apt to be affected by the presence of a few partly welded blow holes. In neither case, therefore, can the tensile specimen be considered as fully representing the rail from which it was cut, much less any lot of rails from which the sample was selected.

Drop Tests Specified.—All the foreign specifications reviewed very properly contain a drop test; some of the drop tests specified, however, are open to considerable criticism. Where chemical composition is specified, and faithfully followed, the drop tests should not include a certain maximum deflection, but should simply specify that the piece of rail shall not break under a single blow on the head, the tup falling from a height increasing with the weight of the rail section. Where the engineer prefers to include a certain maximum deflection in the drop test, besides specifying that the piece of tested rail shall not fracture, the percentage of carbon should be omitted from the chemical requirements. Either method will insure a safe hard rail; but a specified range of 0.10 per cent. in carbon is, perhaps, a better and more prompt means of securing and maintaining uniformity in the product.

Dead-Weight Tests Specified.—This transverse test under static load should include a determination of the yield point, and, by means of still heavier loads beyond the yield point, the determination of greatest permanent deflection. The test may be looked upon as unnecessary when the chemical composition is fully specified and when the ability of the finished rails to withstand shock is determined by a drop test. However, the requirements of the dead-weight tests contained in foreign specifications are met without difficulty by American mills. Seventy per cent. of the forty-one specifications examined specify a dead-weight test, but in quite a number only a weight is used which will give no permanent set. The test is, therefore, frequently regarded in American mills as at least unnecessary, for, when the loads specified are within the elastic limit of the steel the deflections are merely factors of the section of the rail.

FINISH.

Some foreign specifications require, even after the templets have been approved by the engineer, resident abroad, that a section of the rail 12 in. long must be submitted to the foreign engineer and approved in writing before the general rolling can proceed. This is a needless delay, as confidence can be safely placed in the skill and integrity of American manufacturers.

In a number of foreign specifications the permissible variations in height of sections are too rigidly drawn to allow for the unavoidable wear of the rolls. Smoothness of track is in no wise jeopardized by an allowance of 1-64 in. under and 1-32 in. over the specified height; they are the variations permitted by the best American railroads. A number of foreign specifications allow a less variation in length of rail than ¼ in., which is the uniform practice of American railroads.

Most foreign specifications allow a variation in weight of 1 per cent. for individual rails. This can be easily reduced to 0.50 per cent. for the entire order, but the rails should be paid for on actual, and not estimated, weights.

INSPECTION.

The inspectors sent to American mills are frequently unfamiliar with rail inspection, and are, therefore, too strict in their inspection, and too slow in their decisions. Again, when the specifications require all four sides of every rail to be examined for flaws, all holes gaged, each rail tested for length and squared on each end, and stamped in four places by the inspector's mark, and also require him to be present at the testing, to weigh 1 per cent. of the rails, and to watch the loading of the rails to see that only those bearing his stamp are loaded, it is manifestly unfair to the manufacturer to send but one inspector to the mill and expect the manufacturer to conform his product to the number of rails that one inspector can pass upon, in nine or ten hours of the twenty-four. Lack of inspectors frequently necessitates a change of rolls at the mills, and has delayed the departure of vessels on which the rails were being loaded.

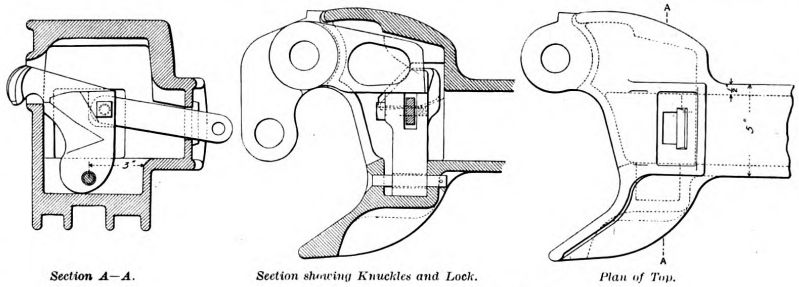
Some foreign specifications require that all rejected rails shall be piled up and kept until the completion of the contract, so that, at any time, the inspector may check them with the numbers entered in the book; and that no rejected rail shall be sold or broken until the completion of the contract. This is manifestly unfair to the manufacturer, because on a large contract, not continuously rolled, a considerable tonnage of second-quality rails might be tied up, which might otherwise be sold. Some foreign specifications state that the final acceptance of the rails and splice bars shall be at the port of delivery. This is unreasonable; final acceptance should be based on tests and inspection made at the place of manufacture.

