April 6, 1954

W. H. PHILLIPS

METHOD AND APPARATUS FOR MAKING CORK COMPOSITIONS AND THE LIKE

2,674,545

Filed Nov. 17, 1950

2 Sheets-Sheet 1

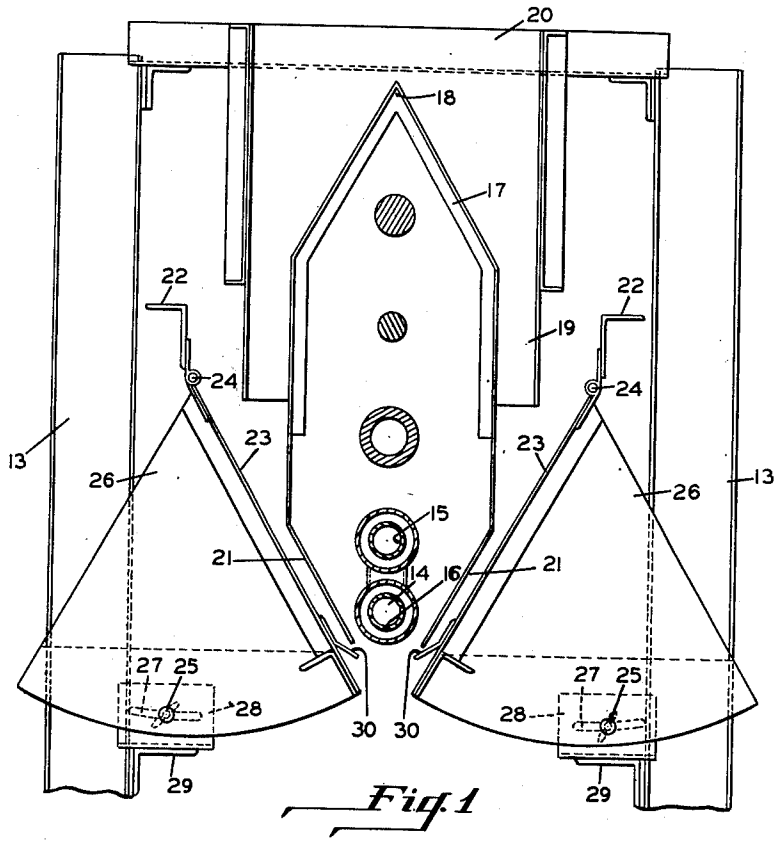


Fig. 1

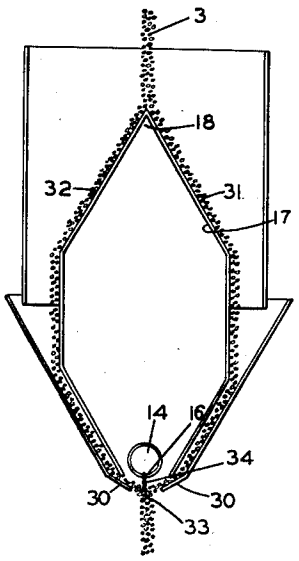


Fig. 2

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2 Sheets-Sheet 2

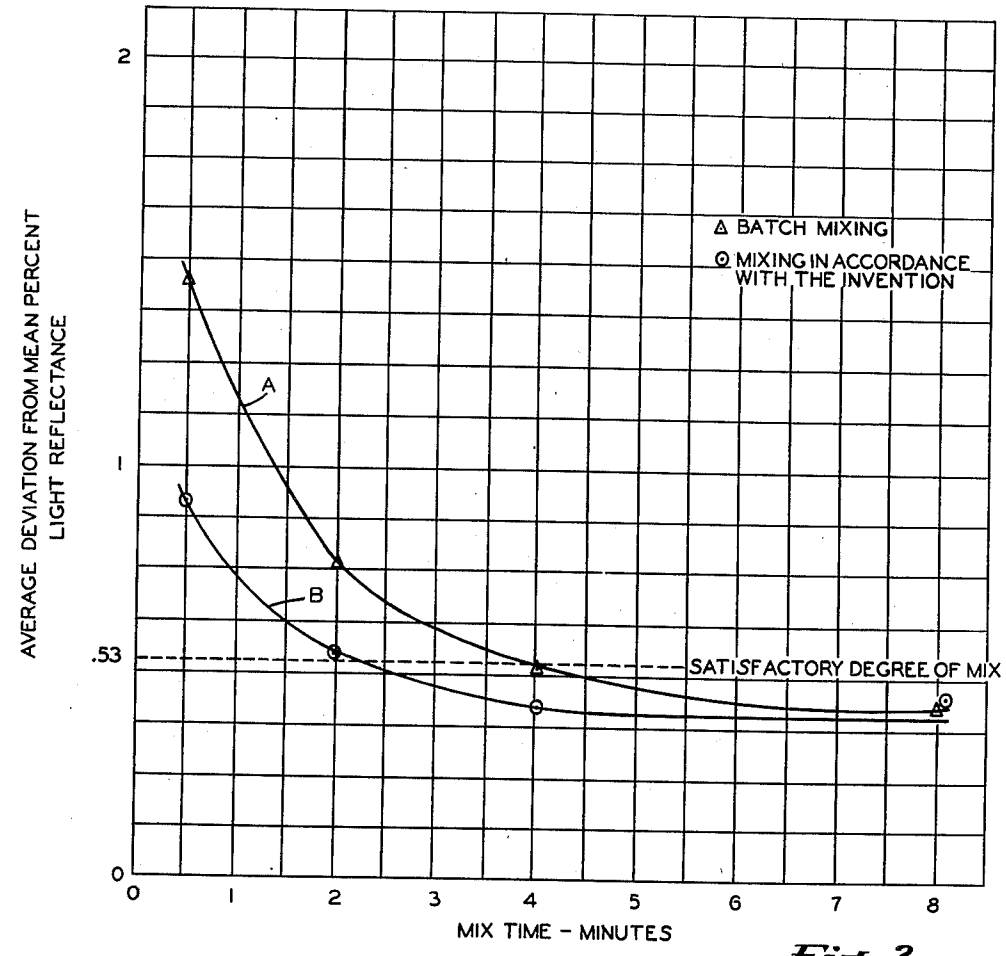


Fig. 3

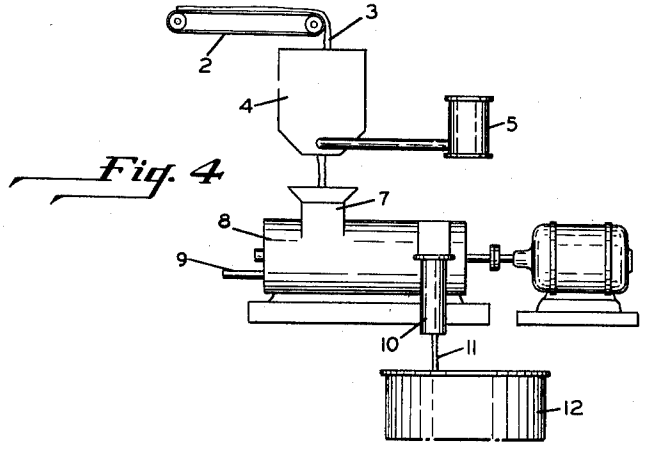


Fig. 4

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METHOD AND APPARATUS FOR MAKING CORK COMPOSITIONS AND THE LIKE

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Application November 17, 1950, Serial No. 196,135

11 Claims. (Cl. 117—100)

1

The present invention relates to a method and apparatus for making cork composition and the like and is concerned particularly with the manufacture of cork compositions including a binder formed essentially of animal glue, a plasticizer therefor such as glycerine, and an insolubilizing agent such as formaldehyde. The invention is applicable, however, to cork compositions of other types made with binders or resorcinol and glue, phenol-formaldehyde condensation products, rubber latex, and other binders. The invention is particularly useful in the manufacture of cork compositions utilizing binders which are heat-sentitive. Cork compositions are commonly used in the fabrication of gaskets, shoe products, cork tile for flooring, and other products.

