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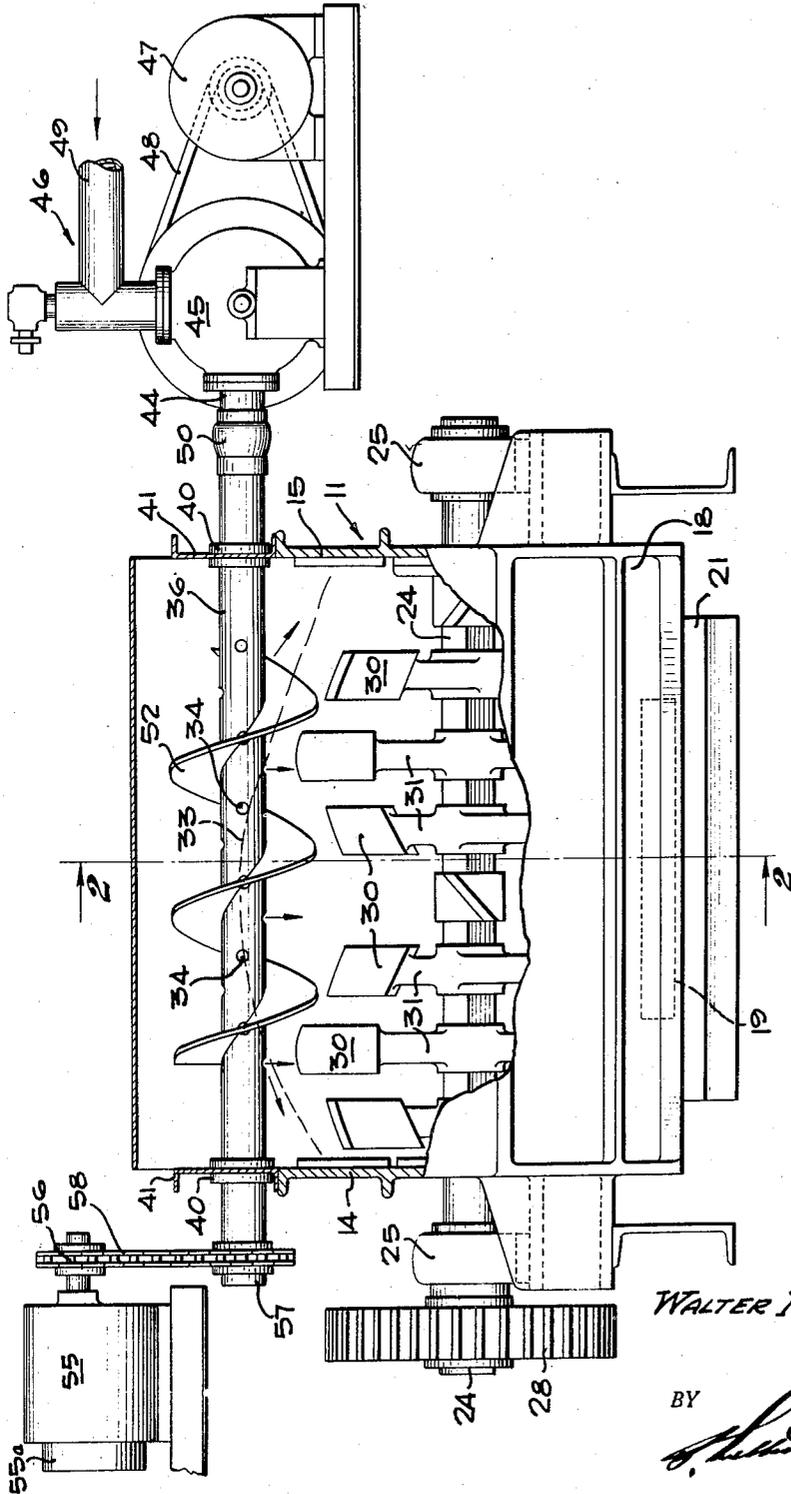
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2,861,786

