The only advantage to be gained by storage of coal is that it provides a supply of fuel during periods of strikes or shortage, but it is detrimental to fuel economy for the following reasons: Double handling increases cost; spontaneous combustion is liable to occur; bituminous coal slacks; and when stored on the ground, dirt is apt to be picked up with it.

As a rule, an analysis of the constituent parts of coal is not furnished to enginemen and firemen, because data of this sort are not considered of much value to enginemen.

It has been found generally very important to instruct enginemen and firemen in the principles of combustion. They should be made to understand how the gases of combustion influence the color of the fire and that unburned gases cause black smoke. This subject should be thoroughly covered in the instruction books on fuel economy, as well as in the individual and class instruction.

CONCLUSIONS.—Care should be exercised always to have fuel furnished according to a rigid specification and this should be further followed by close inspection at the mines. Proper grades of fuel should be maintained for each class of service as far as possible in order to keep the efficiency of both the enginemen and the locomotives as high as possible.

Too much care can not be exercised in keeping accurate coal records, especially at coaling stations. At the same time losses in fuel by overloading tenders and careless handling of locomotives at terminals should be stopped as far as possible. Fuel savings must be made by all concerned and not by the enginemen alone, if the coal bills are to be reduced as much as they can be.

The boiler feed water should be improved wherever possible, and if necessary good treating plants should be installed. The savings resulting from reduction of scale and decreased boiler maintenance will pay the cost of treating boiler feed water where necessary. Suitably located blow off cocks of good design are also a great aid in keeping down boiler scale.

Emphasis should be laid upon the necessity of close co-operation between enginemen and firemen, and between these men and their supervising officers; strict adherence to the proper methods of operating locomotives, proper care and adjustment of lubricators to avoid damage to valves, valve seats and piston packing; and the maintenance of standard adjustments of front end arrangements, exhaust nozzles and other parts essential in producing free steaming locomotives. Definite assignment of the most suitable classes of locomotives to each division, and as far as possible, assignment of regular crews to locomotives, are great aids in fuel economy.

The recent successful application of powdered fuel to industrial plants points the way to large savings in locomotive fuel consumption, provided the system can be successfully adapted to this kind of service. Although there will be an increase in cost per ton due to pulverizing the coal, the expected savings should more than offset this. Some of the advantages claimed for powdered fuel are: Greater capacity of locomotive, and lightening the work of the firemen; reduced fuel consumption due to more perfect combustion, and elimination of standby losses; reduction of smoke; and ease of handling.

Notwithstanding the mechanical aids to effect economy of fuel, it is a settled fact that a well organized department, invested with full charge of the fuel problem, and nothing else, will accomplish material results. Experience of many roads proves conclusively that the institution of such a department is followed by savings which abundantly justify the expense of the administrative and supervising organization.

Report of Committee on Steam Locomotives, Method of Conducting Laboratory and Road Tests.

The American Railway Master Mechanics' committee, C. D. Young, Engineer of Tests, Pennsylvania Rd., chairman, and of which W. H. Flynn, Superintendent of Motive Power, Michigan Central Rd., formerly Master Mechanic of its Canada Southern division, is a member, reported in part as follows:

Locomotive tests are of two kinds, laboratory and road. The former are made at a locomotive testing laboratory where the driving wheels can be mounted on the supporting wheels of a friction brake apparatus for suitably disposing of the power. The road tests are made under conditions of service on the road, the locomotive hauling a train of cars.

Laboratory Tests.

The object of a laboratory test is to determine the steam and coal consumption per unit of power when the locomotive is operated under fixed conditions.

