

road locomotive, the period being determined by the proper length of the working day of the driver, rather than by the capabilities of the machine.

The working time of the traction engine may therefore be stated to be, ordinarily, twenty per centum greater than that of the dray horse, and to be capable of indefinite extension when required.

The loss of working time by the horse through illness, at the farriery, etc., and that lost by the locomotive in the repair shop, are proper subjects for comparison; but it is difficult to determine them in the absence of reliable data. We may estimate these losses as equally affecting the two motors, with a probability that the correction of any error in such estimate may make a change favorable to the locomotive.

First Cost.—Comparing the first cost and running expenses of steam and of horse power, we may work from tolerably well established data. The list price of the Aveling & Porter road locomotive, experimented with at South Orange, is, delivered in New York, about \$4,000.

The average cost of horses purchased by the Third Avenue Railroad in New York city, is now \$157.50, and it would require more than twenty such horses to pull the load of the traction engine, while an addition of twenty-five per cent. must be made for the greater length of the working day of the locomotive. Twenty-five such horses would have a first cost of \$3,937.50, to which must be added the large item of cost of harness.

The first cost of steam and of horse-power is, therefore, nearly equal, the difference being in favor of steam, leaving also, on the side of the engine, the immense advantage arising from its ability to work longer hours when required, and indefinitely. The interests on these first costs also nearly balance each other.

Running Expenses.—The running expenses of the locomotive consist of cost of attendance, of fuel, oil and repairs, and of depreciation in value with use; those

of horse power are attendance, food, stabling, sickness, and depreciation with age.

The cost of attendance upon the one engine and the twenty-five horses may be taken at \$939 and \$3,130, respectively, assuming each driver of the latter to be able to manage a six-horse team. The engine driver receives three dollars per day and the other men two dollars and a half, and there

similar estimate will give, for the annual expense of keeping one horse, very exactly \$300, excluding attendance. In the year 1870, 10,315 horses in the State of New York cost for stabling, feeding, repairs to harness and shoes, etc., according to the official statements, \$3,182,838.24, or \$308.56 each animal. From this is to be deducted about eight dollars per head for receipts from sales of horses,

later.) 65.00
Cost of stabling, general expenses, and incidentals 180.00
Total annual expenses, including depreciation.... 206.43

Add to the above the cost of harness (not stated), say 3.00

The total annual cost of horse-power, for comparison, \$2 X \$209.43 = \$5,235.75, to which we add \$3,130 for driver, and we make a total cost per year of \$8,365.75 to be compared with \$2,439, the total annual expense of doing an equal amount of work.

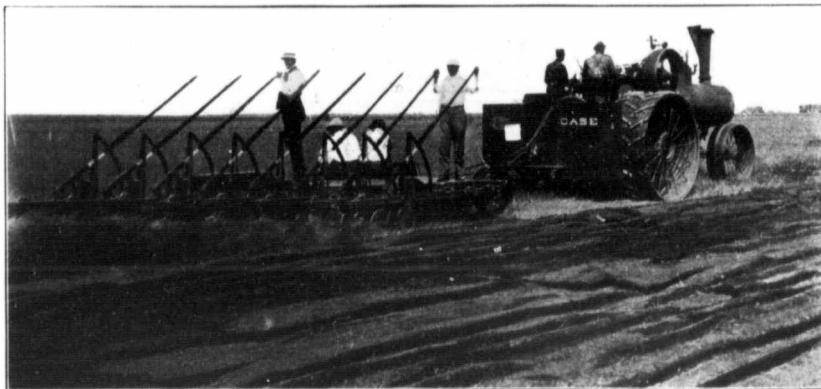
The expense account when doing heavy work on the common road under the described conditions, by steam power, is therefore less than 25 per centum of the average cost of horse power, as deducted from the total expense of such power in New York State, while if we take for comparison the lowest estimate that we can find data for in our whole country, we still find the cost of steam power to be but 29 per centum of the expense of horses.

We may state the fact in another way: a steam traction engine, capable of doing the work of 25 horses, may be worked at as little expense as a team of six or eight horses.

Prospective.—Thus, thirty years after the defeat of the intelligent, courteous and persistent Hancock and his co-workers in the scheme of applying the steam engine useful on the common road, we find strong indications that, in a new form, the problem has been again attacked and at least partially solved. It was formerly supposed that success in the transportation of passengers by steam on post routes would lead to the

application of that motor to the movement of heavy loads and to agricultural purposes generally. When, after so long a trial, the experiment finally seemed to have failed of success, it was believed that steam could not be applied to heavier work on common roads. As we have now seen, however, it appears probable that the inventors of that

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The Case 25 h.p. Steam Tractor pulling an 8 bottom 14 in. Cockshutt Engine Gang

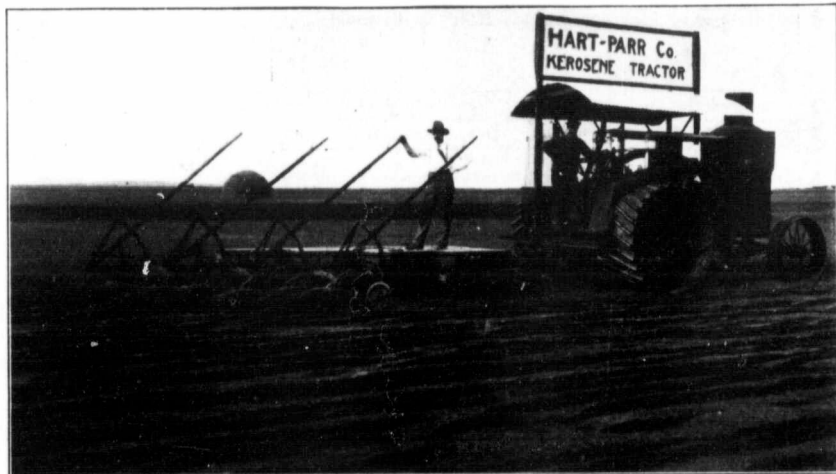
are 313 working days in the year.

The cost of fuel, oil and incidentals, excluding repairs of the engine and its depreciation, may be averaged at \$900 per year, in the vicinity of New York. This is somewhat higher than the cost of similar items on railroad locomotives in New York State.

The cost of repairs and depreciation has been thus far so small at South Orange that it could not be estimated, but for the life of

leaving for annual expenses, say, \$300 per horse. The expense account, excluding attendance, would be, for twenty-five horses, \$7,500, as against \$1,500 for a similar amount of steam power, and including attendance, \$10,500, as against \$2,439.

Referring once more to the expense account of the Third Avenue Railroad, we find it working more economically than the average as given above. This com-



The Hart-Parr at its demonstration work near the contest field. 8 14 in. John Deere bottoms were pulled.

the engine, it will be likely to average something less than fifteen per cent. of the first cost, or in this case, \$600 per annum. This we arrive at by an examination of railroad locomotive expenses, as officially reported.

The total annual expense, therefore, of the traction engine referred to may be reckoned at \$2,439 as a maximum figure, including cost of attendance. A

pany employs an immense number of horses, buys its supplies in large quantities, taking advantage of the market, and is able to do much better than could any individual or smaller capitalists. The following data were kindly furnished by Mr. Charles S. Arthur: Average first cost of horses, per head.....\$157.50
Average price obtained when sold, (3½ years