

and cylinders than the saturated steam locomotive.

60. In starting, the reverse lever should be in full gear to ensure oil distribution to the full length of the valve bushings. Care must be taken that the water level in the boiler is not sufficiently high to cause water to carry over into the superheater.

61. The locomotive man should see that the water level is not carried so high that it will be drawn through the units with the steam, as this will result in making an auxiliary boiler of the superheater, thereby destroying the object aimed at in its application, but, in addition to this, the water carried over will deposit any scale forming matter it may hold in suspension or solution on the inside of the superheater units, thereby coating them with an insulating material that will prevent the free passage of the heat contained in the gases into the steam moving through the units. It is this liming up of superheater units through carrying the water too high or through foaming that causes the superheated locomotive to gradually lose its snap.

62. While there is a difference between carrying the water level too high and a foaming boiler, the results are quite the same; the only difference being that when the boiler begins to foam one can see the effect at once in dry valves, reduced speed, etc., while by carrying the water too high the evil effect is spread out over a greater distance and through a longer period of time. The bad effect is there, however, and always means more fuel and slower speed.

63. A superheater locomotive should not be moved without the required air pressure and the brakes in operative condition. When water is carried over into the superheater, part or all of it will flash into steam, even after the throttle is closed. Under the above condition the locomotive is not under control, because the valve chamber is filled with steam.

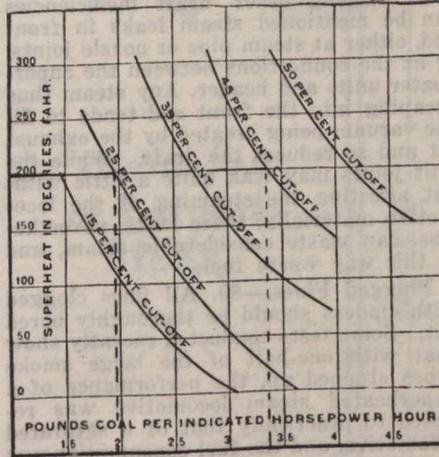
64. Superheater locomotives should be operated with a full throttle opening and reverse lever control, as far as service conditions will permit, the exceptions being: when starting a train, when using a very small quantity of steam, and when drifting. (See paragraph 40.) The accompanying chart illustrates the point in question and shows the variation in coal consumption with various degrees of superheat for each of the following cut offs: Fifteen per cent, 25%, 35%, 45% and 50%. The figures were taken from tests of a large Pacific type locomotive, but they apply with equal force to all superheater locomotives. For example, take the curve for 25% cut off at 200 deg. of superheat. The coal consumption is about 2 lb. per indicated h.p. hour. Then take the curve for 45% cut off at 200 deg. of superheat. The coal consumption is about 3.3 lb. per indicated h.p. hour. This clearly shows why it is better to operate with a full throttle and reverse lever control rather than with a partial throttle and long cut offs. The difference for the example taken is 1.3 lb., or 39% over the incorrect method. The chart also shows the advantages of a high degree of superheat at any cut off in reducing the coal consumption per indicated h.p. hour.

65. It is advisable, in order to avoid the suction of hot gases from the smoke box into the steam chest and cylinders, to keep the throttle slightly open when drifting or making stops, as by passing a very slight amount of steam through the cylinders the front end gases cannot

be drawn into the exhaust column. The throttle must be completely closed just before coming to a full stop.

66. The firing should be light and regular, to produce as high flame temperature and as perfect combustion as possible in the fire box. A high fire box temperature results in high superheat, which will be obtained by a small coal consumption. A heavy, black fire means low temperature, low superheat and coal consumption. Firemen who carefully follow the above outlined practice will save coal for the company and make their own work easier.