PREPARATIONS.—All driving wheels should be turned to same diameter and should be standard contour. Each pair of driving wheels should be checked to see that they are correctly quartered for the crank pins. If the locomotive selected has ever been through the shops for general repairs, the frames should be tried to see that they line with the cylinders. The boiler tubes must be new or newly pieced, so as to be free from boiler sediment. The steam cylinders should be approximately the same diameter and as near to that called for as standard for the class of locomotive, as practicable, and they should be bored if not in good condition. The piston packing rings should be in good condition. On D valve locomotives, the valves and seats should be faced; and on piston valve type, old bushings should be bored if not in good condition, or new bushings applied Piston valve packing rings should be examined and in good condition, after which a test pressure of at least 60 lbs. should be applied to the steam pipes to determine that the throttle, steam pipes and exhaust passage are tight. The front end arrangement for the locomotive should be carefully gone over and checked with the print in accordance with which the front end is supposed to have been applied. The stack and draft pipe should be lined to determine that it is properly erected with reference to the exhaust nozzle. Steam joints in the injector and delivery pipes should be tested to determine that they are steam tight. The lift of the throttle valve should be determined for each live notch on the throttle lever quadrant; when necessary, the cut-off should be taken for each notch on the reverse-lever rack. The locomotive selected should reach the laboratory at least 4 days prior to the time when it is scheduled to go under test, in order to permit the application of all instruments and to take the necessary measurements of various parts of the locomotive.

FUEL.—A standard coal should be selected that can be easily obtained on short notice, and in accordance with the special object in view. If maximum efficiency or capacity is desired, the coal should preferably be some kind that is regarded as a standard for the locality where the locomotive is operated. When oil fuel is used, the rule governing the tests mav be modified to conform to the characteristics of liquid fuel.

THE APPARATUS AND INSTRUments required for laboratory tests of a locomotive are as follows:—Platform scale for weighing coal and ash. Tanks and scales for weighing water. Graduated scale attached to water glass. Pressure gauges graduated to at least pounds for boiler, branch pipe, receiver, exhaust and at other points as is required. Draft gauges for smoke box, fire box and ash pan. Thermometers for calorimeter, branch pipe, receiver and exhaust. Pyrometers for fire box, smoke box and at other points as is required. Steam calorimeter. Steam cylinder indicators. Speed recorder to denote revolutions of driving wheels. Gas analysis apparatus. Friction brake apparatus. Dynamometer for determining the pull at drawbar. Some form of indicator rigging. Planimeters, micrometers, scales, calculating instruments, etc. A calibation should be made by water glass method of both safety valves, and a correction made during a test. The scales, gauges, thermometers and pyrometers should be carefully calibrated at specified intervals.

APPPLICATION OF INSTRUMENTS. — The pressure gauges for boiler, branch pipe and exhaust should be connected with a long siphon and located at convenient points for the observers. Care should be taken to make correction for pressure should the gauge be located so that the water head would affect the reading. For taking temperature of steam in the branch pipe and exhaust passage, thermometers should be inserted into wells, and given proper depth of immersion.

The indicator reducing motion should be some form of pendulum type with light tube for transmitting the reduced motion to a point near the indicator. The pipes leading from the cylinder to the indicator should be not less than ½ in. inside diameter, and they should connect into the side of the cylinder rather than into the heads, thus making a very short connection. Short bends in the pipes should be avoided and they should be well lagged to prevent radiation. A light framework should be secured to the cylinder to act as a brace for the indicators, and for the motion-rod supports. Absolute rigidity is highly essential in this particular. Care should also be taken to set the indicators in such a position, that the finger on the end of the motion rod travels in a direction pointing to the groove in the drum proper.

Draft gauges consisting of U tubes properly graduated in inches, containing water, should be placed at convenient locations, and connected at the smoke box or any other point at which the draft is taken, with a ¼ in. pipe A rubber tube connection should be provided to connect the draft pipe with the U tube. In the smoke box the pipes should be located at the horizontal centre line of boiler in front and back of diaphragm.

The draft in the fire box should be taken through a drilled stay bolt, located at a point about half the length of the fire box and about 24 ins. above the grates. The draft in the ash pan should be taken at some convenient point at about the centre of the entire grate area.

The smoke box pyrometer or thermometer should be inserted so that the hot point or bulb is below the tip of the exhaust nozzle and in front of the table plate. If a thermometer is used for this purpose, it should be graduated to 1,000 degrees. The