The hand car—filled an important need in its day

History, Development Track

Progress traced from early push cars, velocipedes and hand cars to the first use of gasoline engines and to the modern track motor cars now used

IT may be said safely that in no other industry is the plant to be maintained so widely and thinly spread as on the railroads of the country. To be sure, in its shops and terminals there will be found a considerable concentration of facilities for the maintenance of equipment and the handling of freight and passengers; but stretching between these concentrated groups are miles of lines, with roadbed, tracks, bridges, signals, communications lines, outlying buildings, signs, crossings, and fences to be maintained. Because these facilities are so widely and thinly spread, their maintenance introduces a problem not found to the same extent in any other industry; that is, the problem of bringing to the point where they are to be applied, materials and labor required for that maintenance.

For this purpose the track motor car has, in the forty years or more since its introduction, proved its worth in constantly increasing use. Whether the need is for the transporting of one man or a large gang from headquarters to the job, perhaps miles distant, the motor car, through many years use, has come to be considered the answer to the need; and more recently, due to changes in train service, it has taken on to a much greater extent the added function of distributing maintenance materials.

Because of the service rendered by it, the problem of the proper maintenance and operation of the motor car has become of increasing importance. This problem has not yet received the recognition that it deserves. The function of the motor car is often considered supplementary in maintenance work, and correctly so. In many of its uses, the results of its work are indirect; the moving of men, tools, or even materials to the job does not seem so definitely a part of the work of construction or maintenance as does the work of tampers, power wrenches, concrete mixers and other roadway machines. Since its work is indirect, the fact is often overlooked that its use makes productive many man hours of labor that would otherwise be non-productive; and in consequence of this attitude toward it, too little care and thought are given to its maintenance and operation.

Development of the Motor Car

The motor car is an outgrowth of the push car, which, as its name indicates, was first propelled along the track by men walking beside the car or by poles shoved against the ends of ties by men who stood or sat upon the car. The next development was to equip the car with a crank and gears, the crank being turned by two men. This method was further improved by the installation of two pulleys, one on the crank shaft and another on the axle of the car, the power being transmitted to the axle by a belt. The objection to this method of propelling the car was that only two men could work at the cranks at a time. As a result, the idea of the walking beam was borrowed from the old town fire pump, the power being transmitted to the axle by means of a crank and gear which engaged a smaller gear on the axle. Out of this came the hand or lever car, which was a decided improvement over earlier methods of propulsion, as it not only permitted the entire gang to work at the levers but effected a marked increase in speed. This lever car, with but few modifications of the original design, is still used to a limited extent, where the distance to be traveled is small.

First Complete Cars

The first complete motor cars, introduced in 1896, were of the side-load type, designed to carry one or two men in what is now known as "light inspection" service; i.e., by roadmasters, supervisors or other men working alone or in pairs. As the practicability of these small cars was demonstrated, larger ones were built to carry a greater number of men. Viewed from present-day standards, the earliest of these cars were crude in some respects, and often uncertain in operation. The carburetor, induction coil and spark plug as now known were still in the process of development. The mixing of air and fuel was accomplished by permitting the fuel to drip down through a series of screens and wicks within a metal box through which the air was drawn. Much of the engine trouble experienced with the earlier cars was due to the difficulty of maintaining a suitable mixture of fuel and air. The ignition, by means of the low tension "make and break"

and Application of Motor Cars

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system, was never well adapted to motor car service, but was the best available at that time.

During the period from 1896 to 1905, there was marked development. Larger cars of the center-load type for gang use were made available.

The Author

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The carburetor and the high tension "jump spark" system of ignition were developed. However, the use of the motor car for general service progressed slowly. Labor was plentiful and wages low, and the railroads seemed reluctant to replace their time-tried lever car with the newly developed motor car. The employees, however, welcomed the new means of transportation enthusiastically. About 1910, some engines were being purchased by gang foremen and applied to the lever cars or push cars assigned to them. The first engines so applied were not built for this use but were adaptations of engines designed for other purposes. Engines specifically built for motor cars use quickly followed, and many such applications were made.