67. The locomotive man should be sure that the superheater damper is open while using steam, and closed when steam is shut off. This can be ascertained by observing the counterweight on the right-hand side of the smoke box attached to the damper. When the counter weight is up the damp is open, and when down the damper is closed. When the locomotive is shut off and the blower is used, the locomotive man should observe that the damper is in a closed position. If the damper is open with the blower on, the superheater tubes are apt to be burned out, due to no steam circulating through the superheater tubes. When



Variation in coal consumption, with varying superheat at different cutoffs.

using steam, the piston in damper cylinder should always move its entire stroke and stop against its seat, in order to prevent loss of cylinder lubrication past the piston. A leak at this point will permit steam to escape at end of drip pipe attached to damper cylinder, and should be reported promptly.

68. Leaks in front end of superheater units, steam pipes and exhaust column, fire tubes stopped up, and derangement of draft appliances not only interfere with the proper steaming of the locomotive, but reduce the degree of superheat. Blows in cylinder and valve packing will cause scoring, due to removal of oil from the wearing surfaces. All leaks such as those mentioned above should be reported promptly by the locomotive man, because if neglected, they seriously affect the economical operation of the locomotive.

The Locomotive Stoker.—69. On arrival at the locomotive the fireman should see that the stoker is in operative condition, by trying it; next, see that it is properly lubricated, so it will stay in working order over the road; next, build up the fire by hand and see that it is ignited all over the grate surface. Don't try to build up the fire with the stoker, as the stoker may start a bank, and a bank with some certain grades of coal causes clinkers and clinkers mean trouble. Don't start the stoker feeding until you have

pulled out of the yard, and then feed just as little coal as possible to maintain the desired pressure. Look into the fire box occasionally to see how the stoker is distributing the coal, it may save hot work with the hook later on. Shut off the stoker when standing in sidings or drifting down hill. Keep up the fire with the scoop. Close the slides in the deck before reaching the terminal, but keep the stoker running, so as to empty the conveyor trough. This will give the locomotive house men a chance to try the stoker and get it in shape for the next trip. Inspect it on arrival and report any defects found. The locomotive man should know as much about a stoker and its care and operation as the fireman. It is as much a part of the locomotive as the injector or air pump, and a locomotive man that cannot run it is not fully qualified.

70. Although the stoker may make it possible to keep ample steam pressure at all times, any failure on the part of the locomotive man to handle the locomotive skillfully will result in the same increase in the cost of fuel and maintenance as when a hand fired locomotive is abused. When you see foreign material in the coal throw it out before it enters the conveyor.

71. Should the stoker stop operating on the road, don't keep on using steam until the pressure runs down, but stop, if possible, locate the trouble, and fix it. If you cannot locate or repair the defect, give the fireman an opportunity to get the fire in shape so he can fire the locomotive to the terminal by hand. Do not give up the train because the stoker failed.

General.

72. **The Diaphragm and Draft Plate** are put in to control the flow of gases through the flues and to distribute the draft over the grate surface as desired.

73. The draft plate has, however, another function, namely, to give direction to the gases in their passage from the flues to the stack, and in doing this, to aid in keeping the front end clear of cinders.

74. The draft plate simply serves to distribute the draft and to assist in keeping the front end clean. However, while the draft plate does not create draft, it is frequently so adjusted as to obstruct it, and in this way becomes a hindrance to the free steaming of a locomotive instead of a help.

75. The draft plate should always be set so that the opening between the plate and smoke arch is equal to 100% of the total flue area. If the front end should show a tendency to fill up with cinders when the plate is raised, change the angle of the plate by drawing the bottom farther back so it will stand nearly vertical. Furthermore, if the draft plate is too close to the front flue sheet the flow of the gases is so restricted as to cause the locomotive to be what is termed "hot at the door," consequently it follows that carrying the draft plate as high as possible not only decreases the work of the fireman, but also makes his work more comfortable. As it has been shown that the draft plate has but two functions, why change it after it has once been properly adjusted?

76. All front end appliances should be maintained according to the blue print standards as furnished by the mechanical department, keeping them in first class repair and adjustment. Records should be kept of front-end adjustments, so that when the locomotive is reported not steaming, the foreman or man in charge