

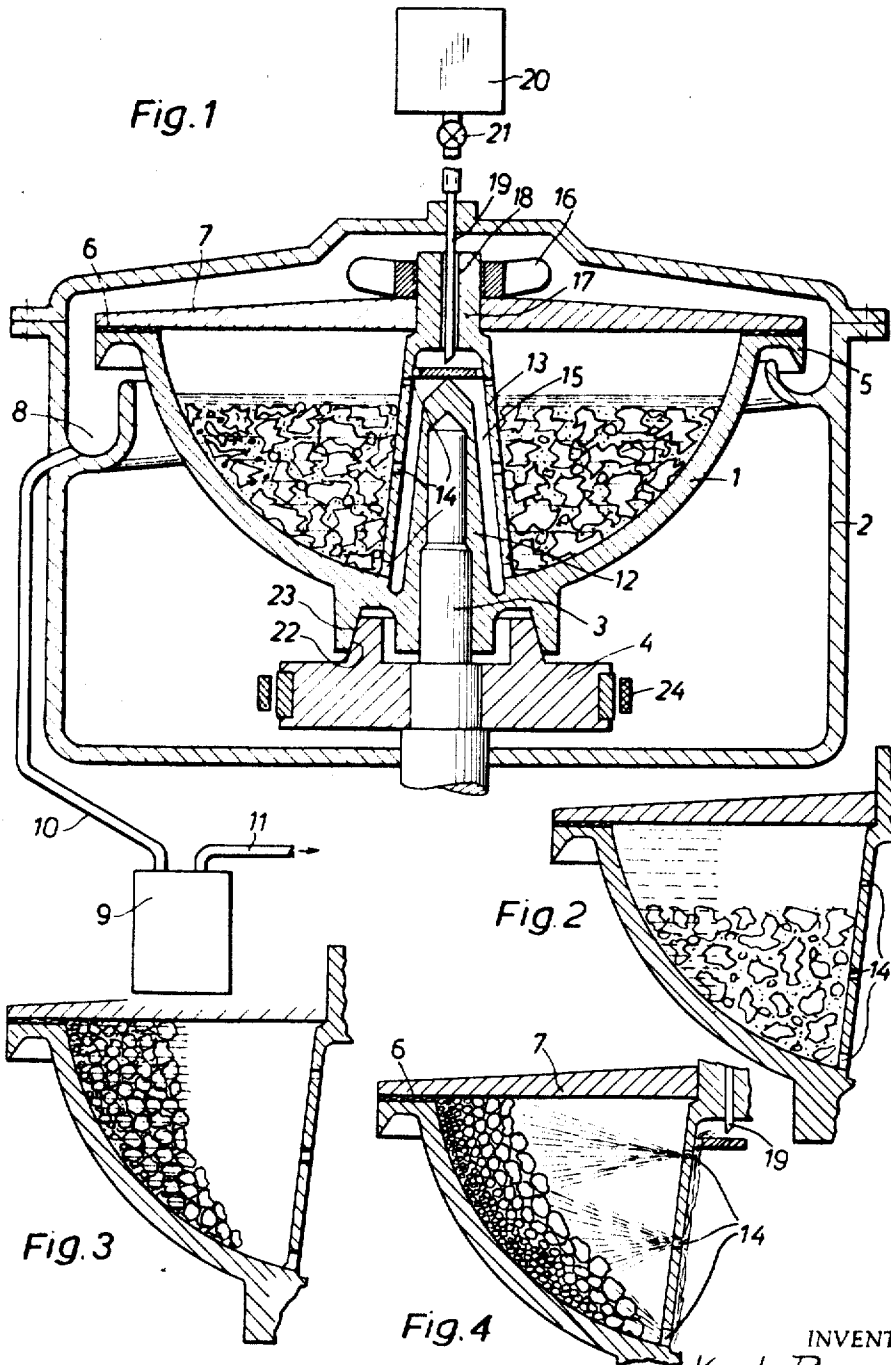
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ROTARY EXTRACTION APPARATUS

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**ROTARY EXTRACTION APPARATUS**

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1 Claim

**ABSTRACT OF THE DISCLOSURE**

A rotary apparatus for separating binder from mixtures of bituminous binder and solid aggregates. The rotary elements are provided with brake means to allow period braking of the drive shaft and container to thereby intermittently vary the rotational speed and provide relative movement between the solvent and the mixture in the container.

The present invention relates to a method for separating a soluble component from a material by washing the material under centrifugal force with a solvent.

