

The car repair, steam wrecking crane and other buildings to be located as near to the roundhouse as the yard track and switching accommodations will permit.

A 200 ton capacity, 75 ft., half-through steel plate girder turntable to be installed in connection with the roundhouse so that the radial tracks leading therefrom will not have crossing frogs. The center to be supported on anti friction roller bearings and the table to be operated pneumatically.

A positive brake and table-latching device to be provided which will be under the complete control of the operator.

The turntable pit to be made with vitrified brick or concrete bottom, well drained and with steam heat piping installed to clear the snow where the locality requires this.

An arrangement of roundhouse tracks to be provided which will facilitate the coaling, sanding, cleaning of fires, watering and turning of locomotives for outgoing trains with the least switching or handling, and without the necessity for locomotives to be run in two directions on any one track.

The tracks to be equipped with automatic switches and cross-overs to facilitate the disposition of arriving and outgoing power and to prevent any liability for blockade or delay to the outside work of despatching. Water cranes with 10 in. outlets, receiving their supply from one or more 100,000-gallon capacity tanks, 50 ft. high, to be located conveniently for both incoming and outgoing locomotives.

An ash pit 30 ft. in length, with entrance under the rail on one side, should be arranged in connection with the outgoing tracks at each water stand pipe, to permit cleaning of the ash pans, as is especially required when they come in partially frozen during severe weather, at the same time that the water tank is being filled, previous to the locomotive leaving the roundhouse tracks.

Suitably located water hydrant and hose, and chemical extinguisher equipment must also be provided for fire protection.

Such a plant as has been referred to must be in charge of an active foreman, competent as a machinist, and to handle both the running repair work and the despatching of the power. He should command the respect of the employes of all departments, and must be backed by the necessary authority and a good organization. He must, in addition, keep himself, by personal knowledge and office records, acquainted with the condition of each locomotive assigned to his station, and see that the periodical inspections, tests, washing out, and the repairs resulting therefrom, receive systematic attention and are not neglected. This done, each locomotive can be kept in its regular turn and in a condition which will fit it to fulfil the requirements at the least cost for maintenance and operation per mile run, until casualty or general bad order condemns it for the general shop. No matter how thorough the organization or system that may be in vogue, the foreman must follow up each detail and have a thorough knowledge of the situation at all times, and see, in addition, that the railway's labor, material and supplies are being utilized to the best advantage, and that rules and regulations are being obeyed by all concerned.

The labor involved in making repairs should be specialized as much as practicable, as this will provide means for the immediate placing of responsibility for irregular work, and the consequent freedom from failures and elimination of the loss in efficiency resulting from the latter.

The inspection of locomotives and the work required, to be reported separately by the engineer and the roundhouse inspector, and on approved forms, immediately after the arrival of the locomotive on the roundhouse tracks. The work so reported to be checked off when done by the mechanic who makes the repairs,

as a record for the railway and for the foreman in charge.

Monthly statements showing the average cost for the repairs and the handling, separately, for each locomotive despatched from the various terminals, also the cost for the handling of fuel per ton, and making comparison with the corresponding period, will be of decided advantage as a means for checking irregularities and to stimulate foremen in charge who may not be directing their efforts to the best advantage.

With proper organization and facilities, provided there is no reason why this modern type of power cannot perform the same, if not more, mileage under the identical local conditions, between shoppings, that has been derived from the previous lighter equipment.

To derive the best results from the operation of the power it should be either single, double or swing crewed, so that in no instance will more than two different engineers or firemen be regularly assigned to one locomotive. In the event of a regularly assigned man being off duty, a person from the extra board should fill the vacancy, continuously, until the regular man returns, or another regular assignment is made.

This will provide an arrangement whereby regularly assigned crews can make uniform wages, and as great a monthly mileage can be obtained from each locomotive as is practicable; at the same time all concerned will interest themselves more directly to inspect, maintain and keep the locomotive in a clean condition, and they will be operated more efficiently and economically.

In the event of deficient service or failures, it will also be possible to determine the responsibility more readily, and the instruction or discipline, if necessary, can be more justly imposed.

