

supported arch and an average flamework of 8 ft. had an average firebox temperature, covering a range of 25 tests, of 2,100 deg. This temperature was taken at the center of the firebox at about the end of the arch. The temperature of the gases entering the tubes showed an average of 1,725 deg., or a drop in temperature of 375 deg.

Another Pacific type locomotive with the same size grate and a tube-supported arch, but with a combustion chamber 3 ft. long, giving an average flamework of 11 ft., showed over the same range of tests an average firebox temperature of 2,185 deg. with the temperature of the gases entering the tubes of 1,485 deg., or a drop of 700 deg. between the center of the firebox and the tube sheet.

We obtain high efficiency at low rates of combustion in spite of the large air excess which generally accompanies. This is due to the fact that at low rates the firebox absorbs a larger percentage of the total heat evolved, and the amount so received for any one firebox depends primarily on the temperature of the fuel bed. It is possible that this temperature is higher with large air excess than with the lower, as the temperature is due to the rapidity of combustion which in turn depends upon the scouring and cutting action of the air blast.

The firing clearance, or the vertical distance between the fuel bed and the lower tubes, or arch, has been materially increased by the introduction of modern types of locomotives with trailing trucks, as this has permitted the firebox to be placed behind the drivers and the grates dropped lower. This one step has probably offset to some extent the high ratios between heating surface and grate area which are found in modern locomotives. The extent of the firebox heating surface is determined largely by the size and location of the grate; but there is no fixed relation between heating surface and grate area, or between firebox and boiler heating surface.

As stated above, the firebox evaporation depends primarily upon the extent and temperature of the radiating surfaces and not on the extent of the firebox heating surface. Increasing the firebox heating surface without increasing the grate area or flamework will result in very little increase in evaporation. Its only effect is to reduce the amount of heat absorbed by each unit of surface, with a slight reduction in the temperature on the fire side of the surface. An evaporation of 60 lb. of water per square foot of firebox heating surface per hour requires a difference of less than 100 deg. between the water and the fire side of the sheet, and if sufficiently high firebox temperatures or sufficiently large radiating surfaces could be obtained, it would be possible to materially increase even this high rate of evaporation without forcing the heating surface to its capacity.

In the Coatesville tests, conducted by Dr. Goss, the two fireboxes gave an evaporation as high as 58 lb. of water per square foot of heating surface per hour; but there was practically no difference in the total amount of water evaporated by each of the fireboxes when working at the same rate of combustion and with the same grate area, notwithstanding the fact that one of them had 12 per cent more heating surface than the other.

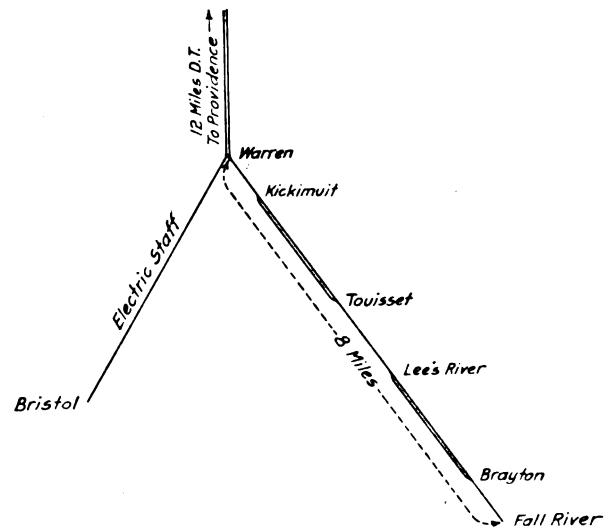
Judging from the past, we are not apt to see any radical departures from the present type of firebox in the near future, unless the nature of the fuel is materially changed, and the writer believes that any improvement in the efficiency of this part of the locomotive will be obtained by paying particular attention to and making ample provision for grate area, firing clearance, gas mixing, flamework or combustion chamber space, and air supply.

RUSSIAN (WHITE SEA) RAILWAY CONNECTION.—It has been decided by the Russian government to commence the construction of a railway between Petrozavodsk and Kem. It is proposed to extend the line to the port of Alexandrovsk to connect the White Sea with the main Russian railway system. The line is to be completed in a year, and to be entrusted to the Olonetz Railway Company, which will build a railway connecting Petrosavodsk with Zvanka on the Northern Russian Railway system.