In the manufacture of cork compositions, common practice has been to charge the desired volume of cork granules into a mixer having a series of helically disposed mixing paddles disposed within a generally cylindrical mixing chamber. The agitators are set into motion; and then a measured quantity of the binder, such as a heated mixture of glue, glycerine, and water, is poured from pails by workmen over the surface of the cork granules in the mixer. Mixing is then continued for a period of time required to secure a reasonably uniform distribution of the binder over the cork granules; and, thereupon, powdered paraformaldehyde is dusted over the mix by the workmen, and mixing is continued for a short further period. The mixed mass is then discharged from the mixer and delivered to the forming molds.

The distribution of the glue over the cork granules by pouring from pails is not uniform; and, as a consequence, mixing for a long period is required to obtain a reasonably uniform coating of the granules with the binder. The problem is particularly acute because of the extremely low density and lightness of the cork granules. They tend to float on films of air during mixing; and because of their light weight, it is a real problem to bring adequate pressure upon the granules in an open mixer to transfer the binder onto all of the granules as relatively thin layers. In commercial practice the volume of cork may be sixty or more times greater than the volume of the binder, the final product being essentially cork with almost invisible lines of glue joining contiguous granules together. In addition to this, the binder is both viscous and relatively dense, militating against ready distribution of it over light buoyant cork granules.

Attempts have been made to spray the binder

2

onto the granules using air or steam as the atomizing fluid, but with glue binders this has not proven to be commercially practicable. Steam tends to degrade the glue and also to increase the water content of the mix objectionably, and air causes the glue to congeal prematurely, before proper coating of all of the cork granules with the binder is effected.

This binder distribution problem increases as the size of the cork particles to be bound decreases. In cork compositions made from cork granules of 20 to 40 mesh U. S. Standard size, for example, common practice with the batch mixing system has been to pass the binder-coated granules over a sieve to remove the improperly mixed, agglomerated cork and binder masses known in the art as "glue balls."

The currently used method of binder distribution does not lend itself to a continuous mixing procedure where the solid and liquid components are brought together at the mixer and, after mixing, are delivered therefrom at a rate equivalent to the rate of input of the ingredients to the mixer.

An object of the present invention is to provide a method and apparatus for combining binders with cork granules or the like which will provide a mixed product having the binder substantially uniformly distributed over the granules, regardless of the size of the granules.

A further object of the invention is to provide a method and apparatus for coating cork granules or the like with a binder and obtaining substantially uniform distribution of the binder over the granules with a minimum mixing period being required.

Another object of the invention is to provide a process and apparatus by which cork granules or the like may be substantially uniformly coated with a binder in a continuous manner rather than by conventional batch mixing.

Another object of the invention is to provide a method and apparatus by which the application of the binder to the cork granules will be controlled within very close limits to secure uniformity throughout the entire mass upon molding.

An additional object of the invention is to provide a method and apparatus for effectively distributing a relatively small volume of binder material over a relatively large volume of cork granules with relatively uniform application of the binder to the cork granules.

Other objects of the invention will become apparent upon consideration of the following de-

tailed description of certain preferred embodiments of the invention.

