vacant spaces will be filled with as much hard material as possible. When the coat of metalling has been thoroughly rolled the spraying machine traverses the road and sprays the surface, one turn generally being sufficient. A thin coating of very fine chips and dust from a stone-breaking machine is then spread uniformly over the surface and finished by further rolling. No sweeping is necessary by this method of construction, therefore a considerable saving is effected in labor and the cost of brooms.

The amount of tar necessary to properly coat the roadstones for every ton of metal applied varies according to the size of the material used and the quality of the tar, but from 4 to 6 gals. may be considered sufficient under ordinary circumstances. This quantity of tar would, therefore, with a 3½-in. coat of metal, be equal to 0.56 gal. per sq. yd. of road covered. The material after consolidation, however, becomes a homogeneous mass, and the internal friction or abrasion is eliminated. The prolongation of the durability of a road so made will be greater, probably doubled, compared with the ordinary method of construction, consequently ultimate economy will be promoted. The surface of a tarred road is practically waterproof, and the elimination of dust and mud, or their reduction to a minimum, would alone be sufficient to justify the general application of tarred macadam.

The reason why tarred macadam, carried out in a proper manner, is free from dust and mud and wears longer than ordinary macadam, is simply because the frictional resistance of the stones is increased to such an extent that internal motion and rubbing are prevented, and the tar and chips which fill the interstices of the metal coating prevent percolation of water and the evils resulting from that cause. Tar, no doubt, might be improved by the addition of a bituminous material, which would further increase the life of a road, but, of course, at additional cost. This fairly represents the possibilities of this form of construction or tar-macadamizing.

PAINTING BRIDGES IN WINTER

The following article was written by a foreman painter of one of the large railroads in the United States. This gentleman has had experience of many years in painting railroad bridges, under all kinds of conditions, and the subject of this article, "Painting Bridges in Winter," is of special interest at this time:

That experience is a good teacher, no one will deny, and after repeated warnings by different authorities on the increased cost of labor and material and the lack of durability from painting metal in winter months, let us recall our experience of six years.

In January, 1901, a large railroad system sent a gang of painters into western Iowa to clean and paint fifty steel girder span bridges. With the force at hand, and owing to other conditions of the work, they were twenty months completing the work. During this time they were painting through the winter months of 1901 and 1902, as well as through the summer months of both years, and every precaution was taken not to paint when there was moisture in the air or when frost was on. The paint was applied on girders in February, 1902, when the thermometer registered as low as 4 degrees above zero, and there seems to be no difference now in the general condition of this work, whether it was painted in summer or winter.

At no time did the work over-run the estimate of cost, although the cost was slightly increased both for labor and material in the winter. However, this extra cost was only a trifle as compared to the care of the structures, and now after more than five years it is impossible to tell whether the structures were painted during the summer or the winter, as the general conditions are the same, and only by looking at the date painted on when finised can you tell when the work was done.

All of these bridges received exactly the same treatment, having first been coated at the factory with boiled linseed oil, which was only a detriment to the surface. The oil bound fast the mill scale, rust, grease and blisters and in the field, without a sand blast, could only be removed by hand scrapers. After the steel was erected it received two coats of paint.

The condition of the work had several advantages, by having a land climate without alkali, sea fogs or gases, which are enemies to paint; yet it has had the disadvantages of being painted, in many cases, six months after erection, the coating of linseed oil and the drippings of salt brine from meat refrigerator cars.

After experience of this kind which may occur over and over again, it only convinces one that the time to paint is just as soon as the structure is erected and before rust starts. Like filling the purse, "Little and Often" makes a good rule for painting, and the season of the year can not be considered when a structure needs paint.

THE MANUFACTURE OF GLASS PRODUCTS.

It has been estimated that $65,000,000 worth of glass products were manufactured in the United States in 1905 Materials used in making these products must have cost nearly $18,000,000, and of this sum $1,000,000 was spent for sand. In the last half of the eighteenth century the value of glass products increased 70 per cent for each twenty years. Their value is still increasing, and because of the remarkable development of an industry so largely dependent for its raw materials on mineral deposits the United States in 1905 began making an investigation of sand producing areas. From this report the following interesting facts have been deduced:

Of the states in which glass is listed as a manufacture Indiana and Ohio at present occupy, respectively second and third rank, the first place being held by Pennsylvania. Glass making has but recently been added to the industries of Kentucky, but factories are in operation at two points.

Indiana is producing less than 1 per cent of the glass sand used in the state, the remainder being obtained largely from the Fox River (Illinois) district and the Klondike (Missouri) district. All the sand that can be produced of sufficient purity even for green and amber bottles finds a ready market at good prices—a condition encouraging to both producers and manufacturers. Attention is called, however, to the fact that no large deposits of sand-stone are known in Indiana that have the purity of the St. Peter sandstone, so abundant farther west, and for certain grades of glass there will always be a demand for sand from beyond the state.

Ohio produces 0.937 per cent as much glass sand as is used in the state. A large part of this, however, passes from the eastern part of the state to factories in western Pennsylvania, and a corresponding amount is brought in from other states, especially from West Virginia and Illinois, at notably higher prices. Glass works are established within an area extending across the state from Toledo to Cincinnati and as far east as Steubenville. The plants are usually well situated in regard to fuel, but many have to pay excessive freight charges on their sand.

The Kentucky factories obtain their sand at Tip Top, twenty-eight miles southwest of Louisville.

USING CONCRETE TO REDUCE NOISE.

Largely unnecessary, city noise is one of the greatest nuisances that a long-suffering public is called upon to endure. Without presenting a bill of particulars, attention may be called to the disturbing and constant din produced by the great majority of elevated railroads. In one way and another, much of the difficulty is now overcome, but the disturbance is still very annoying, says the American Contractor.

The problem is an old one, as old