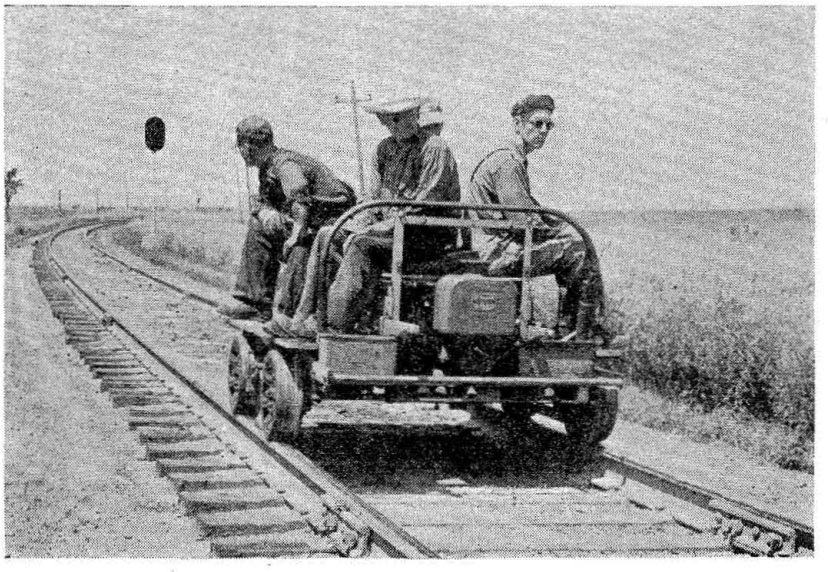
Although the car of this early period had achieved such a measure of reliability that even in the hands of an inexperienced operator, its return to the starting point without serious delay or trouble could usually be expected, it was not wholly satisfying. It lacked power, especially on heavy grades or in locations where wind resistance was high. It was somewhat awkward to handle and could not be removed from the track as readily and quickly as could be wished. It lacked many of the safety appliances that have, in recent years, come to be considered necessary. Its weaknesses were noted by the users, and the word passed back to the builders who were quick to correct them; and while further development was not rapid, it has been continuous.

Safety an Objective

Safety in operation has been the aim of many developments. Some of these were involved in the design of the car, as for example, the substitution of the free-running engine for the direct-connected type. Other developments have been in the nature of accessories, which while they increased the weight of the car, unquestionably promoted safety.

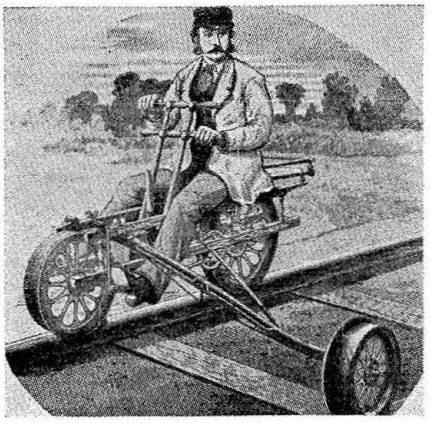
The safety of the car itself, and frequently of the operator and other employees, depends much on the ease and speed with which it can be removed from the track. This has become more important as the speed of trains has increased so greatly in recent years. Much thought has been given to weight reduction and to the design of the car that would promote ease of handling. The adoption of the free-running engine, which removed the weight of the engine from the drive axle and to the loose axle end, was a long step toward easier handling. The introduction of rail skids, set-off skids, and extension lift handles were also helpful. Too, both by more careful design and by the use of lightweight, high-strength alloys, the total weight of the car was reduced. Yet it must be said that weight reduction still remains one of the most desired changes in the car; it is the point on which the modern car is most criticised.

Some of these developments were influenced by the automotive industry. Among these may be noted improved carburetion, better engine design, and especially the application



Modern track cars are now practically indispensable to the transportation and effective work of signal construction crews

of light-weight alloys to the construction of many parts. Of these changes, some followed closely the practices in automobile construction, being essentially the adoption of those practices with only such modifications as were necessary to adapt them to the peculiar requirements of



An early velocipede car

the motor car. Many others were not in any sense copied from the larger industry, but suggested by its experience and studies. There is another way in which the influence of the automobile has been felt. To a considerable extent the inexperienced operator has disappeared; he may still be careless and indifferent, but nearly always he has had some experience with the gas engine, and some knowledge of it, through his acquaintance with the automobile engine.

