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K. SCHULZE

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MIXING ATOMIZING NOZZLE

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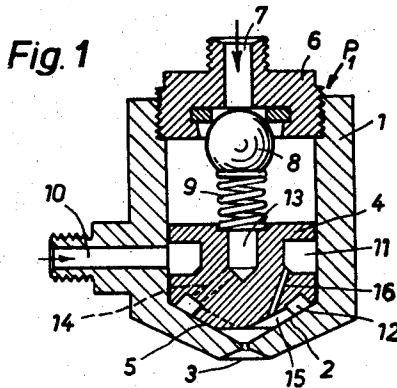


Fig. 3

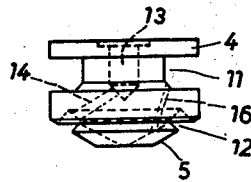


Fig. 2

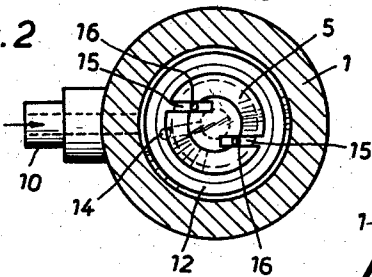
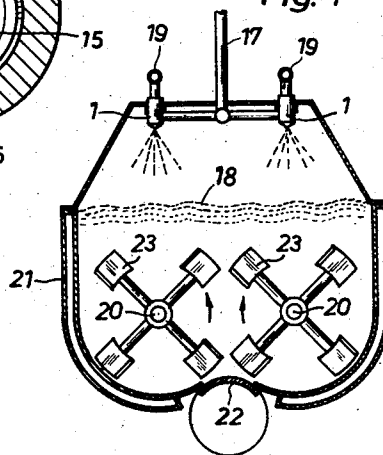


Fig. 4



Inventor,
Klaus Schulze
By Wendt, Lind
and Penack, Attorneys

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MIXING ATOMIZING NOZZLE

Klaus Schulze, Munich, Germany, assignor to "Straba"

Handels-Aktiengesellschaft, Lugano, Switzerland

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1 Claim. (Cl. 239-404)

This invention relates to the production of bituminous mixes which are used for example as pavement mixes in making roads and the like or for making coal and or briquettes.

For atomizing a bitumen or tar-pitch binder into finest minute droplets, a temperature of about 150-200° C. is required, according to the type of binder used, at a spraying pressure of about 280 to 300 lb./in.². In order to add water into the liquefied binder in the feeding line, this water must also have approximately the same temperature so as not to affect the required viscosity of the binder; this water accordingly must be added in form of super-heated water. Upon atomization of the mixture of binder and superheated water the atomized droplets leaving the nozzle are suddenly exposed to normal atmospheric pressure only, and evaporation of the water starts at once when the mixture is discharged from the spraying nozzle. However, the water of the mixture will only partially evaporate until the heat of evaporation has been spent and the temperature of the atomized liquid decreased to the normal boiling point of water. Accordingly a portion of the superheated water added to the binder before atomization thereof is transformed into steam which assists in additionally dispersing the minute binder droplets discharged from the spray nozzle, while another portion of the water remains in liquid state and impinges on the floating aggregate particles simultaneously with the binding agent. This water assists in and greatly improves the spreading of the bituminous binder on the small aggregate particles. The result is an improved uniform coating of the aggregate particles with the thinnest possible films of binding agent.

The object of the present invention is to provide an improved and greatly simplified method for preparing a bituminous mix, in which water under pressure is added to the hot liquefied bitumen within the spray nozzle only and in close proximity to the discharge orifice of the nozzle.

A further object of the invention is the provision of mixing nozzles for spraying a mixture of bituminous binder and superheated water onto the solid particles, said nozzles being provided with a feed duct for binding agent, and a separate feed duct for water, the two ducts joining each other only in the immediate proximity of the discharge opening of the nozzle.

The invention offers the advantage that the pressure of the water introduced into the mixing nozzle does not have to be exactly the same or even slightly greater than the pressure of the binding agent in the feed conduit; it must only be high enough that the water is admitted into the nozzle to freely mix with the bitumen. When the water is introduced into the nozzle ducts just ahead of the discharge opening of the nozzle, it mixes with the binder flowing with high velocity through the nozzle ducts. This high velocity is necessary for obtaining an atomization of the binder into a fine mist of minute droplets. Owing to this velocity, the pressure of the binder in the nozzle ducts decreases somewhat. It is accordingly possible to introduce the water at a substantially lower pressure into the nozzle ducts than the pressure which would be required when introducing the water into the binder feeding conduct ahead of the nozzle. For the practice of my invention, this means a substantial simplification with respect to the arrange-

ment disclosed in my aforesaid prior specification, since it will not be necessary to exactly adapt the pressure of the water to that of the binder.

When operating according to this invention, it is not necessary that the water under pressure added to the bituminous binder is at a temperature above the normal boiling point. By the new principle of my invention, water under pressure and at a temperature of slightly less than 100° C. may be introduced into the bitumen in the nozzle so that it can freely mix with the binder which is under high pressure required for atomization. In the constricted space in the nozzle and under the operational pressure and temperature, the water introduced into the nozzle immediately turns into superheated water shortly before the mixture of water and binder is discharged from the nozzle. The action of this superheated water is the same as above described and as if it were added in the form of superheated water. This procedure greatly simplifies the equipment necessary for carrying out the method according to the invention and accomplishes the same results.

The invention also comprises a mixing nozzle in which a nozzle body, in addition to an inlet for bituminous binder, is provided with a separate inlet for water under pressure, the feed ducts for water and binder extending separately within the nozzle and joining each other only in the immediate proximity of the nozzle discharge orifice. Preferably, the atomization of the binder is obtained by means of tangentially directed outlet ducts into which open the separately extending water ducts a short distance ahead of the discharge orifice of the nozzle.