In the method for determining the bitumen content of road surfacing materials, long approved by the American Society for Testing Materials, the material is soaked for approximately one hour in a given quantity of solvent in an open container. A cover is then placed on the container, with a filter interposed between the cover and the container, and the latter gradually set in rotation, until the centrifugal force squeezes the solvent and dissolved binder radially through the filter. The rotation is then increased to a maximum of 3600 r.p.m. and held there until no more liquid is forced through the filter. The container is stopped and approximately 200 cm.<sup>3</sup> of solvent is added. The rotation is resumed as described above and continued until no more liquid is squeezed through the filter. This last step is then repeated until the filtered liquid assumes a constant straw yellow color. The material from which the binder has been dissolved away is then dried and weighed. The difference in weight between the material before and after centrifuging is equal to the weight of the binder. This procedure takes several hours and its precision is very dependent on how thoroughly the solvent washes the material and dissolves away the binder. Since the procedure can not occur under cover, the staff is exposed to the injurious solvent vapors.

An object of the invention is a method and apparatus for separating a soluble component from a material that avoids the above-noted disadvantages of the prior art and that is quick and accurate.

The invention will now be described in detail with reference to the accompanying drawings, wherein:

FIGURE 1 is a view in cross section of a form of the apparatus of the invention; and

FIGURES 2, 3, and 4 show the container and its contents at various stages of the procedure of the invention.

FIGURE 1 shows the apparatus of the invention at rest filled with material and a solvent. A removable hemispherical container 1 is mounted on a vertical drive shaft 3 in a housing 2. The shaft carries a brake drum 4 and is driven in a conventional manner by an electric motor, not shown. The container 1 incorporates a rim 5 on which are removably mounted a ring-shaped filter 6 and a cover plate 7. The housing 2 has a sloping inner channel 8 serving to collect and carry off the liquid forced through the filter 6 during centrifuging. The channel 8 is connected to a collecting tank 9 via a delivery conduit 10. A conduit 11 connected to the top of the tank discharges the undesired fumes of the solvent into the open air. In a known manner the housing 2 is well sealed to prevent escape of solvent fumes into the work area.

The container 1 further incorporates a conical hub 12 mounted on the drive shaft 3. A conical spray tube 13 provided with openings 14 is spaced from and surrounds the hub to form an annular channel 15. The tube 13 terminates in a portion 17 which, together with a wing nut 16, centers and fastens the cover 7. The portion 17 has an axial passage 18 for accepting an axially movable feed pipe 19. A supply container 20 for solvent is connected to the feed pipe 19 via a valve 21.

The brake drum 4, which is rigidly connected to the shaft 3, has a conically-shaped support wall 22 that carries the container 1 through the intermediary of its foot 23. Although special means can be provided for rigidly securing the container 1 to the drive shaft 3 or the brake drum 4, it is generally satisfactory, as shown in FIGURE 1, simply to mount the container on a driven element and to depend upon friction and the weight of the container to form the coupling. A brake band 24 or other suitable means is periodically operated by magnetic means (not shown) to act upon the drum 4, so that the container 1 is regularly braked at adjustable time intervals. A suitable control not shown operates the magnetic means.

The drive motor can be a repulsion motor the speed of which is made continuously variable by shifting the brushes. However, any other type of electric motor suitable for the purpose can be used, such as a squirrel-cage or a direct-current motor. One must, however, take into account the additional cost of gearing and other auxiliary parts.

FIGURE 2 shows the container at the start of the process. The material is still in the form of relatively large pieces of various sizes. The individual pieces are comprised of filler held together by the binder. With rotation of the container 1 at a relatively low r.p.m., only the solvent is forced against the side wall of the container; the material, because it is composed of large pieces, remains on the bottom of the container.

The container is periodically braked to a complete stop and then released. During rotation the solvent is driven towards the side wall of the container and upwards towards the filter 6. During braking the solvent flows back until it assumes the position of FIGURE 1. Thus, the material in the container is thoroughly washed by the solvent as it moves back and forth.

The washing thus effected quickly dissolves the binder in the solvent. The material is progressively dissociated until only insoluble pieces remain to which the undissolved portion of the binder still adheres.

FIGURE 3 shows the dissociated material which, because of the reduced weight of the smaller pieces, is now forced against the wall of the container. As the container is periodically stopped and restarted, the material and solvent is periodically forced against and up the wall and allowed to sink to the bottom. Since the material moves more slowly towards and up the wall and sinks more rapidly to the bottom than the solvent, the pronounced relative movement between the two assures a thorough washing of the material.

After most of the binder has been dissolved away, one proceeds as follows.

The brake control is shut off and the container allowed to slowly increase in speed. As shown in FIGURE 4, the material piles up against the wall, the smallest pieces being at the outside and higher up the wall. The material thus acts as a kind of pre-filter for the solvent being centrifuged. During the centrifuging a measured amount of fresh solvent is added via the feed pipe 19 and sprayed through openings 14 on the material piled against the wall, to rewash it. Rewashing is preferably done only after the original quantity of solvent along with the dissolved binder has been centrifuged through the filter 6.