Further developments are to be expected. Just what they will be is largely conjecture; probably a further reduction in weight, especially by the substitution of lighter and stronger materials for those now used, possibly the use of Diesel power in place of the gas engine, and perhaps more or less radical changes in general design.

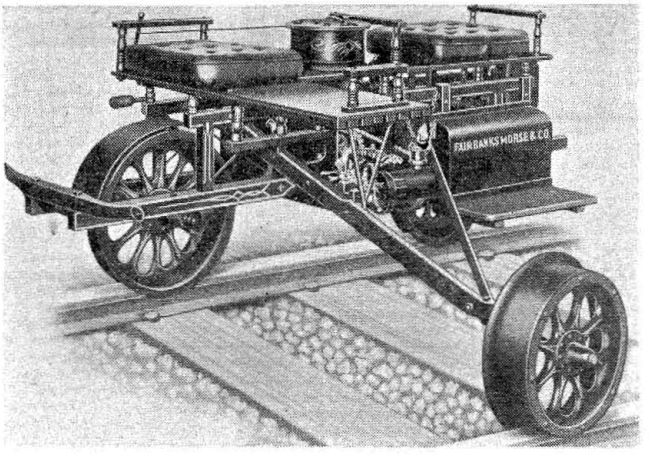
The Life of the Car

The cars of today are far superior to those of even 10 or 15 years ago. They are powered more adequately, yet without increase in weight. They are much more reliable and economical in operation and are more easily maintained. That they fully justify their use in maintenance of way work and the other services to which they are applicable is attested by the fact that approximately 52,000 of them are in use on the railroads at the present time. These 52,000 cars represent an investment of approximately $15,000,000. During 1944 it is estimated that more than 3,200 new cars were purchased at a cost in excess of $1,000,000.

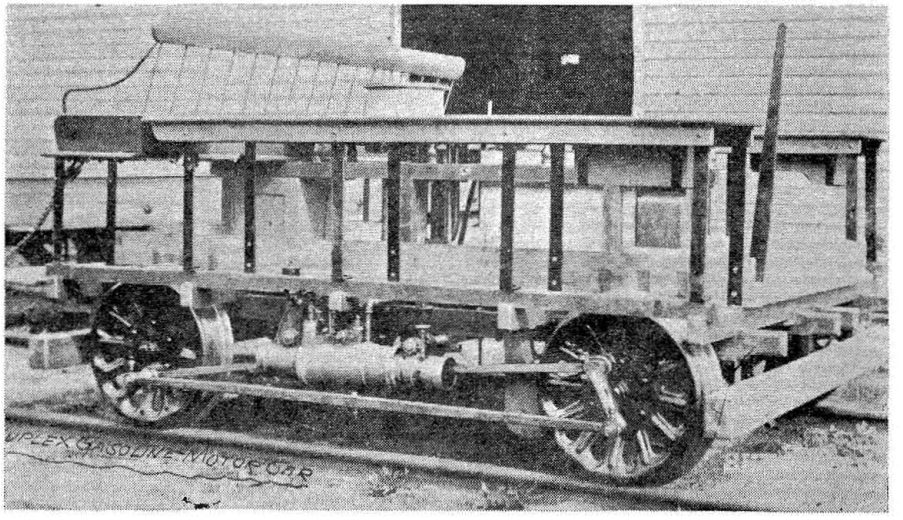
The number of motor cars purchased in a given period and the number in use at any time varies widely. During times of heavy traffic, maintenance work increases and there is an increase both in the number of cars in use, and in the number of cars purchased. During years of slack business there is some reduction in the number in use and, for obvious reasons, a reduction in the number purchased.