The accompanying drawings, somewhat diagrammatic in character, illustrate an embodiment of the present invention. In the drawings:

FIGURE 1 is a vertical section through a mixing nozzle according to the invention;

FIGURE 2 is a view from below on the nozzle insert, showing the nozzle body in horizontal section;

FIGURE 3 is a view in elevation of the nozzle insert.

FIGURE 4 shows a mixing apparatus in transverse section;

The represented nozzle comprises a cylindric nozzle body 1 having a cone-shaped nozzle tip 2 provided with a central discharge orifice 3. An insert 4 has a pressure fit in the cylindrical nozzle body 1, and has its conical bottom face 5 bearing on the inner face of the nozzle tip 2.

The nozzle body 1 closes on its top by a threaded plug 6 having a central inlet opening 7 for bituminous binder. A nonreturn valve 8, charged by a spring 9 which bears on the insert 4, opens the admission of liquefied bituminous binder when it is fed under the required pressure.

The side wall of the nozzle body 1 is provided with an inlet 10 for water. This inlet communicates with an annular duct 11 in the nozzle insert 4. A further annular duct 12 is formed in the conical bottom face 5 of the insert 4. The binder admitted through the inlet 7 arrives through a central bore 13 and an inclined bore 14 in the insert 4 at an annular duct 12, from which two grooves 15 which are directed tangentially with respect to the discharge orifice 3 in order to impart a rotary movement to the stream of liquid which is atomized, lead the orifice 3. The binding agent supplied at high liquid pressure of about 20 at. receives the necessary twist by the tangential grooves 15 in order to form a cone of atomized liquid having a large angle at the summit, so as to obtain the greatest possible atomizing effect. The two tangential grooves 15 are connected each by a bore 16 with the annular duct 11, so that water from the water feed conduit 17 (FIG. 4) entering the nozzle

through the inlet 10 is introduced into the stream of binder in the nozzle immediately before the stream is discharged through the nozzle orifice 3. Immediately the water under pressure is mixed with the binder, the mixture is discharged and atomized and, as described before, the superheated water is transformed into steam and water of 100° C., the water and the atomized binder impinging together on the floating solid particles 18 (FIG. 4), where the water effects the desired action of improving the spreading of the binder.

According to one manner of carrying out the method according to the invention, the hot liquefied bitumen is fed through conduits 19 to the nozzle at a temperature of about 170° C. while superheated water, also at a temperature of about 170° C. and a corresponding pressure is fed through the conduit 17 to the nozzle.

According to another manner of carrying out the invention, the water fed to the nozzle is not in superheated condition, but is only superheated by contact with the hot binder in the nozzle. For example, water under pressure and at a temperature of about 95° C. is fed through conduit 17 and inlet 10 into the nozzle, while the hot binder is supplied at a temperature of 200 to 220° C. The entire nozzle is heated to this temperature by contact with the hot binder, and when the water is fed through inlet 10, annular duct 11 and bores 16, it is heated by contact with the hot walls of the nozzle ducts to a temperature substantially above 100° C. Since the binder in the nozzle is under high liquid pressure, the water at a temperature above its boiling point cannot evaporate but is transformed into superheated water. This superheated water flows through the bores 16 into the tangentially extending ducts 15 where it is mixed with the hot binder under pressure and still further superheated by contact with the binder. Immediately after formation of the mixture of binder and superheated water, this mixture is discharged from the nozzle and atomized, and the atomized mist is impinging on the floating solid particles. In this procedure the temperature of the mixture of binder and superheated water discharged from the nozzle is dependent on the temperature of the water admitted into the nozzle, on the temperature of the binder and on the quantitative proportion of the two components of the mixture. This manner of preparation of the bituminous mix, in which the water is not heated above its boiling temperature, offers the advantage that no high pressure steam boiler is required in the equipment.

FIG. 4 represents a mixing container 21 for the preparation of the bituminous mix. The mineral aggregate which may be cold or heated to about 95° C. is whirled up by means of impeller blades 23 on oppositely rotat-

ing shafts 20 into a floating zone 18 where the particles remain in a transitory condition of suspension in which they are impinged by the fine droplets of atomized binder and water discharged from the nozzles 1. The actual mixing time for one charge of aggregate in the container 21 will last only about 30 seconds. As soon as the required amount of binder and superheated water has been atomized, the mixing is ended, the gate 22 in the bottom of the container is opened and the coated aggregate is discharged.

I claim:

An atomizing nozzle used for spraying a mixture of a bituminous binder and water comprising a generally cylindrical nozzle body portion having inlet means for liquefied bituminous binder under pressure at one end thereof and a nozzle tip having a discharge opening at the opposite end, an insert member fixed within said nozzle body portion adjacent the discharge end thereof, said inlet means and said insert member defining a chamber within said nozzle body remote from the nozzle tip, non-return valve means in said chamber coacting with said inlet means to admit bituminous binder under predetermined pressure into said chamber, said insert member having a first annular groove therein defining together with the cylindrical nozzle body portion a first annular duct, said nozzle body having water inlet means communicating with said first annular duct, said insert member having a second annular groove defining together with said tip end of said nozzle body portion a second annular duct, said insert member having duct means traversing said insert member for establishing communication between said chamber and said second annular duct, said insert member further having tangentially arranged discharge ducts between said second annular duct and the tip end of the nozzle body portion for directing bituminous binder to said discharge opening, and said insert member having further ducts between said first annular duct and said tangential ducts whereby water from said first annular duct is directed into the stream of binder in said tangential ducts immediately ahead of the discharge opening.

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