Metal Car Repairs.

Mr. F. H. Stark, Master Car Builder of the Cleveland, Lorain & Wheeling, is now using a Ferguson locomotive fire kindler for heating the parts of metal cars which have to be straightened, or otherwise repaired, without removing the parts from the car. It is found that this crude oil burner is very well adapted to the purpose, as the heat can be applied directly to the bent parts or cut off quickly, and the burner is safe to use about shop buildings. This device was fully described in our issue of April 20, and was put on the market by Leach & Simpson, Chicago, for kindling locomotive fires in roundhouses. Mr. Stark says that before using the oil burner, it was the practice to build what may be termed a portable forge and build up around the bent part, so as to concentrate the heat. Before any work could be done this had to be broken down so the forge could be moved. As the sections of the metal parts are very light, they cool quickly, making it difficult to do much work between heats. The labor and time involved in moving the portable forge about made the work very slow and costly with the former method, and he finds that metal car repairs are greatly facilitated by the use of the Ferguson burner.

The New American Coupler.

To facilitate the work of coupling and uncoupling trains the American Steel Casting Co. has produced a new all-steel coupler. The special features of this latest coupler are the trigger and knuckle. The design is illustrated in Figs. 1, 2 and 3, a plan and various sectional views and elevations. The relation of parts is made clear in Fig. 1. In Fig. 2 the modified knuckle is shown, and in Fig. 3 the trigger is illustrated.



Section A—A. *Section showing Knuckles and Lock.* *Plan of Top.*

Fig. 1.—New American All Steel Coupler.

It is apparent that an extension of the lock has been made. This is a bevel-faced "dog," which works on suitable bevels on the tail of the knuckle, when the lock of the coupler is opened. The action is upon the rear of the knuckle and therefore sets the knuckle forward in position to couple. When desirable to break the train at one or several places, the operation of unlocking thus sets the main factor of the lock on top of the knuckle, the lock then being in open position, ready to uncouple or to couple, dependent upon train movement, and independent of any further attention by trainmen. It never has been necessary to open the lock to prepare for coupling of cars. The tail of the knuckle raises the lock automatically, in closing, and, having passed it, is secured in locked position by the drop action which is well known. No lock-guard is required in the present form of coupler, as the bearing of the face of the knuckle against the lock is vertical. The chief advantage of this latest arrangement is its constant readiness for action, once it is set, without the attention of trainmen at each coupler where trains are parted or to become so.

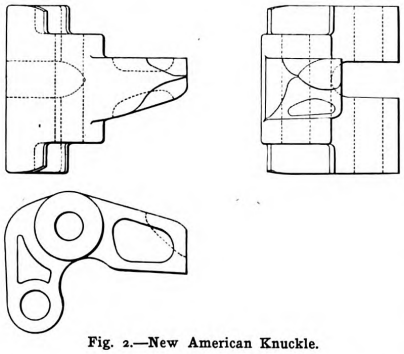


Fig. 2.—New American Knuckle.

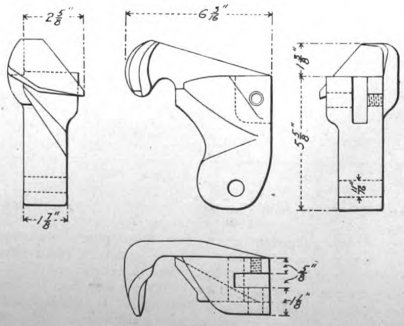


Fig. 3.—American Unlocking Trigger.