The average life of a motor car is generally considered to be about 10 years, although many cars remain in service much longer than that. Many things affect the life of a car; care in design and in the choice of materials, care in maintaining and operating, and, of course, the amount the car is used. Many cars still in service are 20 years old or older. In such cases, little if any of the original car remains; but by the renewal of parts the life of the car has been extended far beyond the average. Whether this is economical may be questioned for two reasons. The first of these is based on the service received from such an old car; there will always be some parts nearing the end of their life, and the failure of one such part may delay the work of a gang to such an extent as to more than offset any saving effected by delay in replacing the car. The second reason is based on obsolescence; while the changes in design from time to time, as has been noted, have not been radical, they have, even in a life span of 10 years, improved the service of the car to a marked degree.

Practices in the retirement and replacement of cars vary on different railroads. The advisability of the retirement of a car may be determined by comparing the estimated cost of repairing it with the cost of purchasing a new car to replace it. If the cost of the repairs amounts to as much as 60 per cent of the cost of a new car, the old one may well be retired. However, obsolescence should also be considered; if for example, the old car is direct-connected, its retirement on a lower per-

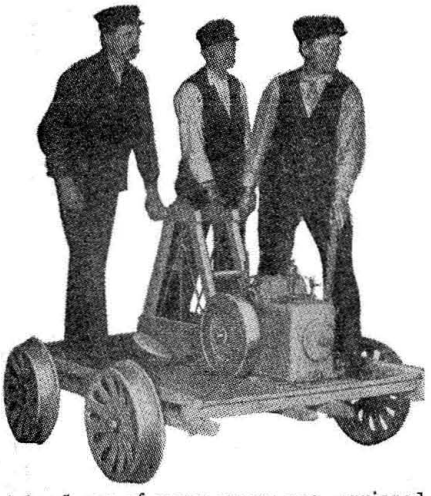


The first complete motor car—a light inspection car of the side-load type



This center-load gang car, one of the first to be built, was propelled by two water-cooled engines, one on each side

centage would be warranted when the increased safety in the use of a car with free-running engine is considered. Again retirement on a lower percentage of the cost of replacement may be justified if the old car is the only one, or one of a very few, of that particular type on the property, or if it is of a type that has proved unduly expensive to maintain or hard to handle.



A hand car of many years ago, equipped with an early gasoline engine

The Motor Car in Track Work

The tasks in the maintenance of way department in which motor cars are employed include almost every operation in the conduct of the work of maintaining tracks and structures. Their principal field is in track work, not only for regular section gangs engaged in the routine work of maintenance but also in extra-gang and construction service.

Formerly it was considered that the use of a motor car would save, for the foreman and men on the average section, an hour each day that would otherwise be spent in non-productive work. Owing to the lengthening of sections on many roads, this saving has been increased from 50 to 100 per cent in some territories. In fact, the use of the motor car may be considered a principal factor making the lengthening of sections possible. In addition, the efficiency of the men is increased by reason of the fact that practically no exertion is required of them in the operation of the car, and as a result their full energy is available for the work in hand. It is also possible to secure and hold a better class of men where motor cars are used. The motor car also permits a foreman to get over his track at more frequent intervals. Another advantage is the convenience and speed with which gangs may be mobilized at any time for emergency or other work. It is of decided advantage in enabling a gang to get to an accident or washout promptly. It is of particular value in permitting a gang to get over its track quickly after a storm, thus reducing delays to trains and the possibility of accidents.

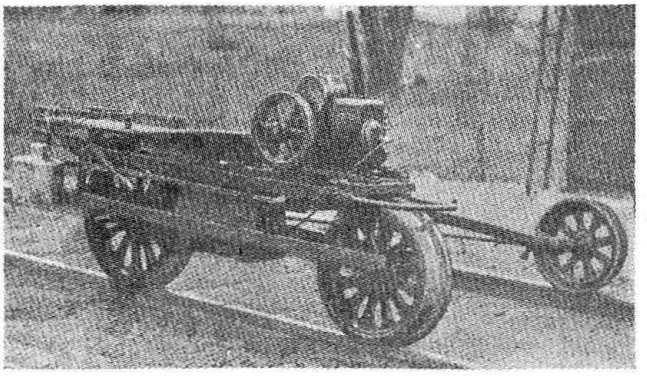
The use of motor cars is of particular value with extra gangs in handling both men and materials. This is especially true in handling men as it eliminates the necessity of sending them on regular trains whose schedules may not be adapted to the working hours, and delivers them to the job without an extra stop for the train. The use of motor cars also makes it possible in many cases to select more favorable camp sites. The time saved by extra gangs is generally greater than that with section gangs, both because of the longer haul and the greater number of men involved. It may often amount to 1½ to 2 hours daily for each man, as in the case of exceptionally long sections. On the basis of a 50-man gang, this would aggregate 75 to 100 man hours, or the equivalent of 9 to 12 additional men.

