

the presence of flat metal surfaces, such as this reinforcing plate would be, if the rivet heads did not project."

RECOMMENDATIONS.—Wooden cars with standard M.C.B. lining should have the ends reinforced with metal construction in accord with fig. 1, or its equivalent.

Steel underframe cars with end lining $1\frac{1}{2}$ ins. thick and over should be equipped with outside braces, shown on fig. 1, but the inside plate may be omitted. In applying outside braces, due regard must be given to compliance with U.S. Safety Appliance Rules for coupler and end ladder clearances.

Cars with wood superstructure, requiring complete renewal of ends, should have steel ends applied, in accord with fig. 2, or its equivalent.

New cars should be equipped with ends of the type shown on figs. 3 and 4. The section modulus of the posts and braces, 2 ft. above floor line, not including corner posts or flat end plate, should not be less than 15. The Murphy or Van Dorn steel ends can be used instead of those shown on figs. 1, 2, 3 and 4.

Each end must be attached to the longitudinal car members, either directly or through other members, by fastenings sufficient in strength to develop the full strength of the end.

The constructions shown in the diagrams are equally applicable to outside or inside end sill cars by modifying the attachment at bottom to suit depth of end sill.

Seal Records of Box Car End Doors.

G. A. Hancock, General Superintendent Motive Power, St. Louis and San Francisco Rd., wrote a member of the committee as follows:—

"I have received a communication from the local freight agents of the Eastern Division on a subject which I think merits the attention of the committee of standards. Their communication reads as follows:—Much difficulty is experienced in having yard clerks obtain accurate seal records of end doors, on account of inconvenient location and risk of personal injury. Claims are now being paid on account of no end door seal record, and cars are being pilfered by theft through end doors, which can be entered with the least chance for detection. Is an end door in a standard box car essential? If so, could it not be placed near the side of car where seals could be read from the side ladder?"

"It brought out the discussion that an end door is desirable for loading certain classes of lumber, and that in a shipment of lumber there sometimes are specially designed pieces that are too long to go into the side door, and that have to go in at the end door, so the agents have referred the matter to this office with request that we advise: If it is essential to have end doors in box cars; if end doors are necessary, if they cannot be located where the seals can be read with less danger of personal injury than at present; if some standard location cannot be adopted so that all will be alike; if the vertical height of the end door could not be made standard and door so designed that it could not be entered by a person intent on robbing the car, even though door was not sealed.

"As we are not putting end doors in our modern box cars, but as they are being placed in cars built by other companies, I believe that this is a matter that should be handled by the committee on standards and recommended practices, in connection with reports they made in 1912 on the height of seals on side doors."

Both kinds of cars, those with and those without end doors, used for the purpose of loading lumber, have been common in years past, but each year fewer new cars

with end doors are built, because the end doors are valuable only on roads handling long lumber directly from the lumber regions as an important feature of traffic. Roads which formerly equipped all box cars with end doors have eliminated them from new cars, and are permanently fastening them in place on some of their old cars, leaving the end doors operative only on short box cars. This indicates that with the advent of the 40 ft. box car the end doors will gradually become obsolete.

RECOMMENDATIONS.—End doors used

for loading lumber in box cars are essential only on roads having long lumber loading in box cars as an essential feature of traffic. End doors must be so constructed that when closed they lock automatically, by means of a lock accessible only from the inside of the car, thus avoiding the necessity of taking seal records. Seal appliances now in use, and not accessible from ground or from end ladders, should be revised so as to be accessible from ground or end ladders, to promote the safety of employees.

Report of Standing Committee on Mechanical Stokers.