According to the present invention, preblending of the granules and binder is effected by delivering a relatively thin stream of cork granules into contact with a thin stream of binder to distribute all of the binder onto a substantial or a major portion of the granules. Thereafter, the granules are mechanically worked, and the binder is uniformly distributed over all of the granules. Preferably, the apparatus is so constructed that the granules are fed as two similar continuously flowing streams approaching each other at an apex, and the binder is delivered as a plurality of thin streams at the apex where all of it is deposited upon the flowing cork granules. The granules so treated are discharged directly into a continuous mixer where the binder is uniformly distributed over all of the granules and the properly mixed mass is continuously discharged from the mixer. By controlling the rate of flow of the cork granules and the rate of flow of the binder, it is possible to attain an extremely accurate proportioning of granules to binder throughout the whole period of continuous operation. By the process each unit of ingredients, whether it be a pound or a ton, will be similarly proportioned. Thus when redistribution of the binder onto all of the cork granules is effected in the mixer, a product of unusual uniformity as to binder distribution is obtained. The apparatus is designed to provide close control of the rates of flow of the granules and the binder to achieve the desired uniformity in the mixed product.

While it is preferred to employ a continuous mixer which receives the discharge from the preblending device, a conventional batch mixer may be employed. However, there are a great many advantages to be derived from operating the process continuously, using a continuous mixer. The mixer disclosed and claimed in the copending application of George E. Gard and mine, filed November 17, 1950, Serial No. 196,137, and entitled "Mixers", now Patent No. 2,596,672, will serve very well.

This type of mixer is effective for uniformly distributing the binder over all of the cork granules. It operates at a relatively high speed, and substantial power is applied to a small volume of cork and binder in the mixer. For instance, the mixer may operate at all times on a charge of only about ten pounds of cork granules and binder, but about 20 H. P. of energy will be expended in effecting the mixing of such a small quantity. Any particular portion of the mass is disposed in the mixer for only a few seconds, approximately ten to fifteen seconds in fact, so that the mixing is effected very rapidly. While the working is intense because of the viscous, sticky nature of the glue binder, there is no substantial breaking of the fragile cork granules which would objectionably reduce the average size of the cork particles in the finished product.

Preferred practice is to provide a system by which the binder is continuously recirculated, such system preferably being substantially closed so as to avoid change in the consistency of the chemical composition of the binder due to loss of water, for instance. A continuous recirculation system of this type which permits accurate control of the volume of binder applied is disclosed and claimed in the copending application of George E. Gard and mine, Serial No. 196,136, filed November 17, 1950, and entitled "Recirculation System."

In order that the invention may be readily understood, the following example will illustrate the applicability of the invention to the manufacture of a cork composition utilizing a conventional glue-glycerine-formaldehyde type of binder. Reference will be made to the accompanying drawings, in which:

Figure 1 is a generally diagrammatic view, partially in section, illustrating the preblending device of the present invention;

Figure 2 is a view similar to Figure 1 diagrammatically illustrating a preblending operation;

Figure 3 is a chart which compares the binder distribution on the cork particles attained by batch mixing as compared with mixing in accordance with the present invention; and

Figure 4 is a schematic diagram illustrating the method as applied to cork composition block manufacture.

For purposes of illustration, a cork composition composed of cork granules of a particle size known in the industry as 5–10 mesh U. S. Standard and a binder composed of 2½ parts glue and 8 parts glycerine with 1 part of water, the binder to be insolubilized with formaldehyde, will be referred to.

The cork granules may be fed, as shown in Figure 4, from a weighing conveyor 2 such as a Merchen Feeder sold by Wallace and Tiernan Company, Newark, New Jersey, which will deliver the granules 3 as a thin ribbon and at a fixed rate, say twenty-two pounds per minute, to a preblender 4 which is diagrammatically illustrated in Figure 4 and will be described in detail in connection with Figure 1. The preblender 4 is supplied with the glue, glycerine, and water mixture heated to a temperature of about 190° F., the same being supplied from a tank 5 by a pump which delivers the same through preblender distribution orifices at the rate of about six pounds per minute.

