

The opportunities for economy in connection with the reduction in damage claims follow the better lookout from the locomotive by the fireman because of being left free to watch signals, crossings and the operation of the machinery on the left side.

One of the essentials in this connection is noiseless operation. The stoker should not prevent free conversation across the cab nor make any noise that can be heard when the locomotive is running. The development of the past year or two has shown a wonderful improvement in this particular and stokers are now being applied which are essentially noiseless in their operation.

The stoker should be 100 per cent efficient; it should do all the firing, handle all the coal from the tender with the minimum attention and not require alteration of the distributing means after it is once properly adjusted. The fireman should be free to attend to the duties mentioned above and should be able to control the stoker operation from a position on the seat box.

It is well established in manual firing that small quantities of coal fed frequently and distributed by the "cross fire" method give the most perfect combustion. The stoker should follow this method but perform the operation more exactly than it can be done by hand. Recent development shows a full appreciation of this requirement, and at the same time provides a flexibility that allows the stoker to exactly meet the conditions of combustion at the various parts of the grate. If 70 per cent of the coal is being burned on one side of the grate, the stoker should discharge that proportion of the fresh fuel on that section. If more fuel is being burned in front than at the back, the stoker should distribute to suit. This flexibility is essential for 100 per cent stoker work.

There is another feature of improvement in the most recent of the scatter type stokers that has been particularly appreciated by designers and by enginemen. I refer to the absence of any part of the stoker on the boiler head or in the cab. There are stokers now being applied which show practically nothing in the cab and thus allow the best arrangement of the many instruments and appliances required on a modern locomotive. This, especially in connection with the reduction of noise, is one of the most important developments of the recent past, as it is in the direction of greater safety of operation and reduced strain on the mental and physical energy of the engineer. The absence of apparatus at this point also permits the proper inspection of all the staybolts and their renewal if necessary without the removal of any part of the stoker.

BEAM-LIGHT SIGNALS ON THE PENNSYLVANIA

The Pennsylvania Railroad, in connection with the introduction of electric traction on its main line from Philadelphia westward will introduce, in place of semaphore block signals, a novel arrangement of lights, uncolored, by which both motion and color will be done away with, the lamps being used day and night. Mr. Rudd, the signal engineer, has given us the following description of the new signals:

"We have developed what we call, for lack of a better name, the 'beam-light' signal, and are to install it between Overbrook and Paoli, about 16 miles of four-track road with five interlockings. The signals will give three-block indications, and will be located approximately 3,500 ft. apart. If the scheme proves satisfactory it will be useful especially where A. C. track circuits are installed, as with it the only moving part in the system is the control relay, which is necessary with any system. As designed each unit is generally arranged as shown in Fig. 1. Four fixed lights in a row, one light being common to all three rows. The containers for the lamps, lenses, etc., are clamped to steel tubes diverging from a center casting, a suitable background being attached to the center support but back of and separate from the tubes supporting the lamps.

"The lamps are spaced 18 inches apart, center to center, and are 12-volt, 4-candlepower, 5-watt Mazda; concentrated filament

with adjustable base, burning at 11-volts in bright daylight or in fog, 6-volts at twilight and 3-volts at night. The current consumption will average up about ten watts for the four lights. Special inverted $5\frac{3}{8}$ in. lenses and very light yellow cover glasses are placed in front of the lamps; and a reflecting mirror above the cover glass to throw some of the rays down for close range. There will be a hood over each unit. These lights are readily seen in brightest sunlight at 4,000 ft. or more. Scareheads of newspapers can be read by them at night 1,000 ft. away if the full day voltage is used; hence the necessity of dampening down at night.

"The voltage will be controlled from the nearest signal cabin by the signalman. The entire arrangement is immovable, the rows of lamps being lighted as conditions require. Two units will be used on all signals—equivalent to two semaphore arms—thus making a uniform system, the aspects corresponding to the position of the arms as in standard practice, but at interlocking signals the bottom (low-speed) arm will not be displayed in the stop position at all. When it is required two short-range lights will be shown, diagonal or vertical, in addition to the two upper arms horizontal. This is a decided advantage, as the engineman will know that unless two full size beams appear, the signal is improperly displayed. No permissive aspect



will be required, but if needed it can be shown by a row of lights diagonal (45 deg.) in lower right-hand quadrant.

"The staggered light effect to distinguish stop and proceed signals from stop and stay will be produced by having the bottom horizontal beam moved to the left one light, as shown in Fig. 2, the difference being required only in the stop indication.

"For dwarf signals, which cannot be hooded lest close range reading should be obscured, frosted white cover glasses and higher candlepower lamps will be used.

"This arrangement will eliminate all failures due to moving parts of signals and mechanisms (except the relays), and all chances of freezing or sticking clear. From our records it appears that this should reduce all failures, with their consequent delays, at least 10 per cent, and all dangerous failures 40 per cent. The scheme solves the colored-light problem for night indications completely, by eliminating all colors and establishing signaling by position only.

"With current supplied from a power line generation of current is cheaper, as there is no 'peak of the load' to be provided for as in motor signal work. This reduces the cost of operation. The initial cost of installation is less; the cost of maintenance, aside from necessary policing should be less and the cost of delays will undoubtedly be reduced. The risk to employees is reduced as all their work will be on the ground, except occasional inspection of wires, adjustment of lights, renewal of lamps and cleaning the lenses."

ELECTRIFICATION OF A PORTUGUESE RAILWAY LINE.—A decree has been signed by the president of the Portuguese Republic for the electrification and lease of the railway connecting Lisbon with Cascais. The line is about 16 miles long and is owned by the Portuguese Railway Company. It is double-tracked, of broad gage, and rock ballasted. There are practically no grades. The line serves the so-called Riviera of Portugal and should be a paying investment. In the summer season 40 trains each way are operated, and in winter 26. Expresses make the entire distance in from 35 to 40 minutes, with 3 stops; the locals, stopping 19 times, take 1 hour and 8 minutes. It is proposed to operate electric trains every half hour and to make the entire run in 25 minutes.