Back Lights.*

The great increase in the number of signals installed within recent years on the railroads in this country has demonstrated to all railroad men interested in signaling that the present standard colors for signal indications at night are in need of a radical change, as there are too many chances for a confusion of signals; and derailments directly traceable to this fault are too frequent. The use of the white light for a clear signal at night is the cause of most of the trouble; and the substitution of a green light for white as a safety signal and yellow for green as a caution indication will go far towards eradicating this evil. Most of the up-to-date railroads now use the two-light spectacle on new installations, preparatory to making this change, and it may confidently be predicted that the majority of the railroads in America will adopt these colors as standards in a few years.

The white light is used as a night indication on signals in another way; namely, as a back light while the signal is at safety; whereas the danger position is shown on the back of the signal by a purple light. Not infrequently also has the white back light led to confusion, and it would be a step forward to eliminate this feature.

Until within recent years, one of the serious problems was to obtain a lamp that would burn all night in all weather, and back lights thus came to be considered a necessity, but there does not seem to be any good argument for their use on automatic signals, especially on portions of a road remote from towers. Their use on these signals has led to confusion. This is liable to be the case where two signals, located on opposite sides of the tracks, which govern in opposite directions, are so located that the back lights of the one signal may be seen before or at the same time as the front lights of the governing signal. This may be a rather remote case, but it is not always the most probable conditions that must be met. The use of back lights on automatic signals, especially at such points, may be more dangerous than their discontinuance would be. Some roads have already dispensed with back lights on all automatic signals; and the officials of these roads are so well satisfied with the result of this experiment that the question of restoring these lights has not since been considered.

There seems to be no reason for back lights on signals at interlocking plants, the front lights of which face the tower. In fact, signal lamps have reached such a state of perfection that if it were possible to have some guarantee that the lamps would always receive proper attention, it would be a question whether back lights should be used on any signals. But on those signals that require them we should eliminate the white light and yet give the towerman an indication of the two conditions now shown, namely, when the light is burning, and when the signal is operating properly. The only color left us is purple—the color now used as a back indication on a signal while it is at danger. This color is an ideal one for this purpose, for although it has not sufficient carrying capacity for use as a front light, it can be clearly distinguished at a distance of about a quarter of a mile, far enough for the needs of a back light. The normal position of signals at interlocking plants is at danger, and the signal is at safety only for a few minutes at a time. Why, then, is it necessary to have any light displayed at the back of a signal while it is at safety? Let us suppose that a light be extinguished by the jar of the post occasioned by the signal being pulled to safety. In this case one of two conditions might arise: either the engineman of the approaching train would note the absence of a light where one is usually displayed, and treat the signal as a danger signal, or, uncertain of the previous existence of the light, or its location, he would pass the signal. Certainly in the first case no accident could happen; while in the second a train would merely pass a signal at safety. There does not seem to be any possible chance for an accident under either condition, and no more probability of delay than in the present practice. By this arrangement of back lights an indication of the improper working of the signal would also be given, as there would

*Paper to be read before the Railway Signaling Club, Atlantic City, September 11.—Condensed. By W. H. Lane, Supervisor Mechanical Signals Lehigh Valley R. R.

be a blue light displayed with the signal when at danger, and no light when at safety. The back spectacles should be so designed that the blue glass cover the light at all times except when the blade is in the horizontal position. The towerman is thus assured that a danger signal is displayed in the front of a signal whenever the blue light is visible. Such a spectacle would not require a blue glass, as the light would be displayed through a blue glass in the back of the signal lamp.

Automatic Block Signals on the Chicago & Alton.

