

limits in composition and within different limits than is the case in a mixture exposed to light traffic of mixed character. These conditions make it more and more necessary to have plant equipment capable of the most accurate work and susceptible of at least as much control as is required for similar manufacture in other branches of chemical technology. These conditions are being met with by the more progressive manufacturers of paving plants.

**Lack of Skilled Labor.**—Generally speaking, the labor available for the operation of asphalt plants is of very unsatisfactory character, and is not to be entrusted with carrying out any important operation without the closest supervision. This statement does not, of course, apply to the operations of those concerns who continuously carry and carefully break-in the labor controlling the more important portions of the mixture manufacture.

Generally, however, the labor available at the asphalt plant is the kind which is picked up locally, and most frequently such plants come upon the work with scarcely anyone but a foreman having any idea as to operation. These conditions make it essential that the important operations in turning out these mixtures be so arranged as to be subject to almost automatic control, so that the labor available need not be depended upon for the success of the work.

In other words, the paving plant should be made fool-proof, or as nearly so as is possible with reference to those features which enter into the control of product.

The result of crude facilities and poor labor is that with the best of intentions, and frequently with the best of efforts, inferior results follow simply because, in the final analysis, the pavement mixture, however well planned or however well set, is dependent for its accurate proportioning upon the man at the mixer, who frequently holds his job because no one else will stand the dust, dirt and heat of this portion of the work.

The writer has been often amused when visiting paving plants to find, upon asking the plant foreman as to his mix, a ready response in odd and exact figures of different materials used, and then to climb up on the mixer and find the gentleman of color presiding there, overdraw his A.C. bucket ten or more pounds, the bucket carrying a choice accumulation of dirt, its tare a matter of ancient history, the amount of filler dependent upon half-filled buckets of variable number, and a general promiscuous intermingling and wandering of various aggregates from their respective bins.

The box weights given by the foreman with so much assurance and emphasis on the ground become a matter of chance and purest guesswork at the mixer. Without an inspector almost continuously at the mixer, the well-planned proportions and the careful judgment used in making the mix become a theory, subject to the vagaries of totally unskilled and unreliable laborers.

**The Requirements.**—The important operations of a paving plant, from the point of view of the engineer, may be briefly stated as follows:—

- (1) Melting of refined asphalt and fluxing to produce asphaltic cement.
- (2) The proportioning and feed of cold aggregate into the dryers.
- (3) Control of temperature of aggregate and of asphalt cement.
- (4) The separation of complex aggregates and distribution into various bins.
- (5) The weighing out and combination at the mixer of the components of the paving composition.

The ideal paving plant will approach the maximum of efficiency in proportion to the extent that these operations may be controlled automatically or with the least possible dependence upon the labor employed.

If the attention of the manufacturer of paving plants be directed towards these features rather than to further improvement in capacity, a great deal will have been accomplished for the benefit of the paving industry. As a matter of fact, the later types of standard plants on the market have generally little to be desired as to mechanical reliability or capacity of output. There is even a tendency for some of these plants to turn out more material than can be given proper attention in laying, so that the time is ripe for more important development in the way of control of product.

**How to Meet Requirements.**—The writer desires to point out somewhat generally the character of mechanical devices which he has in mind with reference to accomplishing the above-mentioned important operations. In doing so, however, he desires to disclaim any mechanical ability or knowledge of details by which these rough ideas might be carried out.

**Asphalt Cement.**—With reference to preparation of asphalt cement, there is nothing wanting in the best types of present plants. The refined asphalt is melted by steam or indirect fire, and the fluxing operation is sufficiently well regulated by weighing out the required proportions of materials and agitating them mechanically by air or steam until homogeneous. Generally, there is very little danger of overheating. The temperature of the asphalt cement can be subject to very considerable ranges without injury.

**Feeding Aggregates.**—The proportioning of cold aggregates into the dryers, as now carried on, is accomplished generally by bringing up to the cold elevator, and piling there, the individual elements of the aggregate. From these piles, one or more men feed the material into the elevator by means of shovels or hoes, regulating the proportioning by the number of shovelfuls of material from each pile. Sometimes this is also done by bringing up the material in wheelbarrows and piling the different portions in one pile, the proportion being regulated by the number of wheelbarrows operating from the stock piles of individual aggregates.

In either case, the labor employed in accomplishing this result cannot be depended upon to maintain correct proportions with measuring units which are, to say the least, crude at best. Very frequently, the wheelers drop out of line or out of order, leaving the other feeders or wheelers working, regardless, at their respective materials. Sometimes the cold elevator will be carrying one element of the aggregate almost entirely, and again, some other element will be carried in preponderating proportion.

This lack of uniformity produces a constantly varying temperature, in the heating drums. It would seem possible that this operation of feeding aggregates could be accomplished by separate conveying devices, bringing each component from its pile at predetermined rates of feed regulated by interchangeable gears or other simple speed-governing device.

By some such arrangement, the proportions of the aggregates could be regulated accurately and uniformly. Even the filling of hoppers or buckets attached to the conveyers operating from each pile of materials might be simply effected.

**Temperature.**—The temperature of mineral aggregate leaving the dryers must be controlled within fairly close limits. If the aggregate is too cold, it will not mix

(Continued on page 446).