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enough on fire." This is sometimes done at the suggestion of the fireman after the fire has become clinkered. There may be several causes entirely apart from the nozzle, such as flues leaking or stopped up, netting stopped up, leak in fire box or smoke arch, improper running or firing, or a number of other causes, and with the defect remedied, there would be no necessity for reducing the nozzle. But if nozzles are allowed to be reduced indiscriminately, it is probable that some other defects at least may not be corrected. The contracting of the nozzle calls for a heavier fire to be carried on this engine than on other engines of the same class, and may result in fireman firing engines that have not had nozzle reduced, heavier than is required, with the result that another fire is spoiled and another engine is reported not steaming. We record the size of nozzles on the monthly engine condition report. It is first determined what size nozzle the engine will steam with freely, after having made allowance for varying conditions, and with standards established for each type of engine slightly smaller than our tests show engine will steam freely with, we maintain same. In the roundhouse we keep a board slotted so as to straddle the bridge and we put this down in the nozzle without opening the front end and thus check actual measurements with the measurements reported.

Some very valuable tests conducted by the Santa Fe Railroad show that engines equipped with a nozzle as large as is used on the average railroad, shows the back pressure in cylinders, at times, to be equal to the pull at draw-bar, which means that as much of the power of the locomotive is used in creating draft under these conditions as is used in pulling the train. From this the premium that is paid for contracting nozzles unnecessarily, or neglecting to clean them out, is readily seen, and this feature should not be left to the discretion of someone in the roundhouse that would prefer to contract the nozzles rather than go after the real cause of the trouble. With us, nozzles are not reduced without the consent of the Master Mechanic, and Assistant Superintendent Locomotive Fuel Service.

Another cause for waste of fuel lies in valves so set that engines cannot be worked in the most economical cut-off. We found this was especially apt to occur on large freight engines equipped with slide valves. Unless this is specialized on and tests are made to show the difference in fuel consumption of an engine working at long stroke or in close cut-off, the shops may not be particular to set valves so that engines can be worked properly. On one division it was found by marking the cut-off on the quadrant, that the minimum point at which engine could be worked was frequently not closer than 11 or 12 inches on slide valve engines having 22x30 inch cylinders. Valves were then squared up to work at any point in cut-off and it was found that the five-inch notch was the most desirable minimum cut-off for this class engine. Quadrants have been similarly stenciled on one or two engines of nearly every class.

With reference to engine conditions.—Our mechanical officers try to make things as convenient as they can on the engines and are very appreciative of suggestions. Enginemen themselves are continually making sug-

gestions that help the fuel performance, and we try to carry them out whenever practical. It is very important that engineers familiarize themselves with the amount of fuel required to fill tank and make out tickets for the exact amount ordered, for in the event of taking coal from connecting lines or mine tipples on line, the engineers are, in a way, the purchasing agents of the company they represent.

Sufficient draft through the ash pan is very important. It takes a great deal of air to burn coal properly. It is estimated that 20 pounds or 260 cubic feet of air is required for the proper combustion of one pound of coal, or 3,900 cubic feet for each shovelful.

One thing that is frequently lost sight of is the relative cost of lubricants and fuel. I have in mind one division where the approximate cost of fuel was \$83.00 and the cost of lubrication 45 cents for a round trip of about 500 miles. The lubrication should be watched very closely by the engineer, and those having supervision over the crews should keep this feature in mind. But an engine should not be run with dry valves or cylinders. The engineers should carry extra oil with them and keep the engine well lubricated at all times. If careless in the use of oil, that can be handled on its merits, but it is just as reasonable, in my opinion, to say that we could have just so much coal to make the trip with as to start the engineers out without an emergency supply of oil, to use in case something should happen on the line.

Attention to detail is highly essential to locomotive operation. Things that are seemingly unimportant may have a decided effect on the final results. It can be safely left to the general officers to furnish new appliances. It is for us who are held responsible for the result, to keep posted and determine the best possible methods of handling such appliances to secure the maximum efficiency.