The power to be distributed on the various districts and localities, according to its adaptability for the service required and the conditions, and for the information of all the officers concerned in the operating departments, the hauling capacity, as rated on a straight, level track at a speed of 10 miles per hour, should be stencilled on each side of the exterior of the cab just above the running board. This information, together with a train resistance rating schedule, will provide all the data required for the proper rating of the car and lading tonnage.

If three or four months' additional wear and service can be obtained from power before shopping, by changing its location, this can be considered as a net saving, as there will be practically no increase in the cost for the general shop repairs that will be required.

As the intention should be to derive the greatest possible individual mileage from the heaviest available locomotives adapted for the requirements, the minimum amount of power should be kept in service during the slack season, to facilitate the making of repairs to and the whiteleading of locomotives, which will be needed during the heavy business season and the probably more severe weather. Such a distribution of the power between the road and the shop will not only permit of the general condition of the equipment being more successfully maintained, but it will assist to bridge over the heavy season with less power and avoid the purchase of additional locomotives that otherwise would not be required for actual service during the greater portion of the year.

The monthly mileage that can be derived from any class of motive power, if turned out of the general repair shop in good condition, is limited only by the terminal delay required to maintain its general condition, and for a sufficient rest for the crews, and the despatch with which it is handled over the division.

The divisions or districts over which the locomotives are to be run should be lengthened to the maximum practicable, and which will

make it necessary for one crew to remain in continuous service from 10 to not over 16 hours as a limit, excepting in case of emergency or under the most severe weather conditions.

Provision for the lay over should be made at the home stations to which the crews and the locomotives may be assigned, and the running repair terminals, if possible, to be located at the business end of the line, so that the most of the power will be automatically available for the transportation department when it is wanted.

It might also be well to state here that too much consideration cannot be given, when locating water stations, to the quality of the water which will be available. An inferior quality of water will be responsible for as much grief, expense and detention of locomotives from service as any other one requirement, and the provision of a suitable quality should not be lost sight of.

There is probably no means whereby a railroad can increase the hauling capacity of its motive power and reduce the cost for the maintenance and operation to a greater extent for the same cost as through the elimination or reduction of grades and curves. However, when these adverse physical conditions must be contended with, it would be more advisable, when stimulating an increased tonnage of trains, that the basis for rating shall be on the train resistance and such as will provide the heaviest tonnage that can be handled by the locomotive under the different weather conditions over the maximum grade which it is required to ascend without helper assistance and when the locomotive is operated at its maximum capacity.

Cross-compound locomotives are designed with the intention to reduce the cost for operation, and not to be worked in simple gear, to haul more through tonnage, regularly, than a single expansion locomotive of the same hauling capacity, and if the unlimited authority of some of the operating officials who are responsible for the making-up, despatching, and the handling of trains would be lessened, there is no doubt but that the net cost for the hauling of a ton of freight would be materially reduced.

The location and arrangement of water, coaling and the other despatching stations and grade crossings; also train movements which will necessitate the least number of stops, especially at points which are at a disadvantage for the stopping or starting of heavy trains, will assist materially in reducing the schedule time and the fuel bill.

If, when making out new time-tables, the road foremen, engineers and others in the motive power department whose daily and practical experience in handling trains should make them competent to judge as to the time required between stations to successfully handle certain trains to the best advantage to the locomotive, would be consulted, the information so obtained could no doubt often be used to advantage in making more desirable connecting and meeting points, which would result in a reduced cost for operating the power and the trains.

By placing adapted locomotives which are in the best condition where the service is the most exacting and the conditions the most severe, and removing the partially worn and replaced locomotives to a more favorable locality, the most successful service can be rendered and a greater mileage obtained between shoppings.

With the ordinary type of locomotive boiler, furnace, grate arrangement, hand firing and mechanism, upon the quality of the fuel supplied will depend largely the steaming capacity of the locomotive and the cost for maintenance and operation. More especially will this be noted where the distances are long, schedules fast, weather and despatching conditions un-