the entire cross-section at the point where the tube is inserted is a forward motion, and where the distribution of velocities is symmetrical about the axis of the pipe.

2. The Pitot tube is a means by which eddies or whirls caused by obstructions in the pipe may be detected, but it will not measure with any degree of accuracy the discharge of a pipe when inserted in the immediate region of such eddies.

3. The rating coefficient of discharge of the Pitot tube for normal conditions can not be applied in the case of abnormal conditions produced by sudden enlargement where eddies exist, but immediately below the region of eddies the rating coefficient of discharge may be applied with a fair degree of accuracy.

4. The eddies produced by sudden enlargement of section extend for the short distance of only about two or three diameters below the enlargement.

5. The disturbance caused by sudden enlargement of section produces abnormal conditions in the distribution of velocities which continue down the pipe for a distance of about 35 diameters.

6. The ratio of the mean velocity to the velocity at the centre, $\frac{V_m}{V_c}$, increases in value, in the case of sudden enlargement, from a minimum near the point of enlargement to a maximum at a point about 11 diameters downstream, after which it begins to gradually decrease, approaching the value of the ratio for flow in straight pipe at a distance of 35 diameters below enlargement.

7. The loss of head due to sudden enlargement may be expressed by the equation, $H_b = K\left(\frac{A_2}{A_1} - 1\right)^2 \frac{V^2}{2g}$ a constant times the theoretical loss by Borda's formula, and in making the observations for the total loss due to this disturbance, a distance of at least 35 diameters of the down-stream section, below the enlargement must be included.

The value of the coefficient K is very nearly the same in the two cases of enlargement herein investigated, and is approximately 0.97.

8. The Pitot tube reversed, i.e., the impact-point turned down-stream, gives a negative pressure-head, which reduced to velocity, negative, gives a value whose ratio with the velocity in the up-stream direction is fairly constant for any given form of tube. But the relative values of the down-stream readings to the up-stream readings for different forms of tubes vary greatly. The maximum negative pressure or suction action at the impact-point of the Pitot tube occurs when the direction of the axis of the opening is approximately perpendicular to the direction of flow.

MINERALS OF NEW BRUNSWICK.

The minerals of New Brunswick, developed and undeveloped, cover a considerable range. They include an antimony deposit at Lake George, which has recently been taken over by the Northern Antimony Smelting Company with a capitalization of $2,000,000; bituminous coal deposits (estimated to contain fifteen million tons); iron, gypsum, oil shales, manganese, graphite, tungsten, molybdenite, copper, lead, zinc, galena, barytes, infusorial earth, black, grey and red granites, freestone, sandstones and other minerals, which offer a very attractive field for investment. A discovery of a rich bed of galena ore was recently made at Maple Grove, York County, by W. H. Griffin, a provincial game guide. Two veins of 22 feet and 12 feet respectively have been uncovered. Ontario parties have secured an option of the mine.

SOME ADVANTAGES OF REFINED COAL TAR FOR ROAD CONSTRUCTION AND MAINTENANCE.*

By Philip P. Sharples,
of the Barrett Company, New York.

THE success of simply surface treatments over waterbound macadam in resisting modern state highway traffic has led in the last few years to a reversion to the macadam type to meet the needs of the lesser traffic roads. Its ease of construction and its adaptability to repairs, widening and reconstruction, commend themselves to the thinking engineer.

The choice of bituminous materials for protecting the surface lies between those which form distinct mats and those which are thin enough to enter into the surface of the roadway and form an integral part of it.

As mat-forming protectors, both asphalts and tars are available, refined to suitable consistencies. They must, however, be handled with extreme care to avoid the formation of a movable mat which ruts and rolls under traffic.

Excellent examples of this form of mat surface long in use are to be seen in the vicinity of Boston. A section of the Newton Boulevard opposite the Brae Burn Club has never been re-treated since the original three-quarters of a gallon of refined tar to the square yard was given in 1906. As the road receives heavy auto traffic, several thousand cars per day, it probably represents as low an upkeep cost for a road kept in perfect condition as any in the United States. The traffic is, however, wholly automobile and the road and its surface as perfect as could be presented for this form of treatment.

The Massachusetts State Highway at West Lynn and the Metropolitan Parkway through Everett and Revere are other examples dating from 1907 and 1906 of the success of this treatment under favorable road and traffic conditions.

The employment of bituminous material applied cold to the macadam surface has to a large extent taken the place of the hot applications. The ease and cheapness of application and the less skill required in their use have been responsible for the wider extension of cold applications.

The refined tars used for cold application have much more penetrating power than any of the other bituminous materials of an equal viscosity. This penetration makes them particularly valuable where it is important to avoid the formation of a distinct mat owing to traffic conditions which would disrupt a mat if formed. It also makes them of the greater value in treating bituminous macadam of every type. The refined tar finds its way into the surface and has a healing effect even on a distinctly disintegrating road.

The amount of bituminous material required will usually vary from ¼ gallon per square yard for re-treatments to ¾ of a gallon per square yard for new absorptive roads. The most favorable results on a first treatment can be obtained by supplying sufficient bituminous material to cause a slight excess to remain on the surface after it has been allowed to dry in for an hour or so. Usually better results are obtained on new work by applying in two treatments at an interval of two to six hours.

The kind of cover to be used depends largely on the local material available. With the refined tars, success may be obtained with a large variety of materials from three-quarter inch stone chips, through the gravels to a

*Abstract of paper read before American Association of State Highway Officials, December 6th, 1916.