In the preblender the binder of glue and glycerine is distributed over the cork granules in a systematic manner, as previously mentioned, so that each unit of cork granules carries essentially the same volume of binder as all other units thereof. The granules fall by gravity into the inlet opening 7 of a continuous mixer 8; and as they are moved through the mixer, they are mechanically worked to distribute the glue-glycerine binder substantially uniformly overall of the granules. The mixer 8 is provided with an injector 9 which delivers about fifty grams per minute of para-formaldehyde in an air carrier into the mixer where it is distributed uniformly over the binder-coated granules and serves upon baking of the cork composition mass to insolubilize the glue. The mixed mass is discharged from the mixer 8 through a discharge opening 10, flowing continuously therefrom as a stream 11 into a receptacle 12 such as the filling boot for a cork composition mold.

The preblender structure is shown in its essential details in Figure 1. It includes a supporting framework 13 across which is positioned a binder distribution conduit 14 and a return conduit 15. The conduit may be about 48" long and may be provided with about forty drilled openings 16 therein about 3/32" in diameter. A recirculating distribution conduit arrangement of the type disclosed and claimed in copending application Serial No. 196,136, previously referred to, is preferred, although other types which are effective for delivering a thin or fine stream or streams of binder may be used.

Mounted in fixed position above the binder distribution conduit 14 and the return line 15 is a separation wedge 17 which tapers at its upper end to an apex 18. A confining casing 19 is provided surrounding the upper end of the separation wedge 17. The casing 19 is open at the top 20 for the delivery of the cork granules to be coated to the apex 18 of the separation wedge 17. The lower end of the separation wedge 17 is provided with fixed guide plates 21 which taper inwardly toward the distribution conduit 14. Mounted on angle frame members 22 is a pair of adjustable guiding plates 23 which are hinged at 24 and may be secured in adjusted position by bolts 25 which pass through openings in adjusting plates 26 and are received within slotted openings 27 in clamping plates 28 which are in turn affixed by supporting members 29 to the frame 13. Directing fins 30 are secured to the guide plates 23 and serve to direct the cork granules to be coated in two thin, generally downwardly directed and converging streams, as illustrated in Figure 2.

The separation wedge 17, the fixed guide plates 21, and the adjustable guide plates 23 extend along the full effective length of the distribution conduit 14 to present converging streams of cork granules to the thin streams of binder delivered from the distribution orifices of the distribution conduit. This is diagrammatically indicated in Figure 2.

The cork granules fed from the weighing conveyor 2 of Figure 4 are delivered as a thin stream about 48" and about ½" thick onto the apex 18 of the separation wedge 17 of the preblender. This separates the stream into two substantially equal streams 31 and 32 which fall by gravity into the zone of the directing fins 30 which direct the streams into a single converging stream 33, at the apex of which binder streams 34 are flowing from the distribution conduit 14. The streams 31 and 32 as they leave the zone of the directing fins 30 may be about 48" wide and about ¼" thick. The binder which is falling into the zone of convergence of the two cork streams is entirely deposited upon the granules. The degree of preblending obtainable is dependent upon the maximum practicable surface area it is possible to produce per unit volume of both binder and cork granules, and such maximum is obtained by feeding thin ribbons or streams of cork granules and fine or thin streams of binder to thus distribute the binder over a maximum surface area of granules. As mentioned previously, the binder should not be atomized but should be delivered into engagement with the unsupported and free-falling thin stream of cork granules 33 as an unsupported and falling, substantially unbroken thin stream 34 (or streams) as shown in Figure 2.

The guide plates 23 (Figure 1) are adjusted to provide a minimum separation from the fixed guide plates 21 consistent with free flow of the granules through the zones of the directing fins 30 and without any substantial building up of the granules which might result in "bridging" and possible interruption in the flow of the granules.

The preblended mix may be discharged directly into the continuous mixer 8 of Figure 4 or may be charged into a batch mixer either directly or from bags or other containers into which the preblended mix may be discharged from the preblender. Here adequate mechanical working of the granules is effected to distribute the binder uniformly as thin films over all of the granules.

