just twice as many cars at the same speed we are using today without any increase in power.

### INSULATION.

The insulation of steel cars is, in the general opinion of most car builders, one of the few points that have been seriously neglected in the past, and of which it cannot be said that an effective solution has been applied as yet to suit our Canadian climatic conditions, but there is no cause that could prevent the solution in an effective way. As has been pointed out pre-viously the method of insulation depends primarily on the extreme weather conditions of those parts of the country in which a certain car will be used. Heat will be transmitted by one or more or all of the three- phenomena, conduction, convection, and radiation. The conduction of heat in all steel passenger cars will be naturally far higher than in wooden cars, the more so since the material in steel cars is far thinner than in wooden cars, the coefficient of conduction of the two materials comparing like 24: 0.17 or 141: 1. The losses of heat through convection would be about the same in steel and wooden cars, but the losses through radiation would be naturally greater in steel cars, since more heat any greater in steel cars, since more heat is transmitted by means of conduction to the outside surface of the steel car. Luckily, however, we have means of checking the losses by radiation and con-

Luckily, however, we have means of checking the losses by radiation and conduction to a marked degree in a lot of the composite materials put on the market for this purpose. The selection of a proper insulation material is made hard by the fact that no scientific investigations into the conductivity of these composite materials are available which would aid the car builder in his task. In order to cut the loss of heat by conduction the employment of entirely closed air cells of small dimensions is suggested, the latter being built up of poor conductors of either organic or inorganic origin on basis of the principle of hollow tiles.

The process of applying insulating ma-terial to the inside and outside shell of steel cars gives poor results, since it is practically impossible to prevent the leakage of air into the large air cells between the insulations, and between the insulation and the outside or inside finish. In those cases where the application of the inside finish has to be done direct to the steel structure of the car, like carlins and posts, the use of an intermediate porous material like corkstone, asbestos, or magnesia, 18 recommended to reduce losses through conduction, the method of fastening the latter matter of design and experiments being a only. Even the application of light wooden strips, although better conductors than corkstone, would be recommended for the ease of applying by means of bolts inserted in keyhole slots of the posts and carlins.

#### INSIDE FINISH.

The question of inside finish is considered in most cases as a matter of appearance only, but, nevertheless, the proper selection of inside finish material should be based on results of experimental investigation.

The objections to wooden inside finish for steel passenger cars are weight, combustibility, splintering in case of wreekage, and warping, and there is the possibility of trouble caused by the different expansion of the outside and inside shell of cars. The use of steel for inside finish of steel passenger cars has also its disadvantages, foremost of which is high conductivity, poor resistance to denting by baggage, on account of thinness of material, the possibility of condensation, and rusting of finish from the inside out, and some minor disadvantages like buckles and dents which

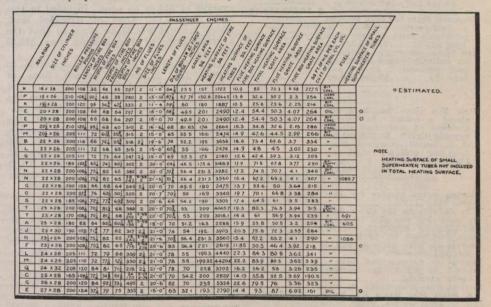
show up after finish has been varnished and painted. The combination of wood and steel has been attempted by several railways for inside finish, consisting in the application of veneer to steel by means of a binder direct, or by means of an intermediate material to receive a binder, but to my knowledge these experiments have been more or less of a failure on account of the different expansion of materials like wood and steel. I do not see why wood should be combined with steel, if not for the only reason of reducing weight and the prevention of splintering in case of wreckage, for the reduction of conductivity by the application of veneers is small and does not count from the standpoint of insula-The best material for inside finish tion. would be sheets that combine poor conductivity with small weight, fireproof properties and a certain amount of resistance to destruction, and I think that several or all of these properties can be found in many

so that there is no particular necessity to treat the subject at all, these points being only inserted for the sake of completing the diagram at the beginning of this paper.

The latest orders of different state laws in the U. S., issued outside of the Interstate Commerce Commission rulings, bearing on sanitation, disinfection, common drinking cups, drinking water tanks, etc., are affecting all types of passenger cars and are therefore omitted.

In summing up the foregoing, railways or contractors taking the purchase or sale of steel passenger cars under advisement should investigate the merits of the turtleback type of car over the monitor type and look into means and ways of reducing the weight and drawbar pull of this equipment, thus bringing cars to a higher economic efficiency than in the past.

The foregoing paper was read before the Canadian Railway Club in Montreal recently.



Switching Locomotives .- Dimensions of Fireboxes Reported as Giving Good Service.

of the composite materials made by different concerns for ceiling finish, of material like asbestos, wood pulp, or other vegetable or mineral bases made fireproof or semifireproof and homogenous by different patent processes. Before using any of the composite materials exclusively it will be necessary to carefully ascertain the properties of conduction, fire resistance and resistance against rotting, the latter only where the basis of the sheets is of vegetable or animal matter.

The manner of applying inside finish is also of great importance. Inside finish for steel passenger cars should be easily removable, and easily appliable to cars after they have once been fitted, so that it will be possible to inspect the insulation and the condition of the framing at least once a year for the first two or three years after the car is put in service.

### HEATING AND LIGHTING.

The construction of the steel passenger car has only very little bearing on the lighting system, be this either gas or electric, and the heating system has also been solved, or nearly solved, for the wooden car, and is, therefore, directly appliable to the steel car, with the possible exception of a necessarily increasing heating capacity to take care of the bad insulation losses of some of the present day steel passenger cars.

## VENTILATION AND SANITATION.

These are matters bearing in the same measure on wooden cars as on steel cars,

The Transit as an Improvised Tunnel Instrument.

# By G. W. McDougal, Kansas City, Kan.

There is a special instrument already on the market for measuring the cross section of tunnels. However, for short tunnels few railways are accustomed to furnish it, leaving the engineer in charge to measure his tunnels as best he can. On tunnel 3, of the Idaho Northern Ry., the regular transit with a vertical arc was converted intowhat answered for a tunnel instrument, by simply attaching a narrow piece of a wooden. straight edge 3 ft. long, to the lowcr part of the barrel of the telescope and making it. parallel with the line of sight of the transit.

When the vertical angle becomes too great to permit looking through the transit itself, the tape is stretched tight from the point in the tunnel roof to the axis of the transit. The three feet straight edge brought parallel to the tape will, to all practical purposes, set the transit on the line of sight for the point in the roof, enabling the correct vertical angle to be read. The vertical angle and distance for each consecutive point enables the area of the resulting triangles (and consequently the entire cross section of the tunnel) to be calculated direct.

It is announced that the Grand Trunk Pacific Ry. hotel in Edmonton, Alta., is to be named the Macdonald, after the late Sir John A. Macdonald.