

be useless to attempt to reduce train resistance by closing the gap between the passenger cars, particularly as the air is more turbulent by the time it reaches the cars. Cab modifications were then introduced. With the present locomotive form, slope of the cab front is such as to create a down draft of air at the cab window; to avoid this, the cab front was filled in to slope backward from the running board, and the overhang of the cab roof was eliminated, generous fillets and curves were employed to eliminate corners and sharp edges, and a generous smooth curve between the running board and cab front was introduced. The object was to take air from the sides of the boiler above the running boards, to shoot it upward in front of the cab windows, to keep them clear. This produced a further decrease in resistance, the combined effect of all the modifications described having been to reduce the air resistance of the original model by 43%. This represented about the limit of progress in removing smoke trouble, by improving the design of the locomotive from an aerodynamic standpoint. Silk threads were then employed to examine the flow of air over the original and modified

smoke layer from blowing down into contact with the top surface of the locomotive, attempts were made to collect a volume of pure air from the front of the stack and to discharge it behind the stack, under the smoke layer. The cowlings covering the dome, turrets, etc., was extended forward to reach past the stack

from the top of the original cowlings to the boiler top behind the stack, was modified to give a greater upshoot to the air discharged from the slot. These changes produced an improved flow, a very strong ascending air current from the slot behind the stack having been indicated. To prevent the spilling of air around the

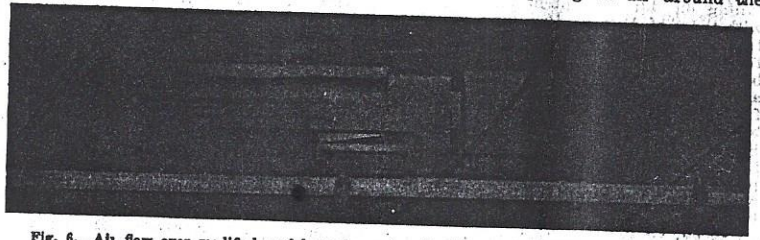


Fig. 6. Air flow over modified model as shown by silk threads, with wind speed of 45 m.p.h.

to the front of the boiler, where it was left open to catch air; the stack then just protruded through the top of the cowlings, and a slot was cut in the new cowlings, where it joined the original cowlings, to allow exit for the air in front of the stack. This arrangement was only

sides of the cab, side plates were fitted to the cab so that they protruded a short distance forward from the cab front, and these, in conjunction with the boiler sides, formed scoops in front of the cab windows which shoot the air upwards over the windows. This arrangement lifted the smoke satisfactorily, but it was found that the modifications had increased the air resistance considerably. Further experiments showed that the forward extension of the front cowlings was largely responsible for this, and it was removed. Other modifications followed, including the removal of the cowlings over the water tank; the provision of cowlings conforming to the cab roof over the tender coal bunker; the cutting down in size of the side curtains on the locomotive to expose much of the valve motion, running gear, etc., and finally modifications to the front of the model, including provision of a solid sloping pilot running in one plane from as near rail level as possible, up to the running boards at each side. The total number of modifications was 27.

General Outline of Results.—By progressive steps there has been developed for the locomotive an improved shape which operates primarily by inducing a layer of pure air to enter under the smoke layer, so that a space enveloping the boiler and extending well above the top of it is fed continuously with air uncontaminated by smoke. The construction of the model is such that the smoke-free layer is maintained beneath the smoke with a minimum of intermingling of the two. Smooth entry for the clean air is effected by a new design for the locomotive front end. At the position of the cab further quantities of smoke-free air are induced upward in front of the cab windows, to augment the layer of pure air immediately above the locomotive. There existed originally a downward current of smoke, which necessitated the provision of a grating on the running board in front of the cab window, to allow for the disposal of cinders collecting there. The modifications to effect this change of flow result in a reduction of approximately 35% of the air resistance of the locomotive.

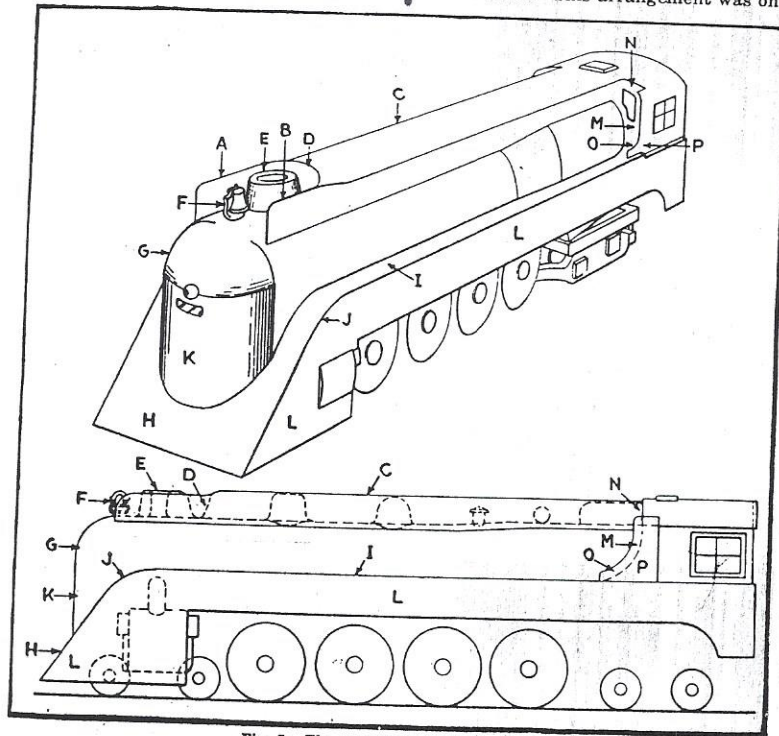


Fig. 7. The completely modified model.

A, B, side plates on each side of stack.—C, cowlings over dome, turrets, etc.; A, B, are continuations of the sides of C.—D, smooth curved surface from boiler top to top of cowlings C.—E, streamlined smoke stack.—F, bell edgewise to the wind in front of the stack.—G, approximately quarter spherical nose on boiler.—H, inclined plane replacing pilot on existing types (coupler not shown in drawing).—I, running boards.—J, rounded front of running boards.—K, smooth cylindrical front between G and H.—L, side curtains over cylinders, valve motion, etc.—M, new front to cab, sloping backwards from running boards.—N, smooth rounded corner between cab roof and new cab front M.—O, smooth generous curve between running board I and cab front M.—P, side plates fitted to cab sides and protruding somewhat forward of the cab front M.

models. It was found that there was no downward flow along the boiler sides, and that the flow over the cab windows was mainly upward, although a slight downward flow occurred where the cab front meets the running board, and there was a slight tendency for air to spill around the sides of the cab. To better keep the

moderately successful, the smoke layer not being lifted to the extent desired. The cowlings was extended forward about 2 in., and its sides dropped down to the rounded nose of the boiler; the two sides of the cowlings were opened out to give a flared entrance; the rear surface of the slot, which ran in a smooth surface

Major Ernest E. Harper, of the Royal Engineers' regular army reserve of officers, has been appointed Secretary for Newfoundland Posts and Telegraphs.

Canadian National Rys. Express Department has opened agencies at Carrot River, Paradise Hill and Porcupine Plains, Sask.

6400 wind tunnel