Keeping engines of a certain class in one working district is essential to proper fuel performance. Neither enginemen or shopmen can learn the proper care of an engine in one trip. The argument that an engine is an engine and a man that knows his business ought to do as well with one as with another, is wrong and is based on false premises. Circumstances require, sometimes, that engines be shifted around considerably, but this is invariably done at the expense of the fuel bill.

The whole problem resolves itself into a question of hearty co-operation on the part of all concerned. Anything that will help to establish a proper fuel performance on the railroad will help every other item of train operation. The work cannot possibly be departmentized. Every department on our line tries to help out in every way they can. The shop people gladly accept suggestions that make engines more economical in fuel and as comfortable for the enginemen as possible. They are very generous in inviting criticism in this respect. The same is true of the fuel department. Any changes that can be brought about in the handling or purchase of fuel that are practical are worked out.

Securing as nearly as possible a maximum tonnage rating for each

locomotive is highly important for a proper fuel performance also. Of course, for obvious reasons, all of these things cannot be done at once. All of the engines are not right all of the time, neither are they all wrong all of the time, and this is also true of the men, and statements of this character should not be taken too seriously. When things go wrong, a good getting-together is the best way to remedy them. We derive a great deal of benefit from the educational meetings held at the different points, and also from the different staff meetings held at the different points, and also from the different staff meetings, held by the division officials. With the best system or method that can possibly be maintained, human error will always furnish the need of a very close supervision. Any device placed on the locomotive tends to make it more complicated and requires that the men who are handling it be taught its proper use, and this emphasizes the need for greater education. Great good can be done in reducing the fuel bill of railroads by exercising proper care in the selection of our firemen, who will later become engineers and who will have under their supervision in the course of their career probably 50 to 100 other firemen, all of whom will profit more or less by the engineer's training. The need of firemen should be anticipated. These men, once employed, should be properly educated to perform their duties skillfully, and if they do not show aptitude, should not be allowed to remain in a vocation that they are not adapted to. A constant effort should be made to familiarize not only the enginemen but engine handling forces and mechanics the right way to handle and care for locomotives, and their work should be checked up often enough to know that it is done in the right way. It is highly essential that the work of fuel economy have the unqualified support of the general officers from the President down, and on the lines which I represent we have this support.

In conclusion, I wish to say that the one thing that has done more to reduce the fuel bill on the Frisco Lines than anything else is the interest and loyalty displayed by our engineers and firemen, and it is only to be regretted that we cannot carry out all of the suggestions made by them as rapidly as we would like to.

Pencil Economy

Much rivalry, engendered from an article which appeared in THE FRISCO-MAN recently regarding economy in the use of lead pencils, is apparent, particularly among the agents along the line, who seem to vie with each other in their efforts to wear pencils down to the lowest possible measurement.

Agent Ira Towne, of Breckenridge, Okla., has forwarded to General Sta-

tioner Windsor the end of a pencil which measures, including the point, less than one-half inch. This pencil was in constant use for two months.

Agent F. O. Mason, of Monmouth, Kans., has even broken that record, as the end of the pencil which he sent in measures just three-eighths of an inch in length.

These are evidences of what can be accomplished by the use of the new pencil holders recently furnished employees.

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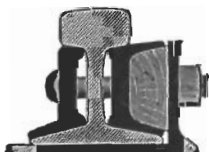
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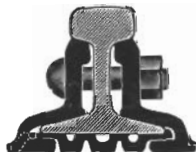
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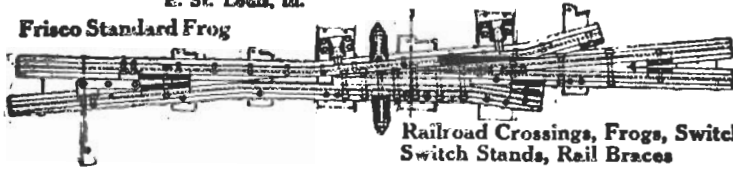
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