

22	H8cs	32	32
22	H10s	..	110
23	H6a-b	1	2
25	K2	..	4
25	K2as	2	3
Total—		155	301

SUMMARY.

Type of Stoker.	No. of stokers in service.	No. of stokers on order.
Street	418	82
Crawford	301	..
Hanna	3	21
Standard	2	3
Gee	1	..
Ayers	1	..

Stokers under development—none yet applied: Strouse, Elvin, Rait, Brewster, and McMullen.

Stokers for which there is no advice of further development: Barnum, Dickerson, Erie, Hayden, Hayden modified, Harvey, Hervey, and Kincaid.

During the past year opportunities have been afforded to observe a much larger number of stokers in service, many of them working in pool runs, which rather strengthens the belief that they are capable of going along, faring under the usual average attention given a locomotive, without developing prominent or serious defects that result in materially increasing terminal turning time. The most natural inquiry would refer to the durability of such machines as a whole. It goes without saying that the stoker, with all of its parts, is susceptible to wear, but those in service have no doubt surpassed the general expectation. They require attention and repairs, but the cost figures are not excessive, considering the stage of development through which they are passing. There is no particular work the fireman can do in the way of making repairs on the read, but attention on his part, though slight as a rule, is beneficial and helpful toward preventing failures. The performance of the stokers in service during the past year has served to show what must be met in the way of durability, and what is necessary to withstand the operating strain. Alterations are now in progress looking toward stronger and more durable machines, which should in turn favorably affect the cost of maintenance.

It is noteworthy that when the demands upon the boiler are fairly uniform, permitting a regular feed of coal, the operation of the stoker practically takes care of itself, but, in the absence of automatic manipulation, manual control does not always result in efficient regulation of the fire; on the contrary, the boiler, if anything, is allowed to blow off more than necessary, not only under working conditions, but quite freely when the demands are reduced, and when the locomotive is not using steam, carrying with it some waste of fuel, due, however, to want of attention. Then, again, there is some tendency, through neglect, to allow the fire to get low while standing on the road, making rebuilding necessary; still with the stoker the fire is readily revived, and little, if any, time is lost thereby.

It is still a moot question as to whether it is economical to use run of mine or screened coal. Both schemes are worthy of consideration, depending upon local conditions, and in the same way that it is necessary a road contemplating the use of stokers can only work out the advantages to be gained after taking into consideration the physical character of the road, the size of locomotives, and the tonnage now being handled, it should ascertain whether upon taking into account all local conditions it is more profitable to use the screened or run of mine coal.

As for fuel consumption, it has been pretty clearly shown that the amount of coal used by the stoker (as to some extent obtains in hand firing) largely depends upon the physi-

cal character of fuel rather than the heat value, so long as the latter is within a reasonable range. The establishment of data to show the relative fuel consumption by hand firing as compared with the operation of the stoker was sought, but so far there seems to be very little statistical information in such shape as to permit a general ready comparison to be made. At the same time some very complete tests have been conducted under a range of operating conditions, character of fuel, etc., but none of them permit conclusions to be drawn without taking into consideration the character of fuel and conditions under which the highest efficiency was obtained. In order to make a true comparison, therefore, it is necessary to ascertain and fully account for local conditions, character and price of fuel.

The year's experience seems to give color to the belief that the stoker is not necessarily a coal saving device, but that its advantages tend in other directions. Dynamometer tests have shown that the capacity of the locomotive is increased, and according to further reports made by the Pennsylvania Rd. an increase approximating 5% in trainload with the Crawford stoker for an equal amount of fuel hand fired has been obtained. The Baltimore and Ohio reports an increase in train tonnage from 5 to 10%. In both, however, it should be remembered that the differences indicating increased capacity were largely dependent upon local conditions. The Hocking Valley advises, in connection with the Street stoker, that it is using fuel known in the Hocking Valley district as "coarse slack." It is coal that passes through a $\frac{3}{4}$ in. mesh screen. As for fuel consumption, the Hocking Valley reports that no definite tests have been made, adding, however, that their fuel record showing consumption of coal per locomotive per 1000 miles does not indicate there has been any reduction in fuel per 1000 ton miles, but that the grade of coal used is purchased at about 40% less than run of mine.

