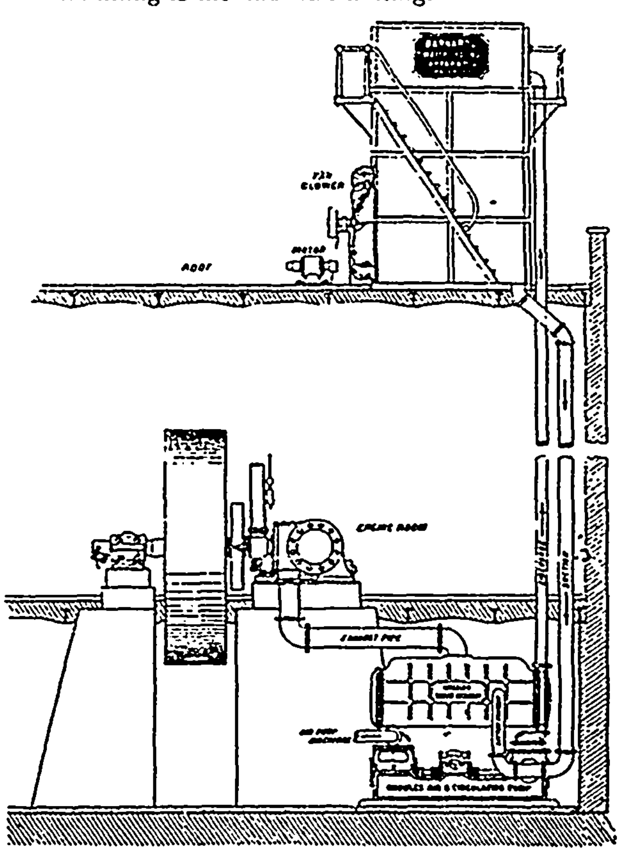
tion, with main channels feeding them. The tops of the small troughs are made like a saw on their edges, so that the fine streams of water run through the hollow of the teeth and spread over the surface of the partitions, making a very even distribution. There are numerous other forms, such as perforated plates, screens, etc., all of which will work, but do not distribute as well as the two mentioned. The filling of the tower or material over which the water is distributed, has taken even more forms than the distributor. From the time when brush was used to the present and latest wire filling, the same idea was at the bottom of every change, namely, to make a given size tower do more work. The cooling effect in a given size tower is a very important point in metropolitan plants, where room is valuable. The first filling was brush. Then round poles were tried. About the same time and at different times since pans have been tried with some success, but were never equal to the tower system. The next was a partition tower, or a board filling. This has taken a great many shapes, the boards being arranged to break up the water and air currents in every conceivable manner. Sheet iron has been tried in various forms, some like stove pipes and others arranged in sheets. The latest and best filling is tile and wire netting.



The tile tower has been described in *Power* and other mechanical papers. It is very satisfactory. One point against this filling for a large tower is its great weight. The wire or Barnard tower is filled with wire netting rolled up loosely and set up on end. In these towers a settling chamber is provided at the bottom, and a heavy grating is placed across some distance above the water. In this space the fan discharges its air. On top of the grating is placed the tile or wire, whichever filling is used, and it is continued on up as far as it is able to support itself, breaking joints, so as to break up the streams of water. There is a portion of the tower carried on up above the filling, to allow the particles of water to settle out of the air current. This prevents a spray flying from the top of the tower, and also any of the water being wasted. Information on the formula for calculating the size of towers is not very extensively known. As far as can be learned, about 50 square feet of cooling surface is required per h.p., when a large quantity of air is used, say 100 cubic feet of air per h.p., and varies with the amount of air and with the arrangement of the filling. In making up estimates the term h.p. does not give definite information. because the amount of steam used per h.p. varies from 15 to 45 lbs. per h.p. per hour, according to the size and type of engine. The only way is to get the water consumption of the engine and figure from that, the same as for running condensing. When an engine is using, say 25 lbs. of water per h.p. per hour, it will require about 4·8 cubic feet of tower for each h.p., with sufficient air and wire filling. With tile filling the cubic capacity required is about 6.5 cubic feet per h.p.

Cooling towers are becoming numerous. We have one in Canada, at Montreal. Two have lately been started at Detroit, and reported as giving excellent satisfaction. The accompanying illustration of Geo. A. Barnard's towers arranged for surface condenser, with the tower on the roof of a high building, will illustrate one application of the system. Further illustrations are not exhibited, because several of the mechanical papers have lately fully shown the different applications of it. It is estimated that the cost of operating a cooling plant is from 2½ to 5 per cent. of the power of the engine, which leaves a large net balance in favor of the apparatus, fully justifying its application on plants of any magnitude, or where the cost of coal exceeds $1 per ton. If a tower is placed on the roof, a surface condenser should be used; and the ascending column of warm water is balanced by the descending column of cool water, and the actual head the pump works against is the height of the tower. If the tower can be placed in the yard, a jet condenser may be used, unless the object is to get pure water for the boilers. In the beginning of this paper the cost of adding a condenser to a 100 horse-power plant was shown to effect a net saving of $420, or 20 per cent. nearly. The cost of adding a tower to such a plant should not exceed $700, the interest on which at 6 per cent. is $42, leaving a net saving of $378. This would make a very good showing on such a small plant, and would in most cases be much larger. Another point is, in cases where engines are carrying a full load and a little more power is required, attaching a condenser would increase the power about 20 per cent., thereby avoiding buying a new engine, the plant carrying this extra load at the same expense for coal and water.

For THE CANADIAN ENGINEER.

THE MANUFACTURE OF MOTOR VEHICLES.

BY J. H. KILLEY, HAMILTON.

Thousands of French, German, English and American engineers, mechanical, electrical and chemical, are at work on the problem of getting up a simple and effectual horseless carriage, suitable for every kind of land travel. It is conceded that the person who can invent and construct a light, inexpensive, practical and mechanically simple horseless vehicle, that can be handled by any man or woman of ordinary intelligence, will acquire both fame and fortune from his exertions. In the past France and Germany have paid more attention to automobiles than any other people in the world. At present England, the United States and Canada are moving in this direction, and many hundreds of patents have been taken out for improvements, or supposed