THE SIMPLE TRAIN STAFF*

The reader interested in train-operation will have noticed in our issue of December 18, 1914, an account of what may be called a simplified block system, in use on the Ligonier Valley and of the use of the electric train staff, on a busy suburban section of the Long Island, without station attendants. While both of these installations lack certain elements which are essential in a complete block system, they are decidedly interesting as examples of ready adaptation of facilities to conditions surrounded by undesired limitations. In neither of these cases can we speak of block signals, as in neither of them do we find fixed visual signals, using that term in its ordinary sense. Semaphores and green and red lights they can get along without, indefinitely.

But in commending simplified railroading in these two instances we have told an incomplete story. An officer of the New York, New Haven & Hartford, to whom the article was shown, reminds us that on that road they have used the staff system, pure and simple; no electric wires, no semaphores, no disks, no telegraph and no telephone. This use was temporary, on the occasion of heavy holiday traffic; but it deserves to be recorded (if for no other reason) because this simple and efficient preventive of butting collisions seems not to be properly appreciated in this country. An electric road in North Carolina and a short freight track of the Lackawanna road are the only places that we can recall where it is used regularly. It was used



for some time about 1890 on a short section of the New Haven road.

The simple train staff was used in England a half century ago. In regular use the system provides for sending two or more trains, following one another, on the authority of the one and only staff, by means of "staff tickets," kept in a cavity in the staff and given out, to preceding trains, by the engineman of the last train, who carries the staff and the unused tickets. With this arrangement the system affords, of course, no protection against rear collisions. In the use of the simple staff today there is available one important advantage which was unknown when the system was in most extensive use in England, namely, the telephone. In case a train finds that the staff is at the wrong end of the staff-section measures can be taken to get the right to the road by wire. In the old days a man was sent on horse back, or on foot; or possibly a hand car could be used. On the New Haven a speeder was provided, so as to make the

*For the benefit of non-railroaders it may be said that the train staff system is a method of regulating the movements of trains, on a single track line, which takes its name from the fact that originally a stick of wood, 22 in. long, was the staff. An engineman, running a train over a section of road, say from A to B, derives his right to use the track over that section not by a timetable, or a signal, as in ordinary practice, but by the possession of the staff. This is given to him by the station attendant at the entrance of a section, and at the outgoing end of the section he delivers it to the attendant at that station. It may then be used for a train running in the opposite direction.

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service independent of the telephone and telegraph. It was used once in the course of three heavy days, on the occasion of the failure of an engine.

The use now recalled was in connection with summer excursion traffic on the line between Providence, R. I., and Fall River. The plan of this part of the railroad is roughly indicated by the sketch. The sections on which the staff was used were those between Warren and Kickmuit; between Touisset and Lee's River, and between Brayton and Fall River. On the first of these sections the staff was colored red; on the next one yellow and on the last one blue. On the days in question the number of passenger trains during the hours between 7 a. m. and 9 p. m. was about 116; and during the busiest period as many as ten trains an hour were run. The speed limit for all trains over the switches at Kickmuit and Lee's River was 15 miles an hour; and, aside from this reduction in speed, there were practically no delays due to the use of the staff. With so many extra trains there were, of course, some cases of waiting at one end or the other of a single track section; but this was not due to the method of operation.

WESTERN ASSOCIATION OF SHORT LINE RAILROADS

Officers of a dozen short line railroads of the states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming met in San Francisco in November last and organized the Western Association of Short Line Railroads. Their main purpose is to secure more equitable compensation for carrying the mails, but the association will take up other matters of common interest. A letter, signed by the president and secretary, has been sent to every member of congress setting forth the bad features of the present laws regulating mail carriage and of the proposed changes now before Congress. This letter says in part:

"House bill 17042 changes the basis of mail transportation rates from a weight to practically a space basis and invests the Postmaster General with autocratic power in regulating the compensation, character of service and form of equipment, even to compelling the use of steel cars for mail carrying, and gives him the power to impose a fine of \$5,000 per day for refusal of a railroad to carry the mail at the rates of compensation and in the manner specified by him. . . . The short line railroads operating in the states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming most earnestly protest against the enactment of either H. R. 17042 or S. 6405 as being grossly unfair to such railroads. Their mail revenue, which at present is entirely inadequate for the service rendered, will be arbitrarily reduced. . . .