In tests made on the Norfolk and Western, it was found with one of the scatter type stokers that there was a considerable increase in coal consumption using Pocahontas slack as compared with Pocahontas run of mine hand fired. The difference in quantity of coal consumed as between screened coal stoker fired and run of mine hand fired was found to diminish as the physical character approached the run of mine, or a product containing a less amount of fine material. While standing along the road it is quite necessary, as can be readily appreciated, to occasionally watch the fire in order to keep it in proper condition and in readiness, especially where slack fuel is used, as the depth of the fire is relatively lighter, but it is not materially unlike what is needed for efficient and economical hand firing.

As referred to in another part of this report, the fuel consumption seems to vary almost in proportion to the physical fineness of the coal used in stoker firing with the scatter type machines, a percentage of the lighter material being evidently drawn through the tubes by the heavy action of the draft. Using Pocahontas nut stoker fired and run of mine hand firing, the consumption figures are not far apart. From this it would appear that with the higher volatile coals containing a smaller amount of fine product, the consumption of fuel as between hand fired and stoker fired should be very close. It also seems evident that though the consumption increases as the coal becomes finer in character, the stoker is better able to maintain steam with it than might be secured on an average hand fired.

With reference to the emission of smoke: It was mentioned in your committee's last year report in substance that, as combustion is improved in stoker firing as against

irregular hand firing, there should be some diminution in smoke. Some observers have reported that with a thin fire and conditions otherwise favorable, stoker firing, as with hand firing well executed, little objectionable smoke is emitted, but as the difference in the range of operating conditions and character of fuel are usually so large, a liberal view must be taken of what might be expected. Your committee has not had the opportunity to make extensive investigations, but has received reports that when the feeds are not forced beyond the limits of complete combustion, the reduction in smoke is longer maintained with the underfeed than with the scatter types, on account of the fuel being delivered up through the bed of the fire as combustion progresses, under conditions of service and character of fuel suitable to their present stage of development.

Following the presentation of our last year's report on this subject, some very interesting remarks were made with reference to contemplated experiments with pulverized fuel on locomotives. Several industrial plants have made installations of furnaces for the utilization of powdered fuel, and the report is that satisfactory results are being obtained. It is also understood that the New York Central has made some investigations in connection with the use of such fuel on switching locomotives, and it is still investigating the subject, but up to the present time it is quite experimental. The Pennsylvania has also given it some consideration, but advises it has nothing of interest to offer.

Report of Committee on Tank Cars.

The Master Car Builders' Committee, A. W. Gibbs, Chief Mechanical Engineer, Pennsylvania Lines, chairman, reported in part as follows:

The most important question presented to the committee has been the question of the continued use in transportation service of the old tanks, originally on wooden underframes. At the time the tank car specifications were first drawn, in 1903, the greater part of the tank car equipment came in this class. While some action was urgently required at that time to improve the situation, it was necessary for the committee to be as lenient as safety would permit in the treatment of the then existing cars, and, consequently, the specification for tank cars having wooden underframes was drawn with very mild minimum requirements, among them the provision that the tanks should be tested to but 40 lbs. pressure, which they must stand without leakage. At the same time, however, specifications were made for tank cars built subsequent to that date, requiring steel underframes, and tanks designed for a bursting pressure of 240 lbs. and a test pressure of 60 lbs. per sq. in. Cars built with this specification are now very largely in use, particularly in handling inflammables.

Service having proved destructive to wooden underframe tank cars, owners have been ordering steel underframes, to which to transfer the old tanks. Several of these old tanks have involved the railways in very heavy losses from leakage of contents, due to cracking of the sheets, particularly the heads, probably due to punishment received from the head blocks. Complaints have also been received of a number of very bad tanks developing leakage on the road.

In considering whether old tanks transferred to new steel underframes should not be put on the same basis as tank cars built after 1903, viz., required to stand the 60 lbs. test pressure, some of the owners considered that this would be an unnecessary hardship, and proposals were even made to lower