

from the coal and also the diversified colors which we get from the coal tar products. During this formative period of coal these forests were the habitation and feeding place of the Brontosaurus and other Saurians that have been extinct for ages, but the skeletons of which have been found in the rocks of that period by modern scientists, carefully chipped out, and assembled into the complete skeleton. The larger museums contain specimens of these animals—the American Museum of Natural History in New York City being especially favored in that respect.



**Fig. 2.—Distributing Tarvia "B" by Means of an Ordinary Watering Cart Fitted with a Distributing Device.**

The family relation existing between coal and tar and the derivatives is graphically shown in the coal tar tree. (Fig. 1). The main stem of this represents the raw tar. Off to the left coke is designated, which is a residue from the fractional distillation of coal. The drawing also shows the production of gas and ammoniacal liquors, refined tars which are used in the saturation of felt for roofing and waterproofing purposes, and those which are manufactured into Tarvia for use in road construction. You will also notice that the various branches of this tree represent the drugs, chemicals, disinfectants, germicides, insecticides, and almost innumerable by-products. Finally, it is of interest to note that by synthetic chemistry we have a class of coloring dyes, etc., which are important in the commercial world.

The making of coke and the separation of the distillates was formerly accomplished by the Bee-hive oven, patented in England in the year 1620. The coal is fed into the oven through the opening at the top and leveled off with a hand rake. The face of the oven is then bricked up to within a few inches of the top, and the heat, which has been retained in the brick from a previous operation or from a preliminary heating, is reflected from the dome of the oven, thereby causing the coal to disintegrate. The gases pass out through the opening at the top, leaving a residue which hardens upon cooling. This is of a light silvery color, and is known as "Coke." In this type of oven all of the by-products are lost, and because of the smoke and disagreeable odors of escaping gas it was impossible to operate it in the near vicinity of dwellings. For these reasons the Bee-hive oven is rapidly becoming replaced by the more modern coal gas retort. In this the operation is substantially the same, except that the distillation of the bituminous coal is done under the exclusion of air. By this method the gases are carried off in pipes, recondensed and scrubbed, thus relieving them of their deposit of tar and ammonia.

The modern gas retort is a more efficient type of oven, which, being built in series, is capable of handling a much larger quantity of coal, and as it is mechanically operated,

is much more economical. In the treatment of the gases for the recovery of the tar and ammoniacal liquors, the gas is forced through a series of baffling plates which are perforated with tiny holes. The plates are placed one back of the other, but in such a way that the unperforated surface of one plate is opposite the perforation in the other plate. The gas is then drawn through these plates and the tar, which exists in minute globules, adheres to the unperforated surface of the plate and is thus recovered. For the recovery of ammonia the gas is passed through a cylinder containing revolving wooden paddles which are constantly kept wet, and the gas coming in contact with the wetted wood is relieved of its ammoniacal deposit.

As it has been shown, in a general way, how tar is produced, it might be interesting to explain the manner of its distribution to consumers. It is sent in tank cars, which are fitted with steam coils to heat the material before transferring it to the distributing wagon. It is also shipped in barrels by rail or boat and by tank steamers, the hold of which is partitioned off fore and aft for the transportation of tar in bulk.

There are three grades of Tarvia on the market—"A," "X," and "B"—the "A" and "X" grades being used in new construction and resurfacing, while the "B" grade in light resurfacing, and as a dust preventative. For example, Tarvia "B" was successfully applied to the surface of a water-bound macadam street in Phillipsburg, N.J.

In this instance an ordinary watering cart was used, fitted with a distributing device, as seen in Fig. 2, at a cost of about \$10. The surface of the street was first carefully swept, then from one-third to one-half gallon of Tarvia "B" was evenly distributed over the surface and broomed out with hand brooms where necessary. After an exposure of several hours this surface was lightly covered with a drifting of sharp, clean sand and the street thrown open to traffic. The initial cost of this treatment was 3 7/10 cents per square yard. The traffic there is more than ordinarily heavy, the street being the outlet for several foundries. Notwithstanding this, the street has been maintained for two years without other maintenance than the annual application of Tarvia "B."



**Fig. 3.—Rolling a Tarviated Macadam Road Constructed by the Mixing Method.**

In new construction there are two distinct methods of application—the penetration method and the mixing method. In the former the tar binder is applied by hand or machine to the stone in place on the road, while in the latter the stone and binder are mixed together, like concrete, and then the mass deposited and the road rolled. (See Fig. 3).

Early Street, Morristown, N.J., is an example of the penetration method of construction of a 6-inch tarviated