be a class of railways adapted for the rural districts, having the same relation to the main lines that the old common highways of the country have to the turnpike roads? Railways ought to be extended—as we believe, they will be extended—into every moderately populous district, whether agricultural, mining, or manufacturing; but so long as they are constructed and worked at a loss, so long will their extension be inevitably retarded.

The construction of cheap railways is not an impossibility. The thing has been done, even in this country. The last instance is the Finn Railway, in the county of Donegal, which has been made at the moderate cost of £5,400 a mile; and there are lines in Scotland—by necessity a land of thrift—where they have been made at a still cheaper rate. By their means, districts before unprovided with convenient access to the great highways of railway traffic have been placed in communication with them, their resources have been opened up, and the results have been as beneficial to the public as to the shareholders.

This subject of cheap railways for country districts has been thought of so much importance by the French Government, that in November, 1861, they appointed a commission specially to inquire into it, and the reports of their officers are now before us. Those reports are of a highly interesting character, and throw considerable light on the subject under consideration. M. Lan, an eminent French engineer, examined most of the cheap lines in England, Scotland, and Ireland, and gives the results of his inquiries in an elaborate report. Although he found several of them at work in England, he seems to have been most struck by the successful results of the little Scotch railways, projected by local enterprise for the accommodation of limited districts, and constructed and worked under local inspection and management. He found them laid out with much judgment, constructed with every regard to economy, and worked at the smallest practicable cost. The result was, that while they were found to be of great local utility, they yielded a fair rate of profit upon the capital expended upon their construction.

"These small companies," says M. Lan, "are for the most part got up in the localities proposed to be served by the construction of a railway. By friendly arrangements with the owners of land, and by reducing the cost of construction in various ways, these local lines are made at a much less cost than if they had been projected and carried out by the great companies, who are usually made to pay the highest price for land, and are themselves prone to execute the necessary works upon a large and costly scale. The constitution of the companies in the localities themselves places the direction of such enterprises in the hands of persons locally interested in their success, who not only really and efficiently direct them, but are always on the alert to seize opportunities for enlarging their usefulness, economising their working, and increasing their traffic. Where the probabilities of increase of traffic are small land is taken for only a single line of way, excepting near some of the principal stations; but where there is reasonable prospect of increase land is taken for a double line at once."

Tunnels are avoided because of their costliness, and the projectors do not hesitate to make a considerable *détour* to avoid a difficulty, rather than undergo the heavy expense of either boring under it, or going over it. "We must observe," adds M. Lan, "that the topographical conditions of the districts served by the lines in question considerably facilitate their execution. The greater number of them have for their object, not to run through or across mountains and valleys, but to hold along the level ground, and join together distant points, or rather simply to ascend the

valleys, whose windings are followed as much as possible. In these primary conditions, the Scotch engineers, while duly providing for the solidity and security of the road, study how best to follow the natural level of the country, 'bugging the ground,' applying themselves with infinite care to avoid all unnecessary expense; studying economy in construction always, and beauty of works never."

The lines being made with the sanction, and partly with the money, of the adjoining proprietors, they are found much less exacting than they would most probably be in the case of a company of proprietors constructing the line who were strangers to the locality; and the arrangements of under and over bridges, of gates and level crossings, which usually add so much to the cost of construction in ordinary cases, are, by such co-operation and assistance, usually accomplished without difficulty, and in the least expensive manner possible.

The stations, also, are constructed with extreme simplicity—the intermediate stations being usually of wood, and the terminal ones only of stone. Long, raised platforms are avoided, the carriages being provided with ample steps, to enable the passengers readily to enter them and alight from them. Of course, this arrangement is not first-class. Lines of such a character, if established near London, would probably lead to endless complaints in the *Times*. But country people are satisfied to have a railway on almost any terms, and they have no difficulty in accommodating themselves to the means of transit, however primitive, which are provided for them. They are too thankful for the blessing to be at all fastidious about it; and they know very well that, as the traffic increases, so will the accommodation be improved.

M. Lan's report on this subject is set forth at length in the "Enquête sur l'Exploitation et la Construction des Chemins de Fer, publiée par ordre de son Excellence le Ministre d'Agriculture, du Commerce, et des Travaux Publics." It is followed by a still more interesting report on the same subject, by M. Bergeron, formerly principal engineer to the Western of France Railway. That gentleman visited England, on his way to Scotland, in 1860, before the appointment of the commission in question; and his object was partly to see the scenery of the North and partly to make inquiries as to the working of the cheap Scotch railways, of which some vague accounts had reached him in France. M. Bergeron, while passing through London, called upon the writer of the present article, for the purpose of ascertaining whether there were any cheap lines, worked by local companies, in the neighbourhood of the metropolis; but such lines being very rare in any part of England little information could be given him, and he proceeded to the north to pursue his inquiries on the subject. In less than two months he returned, having collected the necessary facts, which, in his opinion, were of much practical value, as solving the problem of cheap railways, and pointing out the true method of developing the resources of France in districts comparatively remote from the great centres of its population.

"The case is very simple," explained M. Bergeron. "The great companies do everything on a large scale; the small local companies are directed by gentlemen who probably know little of the locality to be served by the branch, and hold their weekly or fortnightly meetings of a few hours each at a considerable distance from it; the latter is directed by resident gentlemen, who, though not professional directors, and receiving no direction allowance, are yet amply repaid by their trouble by the improved returns on the capital invested by them in making the railway. With the large company the income of the branch is altogether subsidiary, and comparatively insignificant; with the other it constitutes the sole revenue of the undertaking. Hence the careful study of all methods of avoiding unnecessary expense, first in the purchase of land, next in the cost of construction, and lastly in the working and management. All this is of the greatest importance in the result; for, whereas the costly line of the large company may possibly yield little profit, and even be worked at a loss, the small local branch usually shows a fair profit on the working, and the directors are enabled to divide amongst themselves and the other proprietors dividends ranging from three to eight per cent."

This subject is of so much interest and importance to railway proprietors, as well as to the inhabitants of districts not yet brought within the range of railway communication, that we propose to return to it in future numbers.—*Railway News.*