As previously mentioned, by practice of the present invention utilizing apparatus such as that disclosed in Figure 1, the time required for mixing may be substantially reduced, and thus continuous mixing may be accomplished with facility. The degree of distribution of the binder over the cork granules after predetermined periods of mixing in a batch mixer following conventional procedure may be compared with similar granules treated in the apparatus of this invention, following the practice described above, by using dyed binder and making light reflectance measurements on specimens of the dyed binder-coated granules in a Hunter Multipurpose Reflectometer, for instance.

In the chart of Figure 3, reflectance measurements for batch-mixed specimens after mixing times one-half minute, two minutes, four minutes, and eight minutes are shown by curve A. The Hunter Multipurpose Reflectometer readings were taken at a plurality of scanning positions over the 4" x 4" glass cell in which the various specimens were individually disposed; these readings were plotted, and a mean reflectance determined. Average deviation from mean percent light reflectance is plotted on the chart of Figure 3. From standard commercial cork composition batches it has been determined that a satisfactory degree of mixing has been accomplished when the average deviation from mean percent light reflectance is in the order of about .53. This has been indicated on the chart of Figure 3 by a dotted line appropriately designated. It will be noted that batch mixing required four minutes to attain a satisfactory degree of mixing.

Specimens of cork granules coated with an identical dyed binder which was distributed thereover in accordance with the present invention, using preblending equipment of the type shown in Figures 1 and 2, and subsequent mixing for one-half minute, two, four, and eight minutes in a mixer identical with that used in the preparation of the batch-mixed specimens, were examined for light reflectance on the Hunter Multipurpose Reflectometer and average deviation from mean percent light reflectance was determined. This is shown by curve B in Figure 3. A satisfactory degree of mixing was shown to have been achieved in about two minutes as compared with four minutes with ordinary batch mixing in the same mixer. This difference is readily observable on the chart of Figure 3 by comparing the intersection of the dotted line designating a satisfactory degree of mixing with the curves A and B.

As previously mentioned, when continuous mixing is employed following preblending, the material passes through the mixer in a matter of ten to fifteen seconds. With such speed of travel through the mixer, it is essential to have a systematic distribution of the binder over the granules prior to introduction into the mixer to secure uniformity of binder distribution over all of the cork granules as discharged from the mixer. This is achieved by practice of the present invention.

In the drawings the mixer has been illustrated as discharging directly into a filling boot for a mold. The mix may be delivered into a storage tank provided with agitators, such as a reverse acting, double impeller type hopper; or, if desired, may be delivered to other fabricating equipment, such as an extrusion machine or the like, for example.

I claim:

1. In a method of making cork composition and the like, the steps comprising delivering at a substantially uniform rate into a coating zone an unsupported and free-falling, thin stream of cork granules and delivering an unsupported and falling, substantially unbroken thin stream of thermosensitive binder material at a substantially uniform rate into said coating zone to systematically distribute said binder onto said unsupported and free-falling granules as said granules pass through said coating zone.

2. In a method of making cork composition and the like, the steps comprising delivering at a substantially uniform rate into a coating zone an unsupported and free-falling, thin stream of cork granules and delivering a plurality of unsupported and falling, substantially unbroken thin streams of thermosensitive binder material at a substantially uniform rate into said coating zone to deposit all of said binder onto a substantial portion of said unsupported and free-falling granules as they pass through said coating zone.

3. In a method of making cork composition and the like, the steps comprising delivering at a substantially uniform rate into a coating zone an unsupported and free-falling, thin stream of cork granules, delivering a plurality of unsupported and falling, substantially unbroken thin streams of thermosensitive binder material at a substantially uniform rate into said coating zone to deposit all of said binder onto a substantial portion of said unsupported and free-falling granules as they pass through said coating zone, and mechanically working said granules to redistribute the binder material and coat all of said granules therewith.

4. In a method of making cork composition and the like, the steps comprising delivering into engagement with a downwardly directed, unsupported and falling, substantially unbroken thin stream of thermosensitive binder material an unsupported and free-falling, relatively thin stream of cork granules to systematically distribute said thermosensitive binder onto some of said granules and thereafter mechanically working said granules having binder distributed thereon to coat all of said granules with said binder.

