The stoker report of 1917 shows a total of 1,611 stokers (exclusive of Crawford) in service at Apr. 1, 1917. There were placed in service 2,106 stokers between Apr. 1, 1917, and Jan. 1, 1919, which indicates the rapid rate at which locomotive stokers are being applied. The types of locomotives to which the stokers are largely being applied are the mallet, mikado and Santa Fe, which represent the locomotives of large capacity. The question as to the size of locomotives upon which stoker installations are justifiable is one that is frequently referred to and is yet unsettled. It is your committee's opinion that the conditions surrounding individual conditions are so variable that no fixed rule can be recommended for guidance in this connection.

Suggestions have been made involving certain limits in the weight and tractive effort of locomotives, the character of fuel used and the rate at which it must be fired. Limitations on the basis of weight and tractive effort of locomotives may be feasible where the locomotives operate under uniformly heavy conditions, but even then there are certain local and physical conditions to be considered that prevent any general recommendation being laid down even on such basis as this. Locomotives operating in districts where the demand for maximum power is intermittent and for short duration could not be considered on the same basis as locomotives of the same weight and capacity operating where the maximum power is demanded for extended periods. The character of fuel available for firing may also be considered one of the controlling factors in consideration of the application of locomotive stokers to comparatively small locomotives. In view of these governing factors, your committee does not feel justified in attempting to suggest a ruling which might be followed in the consideration of this phase of the subject, as it is believed that this question will have to be settled based upon the surrounding conditions under which the locomotive is required to operate.

There were some questions of general interest in connection with stoker operation concerning which it was thought well to secure an expression from the roads using mechanical stokers. These questions were sent out to such roads and replies to this inquiry have been received from 32 roads; representing a total of 1777 of the stokers now in service. Inquiry was made relative to the kind and character of fuel used, and it is noticed that on all of the roads, bituminous fuel is used; the fuel reported varies in heat units from 9,212 to 14,250 btu.

In answer to the inquiry as to whether the same size exhaust nozzles are used on stoker-fired locomotives as on hand-fired locomotives, it seems that the general practice is to use the same size exhaust nozzle, although a few roads vary from this general practice. Three roads report smaller nozzles on the stoker-fired locomotives, ranging from ⅛ to ¼ in. smaller in diameter. Two roads report that they are using nozzles from ⅛ to ¼ in. larger in diameter than are employed on their hand-fired locomotives.

The consensus of opinion is that the stoker-fired locomotives burn more fuel than the hand-fired. Where percentages of different have been expressed they range from 10 to 41% in favor of hand-firing. This difference, however, is expressed in terms of coal as fired and does not recognize the advantages that have been gained by improvement in the performance of the locomotive resulting in uniform steam pressure and more active and uniform performance over the division. These increases in fuel consumption may, in some instances, be considered as the price of firing locomotives of capacity beyond the range of successful hand-firing.

In referring to the continuous performance of stokers over a division, the record indicates that in the majority of cases the stokers are doing about 100% of the firing of the locomotive.

The failures occurring on the stoker equipment are the same old offenders and are classified as "failure of stoker parts," "foreign matter in fuel" and "wet coal." The record tabulated from the information received as to the percentage of failures that may be classified under these three headings is quite interesting in the variety it presented. On some roads the highest percentage of failures is due to broken stoker parts; on others, foreign matter in the fuel seems o be the chief offender, while on others the question of wet coal is apparently causing the most concern and delays to stoker-fired locomotives.

An effort was made to obtain information relative to the cost of stoker maintenance upon a 1000-mile basis. It develops that very few roads keep such a record, and those that have reported on this item, when grouped together, show a very wide range of costs. One road with 92 stokers in service reports a cost of $1.77 per 1000 miles, while another with 54 stokers in service shows a cost of $40 per 1000 miles. These are the maximum and minimum cost figures presented, and indicate the extent of the variation in cost, and if closely analyzed it would, no doubt, be found that local conditions were possibly largely responsible for the variation.

In the circular sent to the users of mechanical stokers, suggestions relating to features of mechanical stokers to which attention should be directed by the manufacturers were solicited, and for the benefit of the manufacturers it might be well to incorporate some of these suggestions in this record.

A simpler and more accessible lubricating system has been suggested by several roads. Provision for the better handling of wet coal comes as a suggestion from roads that are experiencing trouble in this respect. Recommendations for more accessible conveyor screws are presented, which might be considered in conjunction with one road which suggests that the stoker be constructed so that it will be less susceptible to failure when foreign material gets into the stoker mechanism with the coal. Provision for overcoming the loss of fuel from the conveyor system may well be considered by the manufacturers as this feature has been suggested as a stoker deficiency. Improvement in the arrangement for the positive adjustments of conveyor adjusting plates is recommended, and it has also been suggested that consideration be given to the design of a system of conveyance of the fuel from the tender to the fire box that will provide against puverizing the fuel in conveyance. Better protection from dust for the bearings and gears of the stokers is referred to as desirable.

In the 1917 report, additional reference was made to the Elvin stoker then undergoing development on the Erie Rd. This stoker has passed through its experimental stage and it is understood that it is now in condition to be presented as a commercial proposition. Your committee has learned from reliable sources that the Elvin stoker now in operation on the Erie Rd., is giving very satisfactory service, and that it embodies several individual features which may mean greater economy in mechanical firing. The opinion has been expressed by disinterested parties who have come in contact with this type of stoker and have seen it in operation that, while it may not have reached its final stage of development, there are, nevertheless, marked possibilities in a stoker of this type.

Your committee wishes to recognize the unceasing efforts and activity of the stoker manufacturers in the development of their respective devices, and is of the opinion that with continued effort in the light of service experience, a more perfect stoker may be developed in which objectionable features, such as those outlined, will have been eliminated.

Report of Committee on Tank Cars.

An American Railroad Association mechanical section committee, A. W. Gibbs, Chief Mechanical Engineer, Pennsylvania Rd., chairman, reported in part, as follows: With the war came the necessity for the transportation of various products, among them toxic liquids for filling shells, not previously handled in tank cars. Your committee has given considerable time to the development of designs of cars for this purpose, principally in connection with the U.S. Ordnance Dept., engineering division. Some of the toxic liquids had low rates of expansion, so that the question of pressure was not material, the one important requirement being that leakage must not occur. The class III car was adapted to this service by the modification of certain details, such as omitting all opening s in the shell, making the dome capacity about 1%, special arrangement for closing the dome, openings, etc. Another demand was for tank cars for carrying compressed liquefied gases, notably chlorine. The specification for class V cars, with welded tanks, adopted by the association in 1917, with some modifications of details, met the situation very well.

Some difficulties were experienced in welding anchorages to the tanks. This was remedied by avoiding the use of anchorages having great length of welded contact with the shell.

While a design of safety valve was approved for use with a number of these cars, which it was important to get into service, there were some features of the valve which were not entirely satisfactory, and study of the question, in connection with the representatives of the Ordnance Dept., continued up to the time of the armistice, and has since been carried on by the committee.

The seams of these tanks were hammer welded throughout, using water gas as the heating medium. With steel of a proper quality there seems to be no difficulty in securing thoroughly sound welds and containers which are bottle tight.

Your committee is glad to report that the American Society for Testing Ma-