Heavy-duty motor cars are used by welding gangs for the transporting of men and materials to and from their work. They are also used for towing track weed mowers, and, with discing equipment attached, for discing ballast shoulders.

In connection with motor cars in gang service, the use of push cars* and trailer cars should be considered. The load that the motor car itself can carry is limited by both weight and space. However, a modern section-duty car with free-running engine is capable of towing a well-loaded push car, while a heavy-duty motor car may be expected to haul five or six trailers carrying as many as 100 men or more, or a number of push cars loaded with material.

Based on the number of motor cars used, signal maintenance comes next after track maintenance and each car in this service will make a considerably greater mileage per day than cars in section or extra-gang use. The maintenance of modern signals requires frequent and careful inspection and adjustment of signaling equipment. To do this without a motor car for the transportation of each maintainer and his tools and supplies would require double the number of maintainers now employed.

In bridge and building work, both light and heavy cars are required; the small cars for inspection service and light building repairs, and heavy-duty cars for handling the larger gangs, their tools, and frequently, materials as well. The distances traveled vary greatly but the service generally is comparable to that of the smaller extra gangs.



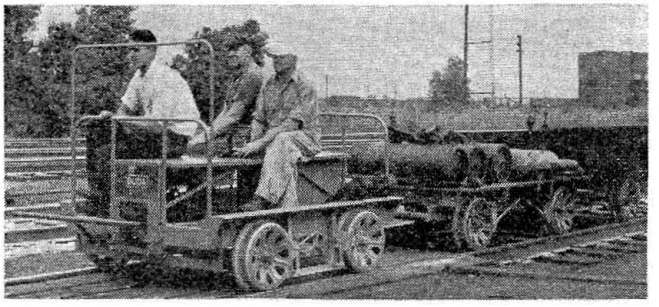
One of the first small gasoline engines installed on a velocipede car

A modern one-man inspection car used by signal maintainer

The use of motor cars in inspection service is practically universal. The cars used are confined largely to two classes; the one requiring a small car capable of carrying one or

*"Push car" as used here means a car designed and used for carrying materials, while "trailer car" or trailer is one equipped for transporting men; the American Railway Engineering Association so defines these terms.

two men and used in bridge inspection and by roadmasters and track supervisors; and the larger party inspection cars, the seating capacity of which varies from 6 to 16 persons, and which is designed for general use on divisions or grand divisions.



The modern gang car can haul substantial loads of men and materials

Division inspection cars usually have a seating capacity of 6 to 8 persons and are capable of transporting the division superintendent and his staff. General inspection trips over several divisions usually demand a larger car with additional seating capacity. These larger cars are equipped with engines of from 25 to 112 hp. and will attain speeds as high as 50 m.p.h. or more. In many instances they replace the division superintendent's business car or a special train, such as was frequently operated in the past for the purpose of making inspections.