5. In a method of making cork composition and the like, the steps comprising delivering a pair of downwardly moving thin streams of cork granules into intersection with one another to form a single, unsupported and free-falling stream of cork granules, at the point of intersection and during free-falling motion of said granules applying to said granules a thermosensitive binder delivered as a plurality of fine independent streams to distribute the binder over a substantial portion of said granules, and thereafter mechanically working said granules having binder distributed thereon to substantially uniformly coat all of said granules with said binder.

6. In a method of making cork composition and the like, the steps comprising establishing a generally downwardly directed, unsupported and falling, substantially unbroken thin stream of heat-liquefied binder and presenting to said downwardly moving stream a plurality of cork granules moving as an unsupported and free-falling stream downwardly into intersection with the path of movement of said stream, whereby said granules receive said binder without substantial change in the viscosity of said binder at the point of application to the granules.

7. In a method of making cork composition and the like by distributing a thermosensitive binder of substantial density over granules of material of extremely light density, the steps comprising delivering the binder in heated condition and liquid form as a plurality of downwardly directed independent, unsupported and falling, substantially unbroken streams of small cross-sectional size, bringing into engagement therewith a relatively thin, downwardly flowing, unsupported and free-falling stream of light density granules to apply to a substantial portion of said granules a quantity of binder sufficient when distributed over all of said granules to effectively bond the same into a coherent mass, and thereafter distributing said binder substantially uniformly over all of said granules.

8. In a method of making cork composition and the like, the steps comprising forming from cork granules a pair of downwardly flowing thin streams of substantial width, which streams intersect and flow as a single, unsupported and free-falling stream from their zone of juncture, delivering said streams of granules to said zone of juncture at a predetermined rate, and delivering at said zone of juncture to a substantial volume of said granules a heat-liquefied, thermosensitive binder material as a plurality of separate, closely spaced, thin, continuously flowing streams extending throughout substantially the full width of said streams of granules, said binder being delivered to said zone of juncture at a predetermined rate related to the rate of delivery of said granules to said zone of juncture, whereby a measured volume of said binder is applied to a measured volume of said granules during passage through said zone of juncture.

9. In a method of making cork composition and the like, the steps comprising delivering cork granules to a coating zone at a predetermined rate of flow as an unsupported and free-falling stream, delivering as unsupported and falling, substantially unbroken thin streams directly onto said granules while in flow a measured quantity of thermosensitive binder for each unit volume of cork granules, delivering said granules with the applied binder to a mixing zone, mechanically working said granules to redistribute said binder over all of said granules, and delivering said binder-coated granules from said mixing zone at a rate equal to the rate of delivery of said granules with said applied binder to said mixing zone.

10. In a method of making cork composition and the like, the steps comprising delivering at a substantially uniform rate into a coating zone an unsupported and free-falling stream of cork granules, delivering an unsupported and falling, substantially unbroken thin stream of heat-liquefied glue and plasticizer therefor at a substantially uniform rate into said coating zone, and systematically distributing said binder onto said unsupported and free-falling granules as said granules pass through said coating zone.

11. In an apparatus of the class described, the combination of a separation wedge which tapers at its upper end to an apex, a pair of guiding plates directed generally downwardly and having their lower portions directed toward one another to define a generally rectangular opening, confining means forming part of said separation wedge disposed above each of said guiding plates and defining therewith a pair of narrow slots opening into said generally rectangular opening for directing thin, wide streams of granules through said opening as a single, unsupported and free-falling stream of granules, a distribu-

tion conduit disposed above said opening for directing a plurality of thin streams of thermosensitive coating material onto a substantial portion of said granules constituting said unsupported and free-falling stream of granules, and means for adjusting said guiding plates with respect to said confining means to alter the size of said slots.

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