A sketch of the portion of the line of the Chicago & Alton which is now being equipped with automatic block signals by the Hall Signal Co. is shown in the accompanying engraving. The road to be signaled is from Corwith Junction to Joliet, 31.5 miles, double track; Joliet to Zarleys, 5 miles, single track, and two miles out from Joliet on the Coal City Branch, single track, making the total length of road signaled 38½ miles.

The signals are semaphores, and each signal (or pair of signals on the same post) is moved to the all-clear position by an electric motor worked by a battery. The face of the home signal blades is painted white with a black stripe near the outer end and parallel to it. The blades of the distant signals are yellow on the face, with two black stripes, 2½ in. wide, parallel to the outer (notched) end. (Semaphore blades 4 ft. long, with white faces, are used on this road for train order signals.) The signals are to have green lights for the night all-clear indication; and the distant signals, when against a train, will show a yellow light.

Forty-three home signals and 39 distant will be put in, and five home and four distant signals now in service at railroad crossings will be connected with the automatic system by electric slots, the track circuit being carried through the interlocking plants. The average length of block is about 1½ miles, the shortest block being 3,000 ft. and the longest 2.4 miles. The home signals are to stand normally in the stop position, and the distant signals, also standing normally horizontal, can be cleared only when the home signal is clear. Each home signal will be cleared (if its block section is free for the passage of trains) by each approaching train as it reaches a point about 1,200 ft. short of the distant signal. With this arrangement the engineman will be able to see the distant signal change to the clear position. The number of switches in the main line is 64. These will set signals at stop when they are open, and will be provided with audible indicators. The audible indicator, a bell, will begin ringing when an approaching train enters the clearing section, 1,200 ft. in the rear of the distant signal.

On the single track lines the automatic signals are arranged to protect trains in both directions, the arrangement of the circuits being the same as that on the Cincinnati, New Orleans & Texas Pacific, which was described in the *Railroad Gazette* of Nov. 12, 1897.

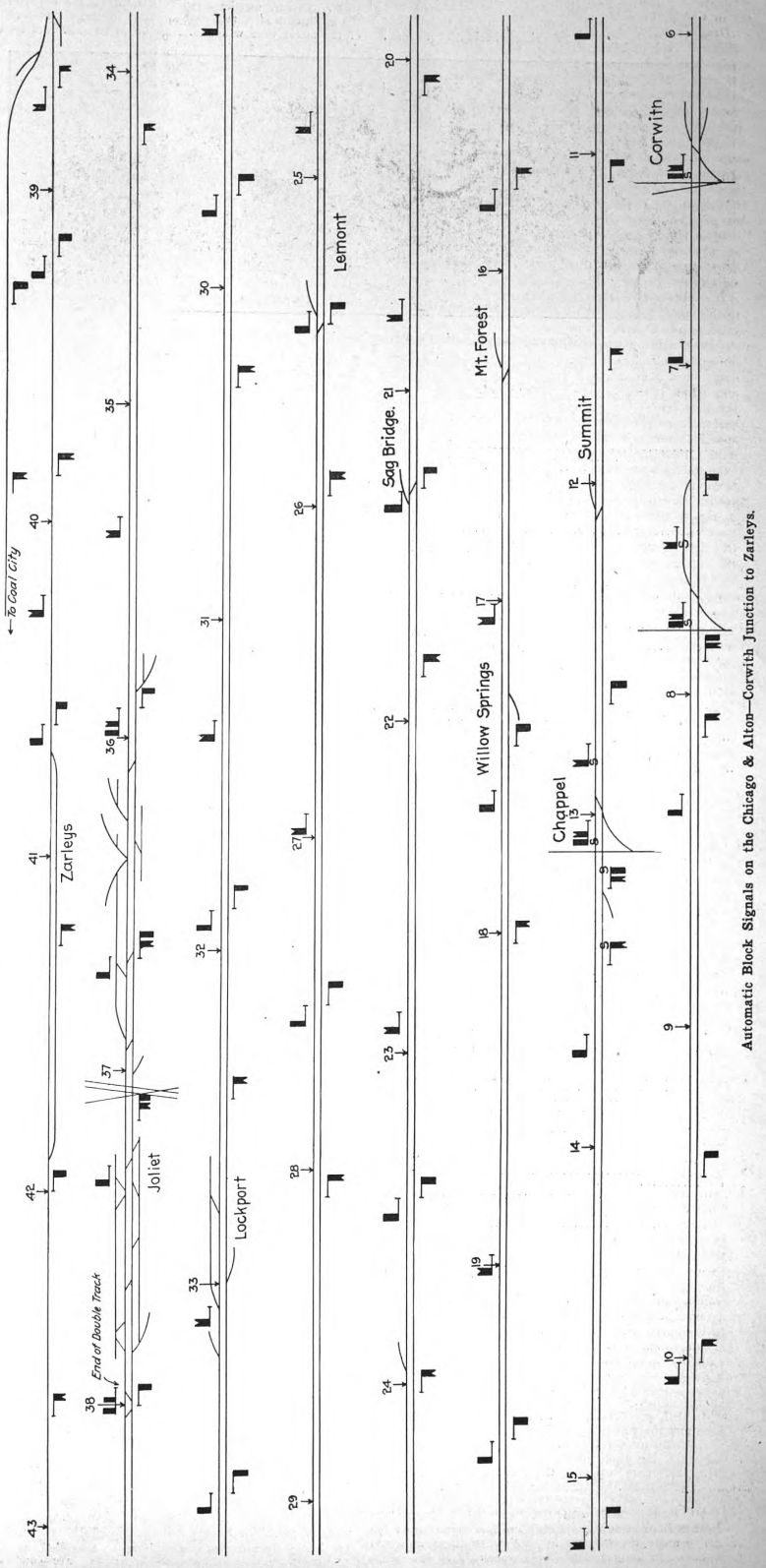
The Transportation Show at Paris.