The Master Mechanics' Committee, A. Kearney, Assistant Superintendent of Motive Power, Norfolk and Western Ry., Roanoke, Va., chairman, and of which G. S. Hodgins, of the National Transcontinental Ry. Commission's Staff at Ottawa, Ont., is a member, reported as follows:—

The development of the locomotive stoker has been watched by many of us with more than ordinary interest and patience, it being another instance where skill and genius, by the application of mechanics, bids fair to materially reduce physical labor. The utilization of machinery to perform what hitherto was accomplished by manual labor has been achieved in much larger as well as smaller problems, but few have been more welcomed than the automatic or semi automatic apparatus by which the larger locomotive is successfully supplied with fuel at a rate and in such a manner as to produce efficiency in the operation of the locomotive, with a reduction in physical work on the part of the fireman.

Curiously enough, few stoker devices differing materially in principle have been launched since the earlier work of developing the locomotive stoker was begun. This subject has been presented to this convention each successive year since 1905, when we listened with much interest to the original paper presented by Mr. Garstang, Superintendent Motive Power, C.C.C. & St. L. Ry. Each year's report has dwelt at length upon the progress made in the continued development of the stoker, and to-day we have results bespeaking marvelous achievements; at the same time the advancement made during the past year, or a little more, has been much greater than heretofore accomplished. While the machine, like many other devices, including the locomotive itself, is susceptible of further improvement, it is receiving benefit as the result of service and study, and probably much will be done before perfection is attained. It is also fair to say that the stoker has undoubtedly reached a commercial stage of development.

Persistent energy in the perfection of the stoker is being rewarded, but it must be conceded that few, if any, devices applicable to the locomotive, having for their purpose the accomplishment of equal efficiency, have carried the difficulties surrounding the successful performance of the stoker, not so much on account of the operation to be performed, but the absence of choice as to arrangement, the absolute limitations in space, and conditions under which the machine must operate.

Within the past few years marked advancement has been made and there is no longer any question that the stoker is of practical value and a perfectly feasible proposition. Pioneers in the work evidently received but passing encouragement in their efforts, doubtless on account of there being probably less real necessity for anything of the kind in average locomotive service than now exists, and for the further rea-

son that any increase in power by such means was not given particular consideration. More recent history very strongly points to the inevitable conclusion that the success of the stoker is not exclusively of mechanical interest, but an operating question as well, and much has been due to the continued solicitude from the viewpoint of capacity, relative consumption, efficiency and operation.

In all work and experimentation with the various schemes suggested, two distinct methods or principles for stoking a locomotive still characterize the stage of development. In one the coal is delivered to the fire box over the bed of the fire, not unlike hand firing, which is generally termed the "scatter" system; while the other delivers the coal up through the bed of the fire from underneath and is designated as the "underfeed" stoker. Both methods have their advocates and strong points of defence. Consequently, having before us the results both types have accomplished, it would be unsafe to conjecture which school will ultimately survive. Probably both will continue to advance, but time only can foretell their fate, and which will in the end prove more economical.

Your committee is therefore unprepared to even venture an opinion as to which type of stoker is better, as both have their points of advantage. There seems to have been a larger number of designs of stokers attempted which have had the "scatter" system for their basic principle than those endeavoring to develop the "underfeed" machine, and probably because the inventors have hoped to reproduce hand firing conditions. Many more types have been worked out than now seem to occupy the field, but those that have lived are constructed upon either the one or the other principle, although they may have differed materially in detail from those that now remain on the market, or have possibly reached the commercial stage of development.

Time seems to have resulted in eliminating many stoker designs, reducing the number mainly to the most prominent, namely, the Crawford, typifying the underfeed; and the Street, representing the "scatter" type. There are, however, two other stokers undergoing development, namely, the Gee and the Hanna, both of the scatter design; and possibly there are many other prospective designs or types which have not yet been presented to the railroads. The stokers which have undergone some development, and may for that matter still be considered (as it is possible their designers are giving them further study with a view of further improvement, etc.), are the Strouse, Barnum, Hayden, Brewster, Harvey, Dickinson, Erie, Hanna, Gee, Crawford and Street. The stoker situation, as well as your committee has been able to ascertain, is as follows:—

STROUSE STOKER.—Seventy-six Strouse stokers have been built to date and ap-