sible is exercised, there will be considerable variation in the mesh composition and temperature of the mineral aggregate as delivered to the mixer. The permissible variations are usually set forth in the specifications and should be closely observed. Mixtures which vary very greatly in mesh composition will require different amounts of bitumen in order to make the best possible type of mixture. Within ordinary limits, no correction will have to be made for this, but, generally speaking, a mixture containing a large proportion of fine particles will require more bitumen to cover these particles than a mixture containing a smaller proportion of them. This is due to the fact that the finer the mixture the greater the surface area to be covered with bitumen. This can, perhaps, be most clearly shown by taking the case of a 1-in. cube which it is proposed to coat with bitumen. In its original state there will be six sides having an area of one square inch each to cover. If this cube be cut into two cubes, there will be the original six sides plus two additional sides to be covered, and every time that the cube is cut there will be an increase in the surface area to be covered with bitumen. In order to secure a satisfactory output from the plant, it is absolutely essential that the greatest possible care should be taken in the mixing and heating of the mineral aggregate. In order to insure the proper mixing of the mineral aggregate, it will be necessary from time to time to take samples of the mixed aggregate and sift them for mesh composition. Owing to the extreme difficulty of securing an average sample of hot, dry mineral aggregate, great care must be exercised in selecting the samples. The arrangement of the plant and the kind of mineral aggregate used will determine where and how often these samples should be tested.

The speaker is inclined to advise the obtaining of samples for test from the overflow of the feeding device used in conveying the cold mineral aggregate to the heating drums. This is usually done by a chain and drum drum into the chute drum elevator. Where these buckets dump into the chute at the entrance of the drying drums, there is almost always a small overflow which gradually piles up underneath this chute. Assuming this to be the case, the pile can be cleaned off at a given time and the material which accumulates during, say, half an hour's run can then be sampled, dried and sifted. It is much easier to sample the damp material than it is the dry, and this not only obviates some of the difficulties attendant upon sampling dry material but gives the inspector an average of the material fed into the drums during the half hour while the pile was accumulating. In this way much better average results are obtained and the inspector is not liable to be misled by temporary and unimportant lapses in the feeding of the material. In other cases, samples of the hot material are obtained from the delivery end of the durity for the material are obtained from the delivery end of the drying drums. In such cases a number of samples should be collected and mixed together and the resultant

Preparation and Heating of the Asphalt Cement or Bituminous Binder.—For the preparation of the asphalt cement or bituminous binder, the contractor may purthase a hard bituminous material and add sufficient flux to it to bring it to the proper consistency, or he may purchase an asphalt cement of the proper consistency in the first infor use without the addition of any flux. In the first instance the melting kettles will have to be charged with the proper proportions of flux and hard asphalt to produce the desired asphalt cement. In large plants this is generate desired asphalt cement. The day's run. The masenerally done at the close of the day's run. The materials are then kept under a gentle heat during the night and brought up to the desired temperature in the morn-

The contents of the kettles are then thoroughly ing. agitated in order to insure complete mixing of the different ingredients and a sample from them is taken and tested for penetration before the contents of this kettle are permitted to be used. If it is too hard, more flux will have to be added to it. If it is too soft, more hard asphalt will have to be added to it. After the additions are thoroughly melted, the contents of the kettle must be again agitated and tested before using. Certain asphalts are more difficult to flux than are others and require a longer period of heating. Overheating of the kettles will result in undue hardening of the asphalt cement. If the flux or hard asphalt contains any considerable proportion of water, this will foam very badly in the kettles and frequently cause them to run over. No asphalt cement or bituminous binder should be used until the water has been thoroughly removed from it. Where the asphalt cement or bituminous binder contains a considerable proportion of mineral matter or impurities, the contents of the melting kettles must be kept thoroughly agitated during the time that they are being drawn upon for use. Suitable mechanical agitation is, perhaps, the most advisable, as in this way the bituminous material is hardened less than if a steam or air blast is used.

Violent agitation with steam or air will very rapidly lower the penetration of the contents of the kettles. In the case of asphalt cements containing a considerable proportion of mineral matter, unless the contents of the kettles are thoroughly agitated, the material drawn from them will vary in purity or bitumen contents with the result that the portion first taken from the kettle will usually run much higher in bitumen than the portions last taken from it. Assuming that the proportions of the mixture have been set to give the desired quantity of bitumen, based on the average bitumen contents of a thoroughly mixed kettle, the mixture turned out with the asphalt cement first drawn from the melting kettle will be too rich in bitumen and that turned out with the asphalt cement last drawn from the kettle will be too low in bitumen. It is impossible to estimate by observation the changes in weights of asphalt cements necessary to overcome this and the only proper way, therefore, is to so agitate the contents of the melting kettles that the supply of the bituminous material drawn from them will be uniform in bitumen contents. If for any reason the asphalt cement for a certain day's run is not entirely used up, it should always be tested for penetration before permitting its use on a subsequent day's run. There is, of course, no objection to filling up the balance of the kettle with new material and mixing it thoroughly with the portion left from the previous day's run. It should then be considered as a new batch of asphalt cement and tested accordingly. Where hard asphalt and flux are to be melted together, the contractor should never be permitted to draw any material from the melting kettles until their contents have been completely melted and thoroughly mixed. Even where the asphalt cement is purchased ready for use, it is not good practice to draw from a kettle containing lumps of unmelted bituminous material. Sufficient melting kettle capacity should be insisted upon to avoid the necessity of doing this.

With the exception of the fluxing, the foregoing remarks apply equally to bituminous binders, purchased by the contractor, of the proper consistency for use.

Mixing of the Heated Mineral Aggregate With the Hot Asphalt Cement or Bituminous Binder .-- It is unquestionably the best practice to weigh out the various ingredients entering into the composition of the finished mixture. Where the different ingredients are measured by volume, much greater variations will occur than when