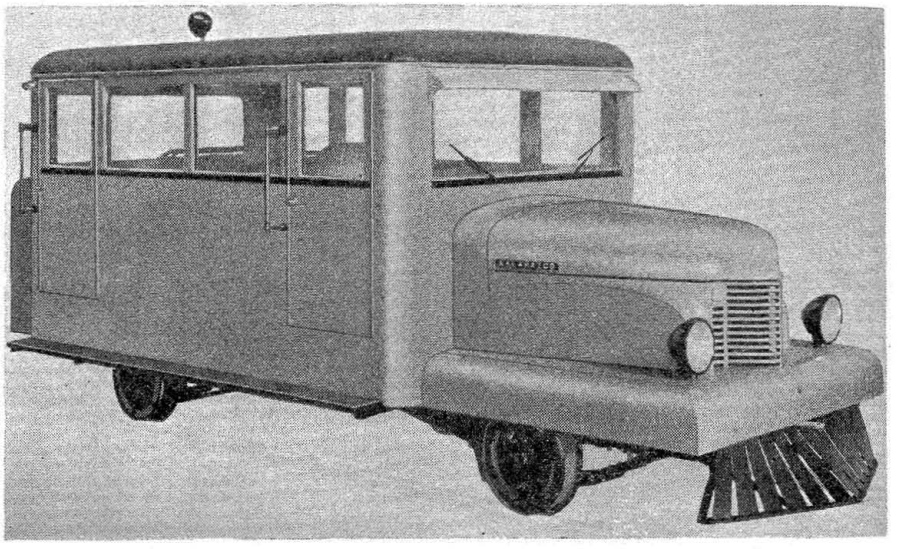
Besides their use as party inspection cars, there are other applications of the use of motor cars that are entirely apart from maintenance of way work. Motor cars are used for hauling employees to and from isolated shops and yards where other means of transportation are not available. They are also used by yard clerks in checking cars on outlying tracks, and by car repairmen for making repairs on bad order cars set out at outlying points. In some cases store departments use them for checking line stocks and for handling materials.

One of the problems in the operation of hump yards employing car riders is to return the car riders to the hump as quickly as possible. The motor car has proved to be the most satisfactory and economical method of performing this task. Heavy-duty cars are used in this class of service, equipped with foot boards in addition to the deck and seat used on roadway maintenance cars. These foot boards permit the riders to board the cars while in motion and also form a foot rest for men seated on the deck of the car. From 10 to 15 men ride the car on each trip. Without motor cars, the logical means of transporting the car riders would be through the use of a locomotive and trailer car. Therefore, the saving by using motor cars is equivalent to the cost of operating a locomotive from one to three shifts per day, depending upon the number of hours the hump is in operation.

During recent years, the use of work trains for distributing roadway materials has been declining, and their use for transporting men to the job has almost entirely disappeared. The latter was always an expensive practice but until the advent of the motor car it was one that could not be avoided. Handling men by motor car has not only eliminated the work train expense, the daily cost of which has increased greatly in recent years, but in addition has in many cases reduced the time lost by the gang owing to the fact that the work train frequently spent much time in a siding clearing revenue trains, or was called late to avoid interference with traffic. Work trains are still used to a considerable extent for distributing materials, but even here, the use of heavy-duty motor cars towing push cars on which materials are loaded has saved many work-train days. Every work train taken off the road makes for efficiency. The motor car, more than any other agency, has made possible the reduction of work train mileage from an average of 42,910,932 miles per year in the period from 1911 to 1915 inclusive, to 15,530,660 miles per year in the five years from 1939 to 1943, inclusively, a reduction of 27,380,272 miles in the yearly average.

The future of the use of motor cars cannot be forecast with any certainty. New uses may be found for them, and in other cases they may be supplanted by other methods of handling men and materials. Especially during times of heavy traffic, travel by motor car is sometimes delayed considerably. In line with the general movement toward the use of off-track instead of on-track equipment, there has been some development in the use of auto-trucks. This trend may be expected to increase where conditions are favorable, and for certain services for which the use of trucks is peculiarly adapted. It may be noted, however, that off-track transportation can be used only where improved highways are adjacent or give ready access to the railroad; and that the purpose of patrolling track is not served by off-track transportation. This latter feature is of particular importance in the case of track forces; and its loss would undoubtedly demand some specific patrolling to replace that now done as the gangs move to and from their work. The duties of signal and communication lines forces are also in general such as to require that they travel on the track.

In spite of possible delays in their operation, and the occasional loss of a car in an accident, there is little doubt that motor cars will continue to be used on the railroads in large numbers for many years.



An up-to-date large party inspection car