The rewashing illustrated in FIGURE 4 continues until

the liquid collecting in the channel 8 has a constant color, indicating that the material contains no more binder. The delivery of solvent is now shut off and the centrifuging continued until all of the solvent is removed from the container 1.

There will now be described in detail the method of the invention for separating bitumen from road surfacing materials.

A weighed amount of surfacing material—preferably approximately two kilograms—is charged into the container 1 and the cover 7 closed down on the filter 6. The container is then mounted on the drive shaft 3; and the feed pipe 19, which is connected to the housing 2, is guided into the passage 18. The valve 21 is opened and a measured quantity of solvent is supplied to the container. Simultaneously or shortly thereafter the container is set into periodic rotation by turning on the control means operating the magnetic means for the brake band 24. The resulting rinsing of the surfacing material by the solvent dissociates the material after approximately five minutes. The relative movement between material and solvent dissolves away the binder in a total of approximately fifteen minutes. If necessary, after five minutes the original quantity of solvent along with the already dissolved binder can be centrifuged through the filter 6, and the same washing procedure repeated one or more times with the addition of fresh solvent.

After a total washing time of approximately fifteen minutes in which the washing is either continuous or, as explained just above, interrupted with the addition one or more times of fresh solvent, the container is rotated progressively faster. As explained above, the material piles up against the container, the smallest particles being forced up the wall and congregating in the region of the filter 6. During rotation of the container at high speed the solvent and dissolved binder are forced into the channel 8. Without stopping the container fresh solvent is delivered at a predetermined rate via pipe 19 and continuously sprayed upon the material, which is rewashed. Any remaining binder adhering to the material is dissolved and collected in the channel 8. As soon as the liquid coming through the filter has a continuous color, the solvent feed is shut off and the material and solvent in the container centrifuged another fifteen to thirty minutes—depending on the kind of surfacing material—until the material is composed of nearly dry insoluble pieces virtually free of all binder. The contents of the container are now dried and weighed. The amount of binder or bitumen is taken as the difference between the weight of the material at the beginning and at end of the procedure.

During the centrifuging time can be saved by filling a second container with surfacing material. As soon as the contents of the first container have been centrifuged the second container can replace the first. In this way the apparatus is almost in continuous operation.

The method of the invention not only completely separates the binder in the shortest possible time, but leaves the insoluble pieces in their original shape and size. In certain cases this is decidedly advantageous, particularly when it is desired—as is the case with bituminous road surfacing materials—to determine the portion of insoluble pieces (gravel and stone) of various sizes in the material.

Contrary to the method of the prior art, the material is not soaked but thoroughly washed in a virtually con-

tinuous process in a closed container. The procedure is thus much shorter and prevents the escape of solvent fumes. Moreover, approximately double the amount of material can be treated, resulting in more reliable average values.

A quick and exact determination of the bitumen content of road surfacing materials has the very considerable advantage in road construction that the unchecked portions of the road surface are much shorter.

The periodic interruption of the rotation of the container 1 can be carried out by reversing the direction of rotation.

The means for interrupting the rotation of the container can be operated pneumatically, hydraulically, or mechanically, as well as magnetically. The control means for operating the brake 24 may be electronic or of any other kind suitable for the purpose.

Although the method and apparatus have been described in relation to the removal of a bituminous binder from road surfacing materials, it will be apparent that the invention is broadly applicable to the problem of removing a component of a material using a solvent affecting only the one component.

I claim:

1. Apparatus for separating the binder from mixtures of bituminous binder and solid aggregates, comprising a substantially hemispherical upwardly expanding container mounted for rotation about a vertical axis, a vertical drive shaft, a hub member formed on said container engaging said drive shaft, a brake drum mounted on said drive shaft for rotation therewith, means on said brake drum for drivingly connecting the container to said drive shaft, said hub member extending from the bottom of said container upwardly within the container, a spray tube coaxially surrounding said hub member within the container and radially spaced from said hub member defining an annular chamber between said hub member and said spray tube, an annular rim on the top edge of said container, a cover on said rim, an annular filter engaged between said rim and said cover, the top of said spray tube traversing said cover, a solvent feed tube leading through the top of said spray tube to supply solvent to said annular space between said spray tube and said hub member, the wall of said spray tube having perforations for radially directing solvent onto the bituminous mixture treated in said container, and a brake band coacting with said brake drum to allow periodic braking of said drive shaft and container, to intermittently vary the rotational speed of said container to thereby provide for relative movement between the solvent and the mixture in the container.

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