

binder, consisting of from one-fourth to one-half of a gallon per square yard was applied, followed by another coat of screenings and more rolling.

#### Experiment No. 3—Pioneer Asphalt Cement.

The material used as a binder in this experiment is refined rock asphalt mined in Utah. In the construction the foundation course was finished as a water-bound macadam road, thoroughly rolled and bonded. The second layer was composed of stone ranging in size from one and one-half to two and one-half inches. This was rolled to a finished depth of about two inches, no water being used. One-half to three-fourths inch screenings were broomed into the surface in a quantity sufficient to reduce the voids about 50 per cent. The asphaltic cement was then poured at a temperature between 390 deg. and 410 deg. F., until all of the stone was thoroughly coated. When the coating had cooled, a thin dressing of screenings was sprinkled over the surface. These screenings were sprinkled but a short distance ahead of the roller, which followed immediately after the screenings were placed. The screenings were sprinkled at first in a thin layer, and as the rolling proceeded more screenings were added, until the coating had absorbed all the screenings which it was possible to absorb. The quantity of the binder used was one and one-fourth gallons per square yard.

The surface is smooth, dustless and in excellent condition with no excess of binder.

Asphalt has been forced to the surface to a degree that it has flowed to the side of the road. The temperature at the time of inspection was only about 85 degrees and yet the imprint of the horses' hoofs was plainly visible at points on the surface where the asphalt had exuded to a great extent. Excepting for these points the surface is hard and dustless. Photograph 2 shows this section.

#### Experiment No. 4—Tarvia "X"

In the preparation of Tarvia X, ordinary coal tar is heated to drive off the water and ammonia. The road was prepared for this treatment in a manner similar to section No. 3, except that the stones in the top course were from 1½ to 3 inches in size. No screenings were used. When this course was thoroughly dry, the refined tar, under pressure, at a temperature of from 250 deg. to 300 deg. F., was spread over the surface by means of a hose attached to a tank wagon. The tank was hauled by a steam roller to avoid the displacement of the stone that would be caused by horses' feet. By the use of the tank wagon the tar was kept heated and under pressure, and this method of applying the tar greatly facilitated the work. The time required for one pouring over the entire section was about one-half hour.

This section shows evidences of dust, due, doubtless, to the fact that a number of cross-streets in the village contributed a portion of their surface. The larger stones are in places exposed and worn, but were held firmly in place. Photograph 4 shows this section.

#### Experiment 5—Tarvia "B."

This material is a tar preparation that may be applied without heating. In this instance it was placed on a macadam road that had been filled and rolled, but had not been watered, and had been under travel for about two weeks. In making the application, all of the dust and dirt was carefully swept to the sides of the macadam, and on the clean surface the binding material, which had been heated for this work, was applied by means of the same tank wagon that was used for Tarvia "X." Two-thirds of a gallon was used per square yard. As soon as the Tarvia had been applied the dust that had been removed from the road was swept back over this surface.

This section is in excellent condition—superior, in fact, to the section just mentioned. It is hard, perfectly smooth and dustless.

#### Experiment No. 6—Liquid Asphalt.

The material used in this section is the Indian Refining Company's heavy asphalt binder, said to contain 90 per cent. asphalt. It was shipped in barrels and was heated for use on the road in a large heating tank. The barrels were rolled on skids to the top of the heating tank, and when in place one head of the barrel was knocked in and the material allowed to flow out of the barrel thus opened. Notwithstanding the fact that the weather was very warm while this work was being done, the material was so heavy that it flowed very slowly, and several minutes were required to empty a barrel in this manner. The material was heated to a temperature of about 200 deg. F. and applied to the road under conditions similar to those used for the "Pioneer asphalt," described above.



Section II. Standard Asphalt Binder.

Ohio State Experimental Road.

The larger stones are exposed in this section, but there are no signs of loosening or raveling. The surface is dustless, hard and smooth.

#### Experiment 7—Ugite.

The material used in this treatment is said by the manufacturers to be a true tar, made by treating water gas tar in such a manner that the hydro-carbon compounds of the paraffins in the water gas undergo a chemical change, resulting in the production of a true tar, without producing free carbon, which is commonly found in the coal gas tars; consequently, a material that does not have the deep black color of the ordinary tar. The treatment was applied in two different ways, as follows:

At the beginning of the section, extending south for a distance of 273 feet, after rolling in sufficient ¾-inch stone in the top course to bind it well, 2.05 gallons of the tar were poured on the road, at a temperature of 240 deg. The maximum air temperature during this work was 87 deg., the minimum 75 deg., and the mean 81 deg. F. The tar was heated in a small heating tank placed at the side of the road, and the average rate of application on this part of the