"The rates of compensation provided for are based on averages obtained all over the country. . . . The short line railroads west of the Rocky Mountains, due to the sparsely settled condition of the country, the heavy mountain grades and long hauls between stations, are operating under conditions far more expensive than those existing in other parts of the United States. The majority of these railroads operate but one mixed train per day each way, so that it should be apparent that no such average can be fairly applied. . . . An exclusive space basis would give the employees of the postoffice department absolute control over the amount of compensation to be paid railroads, according to their opinions or inclinations, and might be used for personal advantage or political gain.

"The Bourne bill further provides that the Postmaster General shall not have authority to authorize payment for more than seven lineal feet of space, for closed pouch service, in any one train. It is immaterial how much space the postal matter delivered to the railroad for transportation will occupy, be it 10, 15 or 20 ft.; only 7 ft. will be paid for, and when the

railroad operates but one train a day, it has no opportunity to equalize this burden.

"Radiating from the termini and from points on the line of most of the short line railroads of the states mentioned, numerous Star Routes carry the mail by wagon or motor to the small towns and ranches not reached by the railroad. These Star Routes are a continuation of the railroads in so far as the mail is concerned, and the retail merchants of the communities off the railroad are profiting by this fact because the parcel post rates, including wagon haul, are less in many instances than even the freight rates on the railroads; consequently the wagon haul from the railroad to destination is accomplished at no cost to the shipper. In this manner immense shipments of foodstuffs and other matter, in the aggregate running into tons and carloads in each consignment, and consisting of flour, bran, canned goods, cement, coal, pressed brick, etc., are sent by parcel post, the government paying out for the team haul alone in many instances more than the total sum received by it for the entire haul by rail and team, and the railroad receives little or nothing for a tonnage that legitimately belongs to it and for the transportation of which, as freight or express, it was formerly paid.

"Since the last quadrennial weighing of the mail in the West, the packers have reduced the standard weight of merchandise packages to about 48 pounds. Mail contractors, builders and merchants have been quick to take advantage of this, which has not benefited the consumer, and as a consequence the railroads are hauling a tonnage of postal matter for which they receive no pay whatever.

"It is a matter of common knowledge that most of the short line railroads in the western states are struggling for a mere existence and if the carrying of the United States mail is to become a heavy burden, it will mean that freight and passenger rates will have to be advanced. . . .

"The short line railroads in the states named urge that the present law regulating railroad mail pay be amended so as to provide for annual instead of quadrennial mail weighing, pay for apartments in cars used as traveling post offices, and relief from carrying the mail between railroad stations and post offices.

"In the event that Congress shall not deem it advisable to amend the present law as suggested, we then urge that the entire matter of fixing rates for carrying mail be placed in the hands of the Interstate Commerce Commission with full power to act."

The president of the association is D. M. Swobe, traffic manager of the McCloud River, and the secretary is C. M. Oddie, general counsel of the Nevada Central, and the office is in the Mills building, San Francisco, Cal.

AMERICAN COMPANIES TO SUPPLY TIES AND FUEL FOR THE EGYPTIAN STATE RAILWAYS.—The Cairo correspondent of an English contemporary, states that the efforts being made by American manufacturers and producers to procure Egyptian railway and engineering orders are remarkable. Only a short while ago a British steamer sailed from California loaded with ties for Port Sudan; and this is stated to be the first business of this kind which has ever been done between the American Pacific coast and the Red Sea ports. Considerable assistance is being given to tie representatives by the fact that most of the ties hitherto used by Egyptian railways have been of Turkish oak or Karamanian wood or of Baltic creosoted pine, none of which are now obtainable. The contract for the supply of coal for use on the Egyptian state railways during the next 12 months has now been let. Of the total quantity required—190,000 tons—a London company has received an order for 120,000 tons and the balance—70,000 tons—over one-third of the supply, has been placed with American companies as follows: 60,000 tons from the Fairmont region of West Virginia, 5,000 tons of New River coal and 5,000 tons of Greek Island coal.