The Western Railroad Co. of France has an opportunity to show something in the way of electric traction at the Paris Exhibition. The line from Issy to Viroflay is designed to connect the Champ-de-Mars with Versailles, and is largely in tunnel and, of course, is worked by electricity. The central power station at Issy will furnish 9,000 kilowatts, using a five-phase current at 5,000 volts, which will be transformed at three substations. From this station also current will be furnished for lighting the stations and for various mechanical purposes about the stations.

The 10 electric locomotives which the company will put in service are shown by drawings. They are mounted on two bogie trucks, and each axle carries a motor. There are two types of these motors; one is mounted directly on the axle and the other is geared. There are two controllers, one at each end of the locomotive, so arranged that the motors form two independent groups, and the motors of one truck can be cut out entirely. These engines have Westinghouse air-brake as well as hand-brake.

Only about two kilometers of the line is now in operation, and this is worked by motor cars, the locomotives not yet being in service. As now used, each train has two motor cars, one at each end, and between them are run one or two cars without motors. Each motor car has two 40 h. p. motors. A train of four cars has 360 seats, and weighs about 90 tons. The maximum speed between stations is 27 to 30 miles an hour. This service was opened with the opening of the exhibition, and has been working regularly since.

The company has four compressed air locomotives for use at the Invalides station and for service in the tunnel, if required. These have two bogie trucks, the axles being couples to and to. The motors are compound, each having two cylinders, the pressure in the high pressure cylinder being 284 lbs., and in the low pressure cylinder 142 lbs. The storage pressure of the air is 1,420 lbs. The locomotives are provided with hot water tanks, each carrying 2,260 liters, and heated by steam blown in at a pressure of 258 lbs. The high pressure cylinders are 12½ in. diameter, the low pressure 20½ in. and the stroke is 22 in. These locomotives also have Westinghouse air-brakes and hand-brakes.



Automatic Block Signals on the Chicago & Alton—Corwith Junction to Zarleys.