PUG MILL MIXER HAVING IMPROVED AGGREGATE CIRCULATING MEANS

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2 Sheets-Sheet 1



*Fig. 1.*

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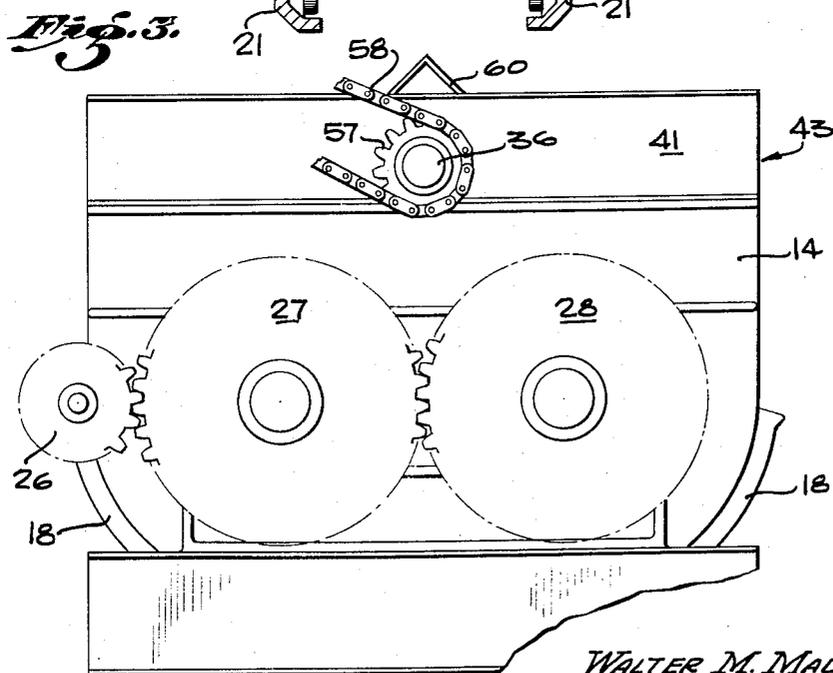
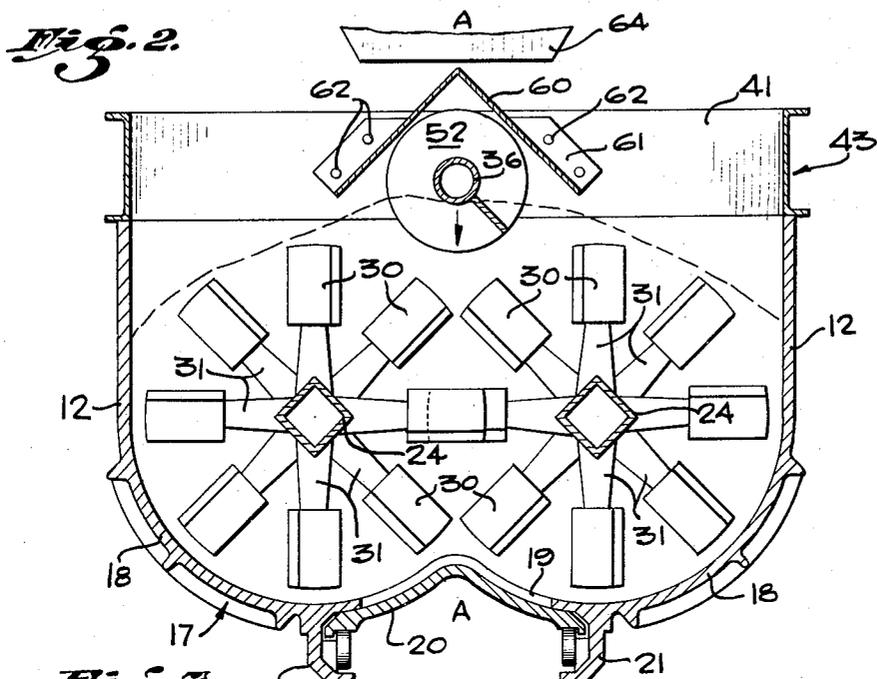
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2 Sheets-Sheet 2



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## PUG MILL MIXER HAVING IMPROVED AGGREGATE CIRCULATING MEANS

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9 Claims. (Cl. 259—146)

This invention relates generally to a method and apparatus for mixing materials and relates more particularly to such method and apparatus to mixing machines of the pug mill type and method of mixing materials therein.

While the invention has particular utility in connection with a method and equipment or apparatus for mixing materials for road construction and the like and is shown and described in connection therewith, it is to be understood that it is not confined thereto.

It is common practice at the present time to produce a paving material by mixing a mineral aggregate, which consists of sand, gravel, granite, or rock pieces of different sizes, with a binding material, such as a bituminous or asphalt material. It is quite essential to the production of a material which will make a good road to take care during the mixing operation that each mineral aggregate piece will be coated with binder material. In this way the paving material, when properly laid on the roadbed, will produce a road which produces a better traveling surface and which has a longer life than it would have if the mixture of mineral aggregate and binder were not as thorough as pointed out above.

It is, therefore, an object of the present invention to provide method and apparatus whereby the mineral aggregate and binder is thoroughly mixed.

It is another object of the invention to provide method and apparatus of this character whereby the mixing of the aggregate and binder is greatly facilitated.

It is still another object of the invention to provide method and apparatus of this character whereby there is better distribution and circulation of material within the mixer body.

A further object of the invention is to provide a method and apparatus of this character to provide constant over-the-top distribution of rock and sand and the like and the binder and thus eliminate concentration of large or small sizes of solid materials in pockets within the mill.

A still further object of the invention is to provide a method and apparatus of this character for transporting the material to voids created at the end of the mill by action of the mixing arms.

Other objects and advantages of the invention will be brought out in the following part of the specification.

Referring to the drawings, which are for illustrative purposes only:

Fig. 1 is a partial longitudinal section of apparatus embodying the present invention;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1; and

Fig. 3 is an end view of the apparatus.

Referring more particularly to the drawings, there is shown a mixer body, indicated generally at 11, having vertical side walls 12 and end walls 14 and 15. There is a bottom, indicated generally at 17, which comprises two portions 18 which are generally arcuate in cross-section and which are connected together adjacent the longitudinal center of the body of the mill. The central part of the bottom is provided with a discharge opening

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19 which is closed by a longitudinally sliding door 20 received in channel-like tracks 21. The door is adapted to be moved to a position whereat the opening 19 is uncovered so that material which has been mixed in the body may be discharged therefrom.

There is means for mixing materials within the body and this means comprises a pair of shafts 24 which extend longitudinally of the body 11 and which are supported adjacent the ends by suitable bearings 25, said shafts being simultaneously rotated by means of gears 26, 27 and 28, the gears 27 and 28 being secured to the respective shafts 24 and being meshed with each other. The gear 26 is connected by any suitable means, not shown, to a source of power, also not shown.

The shafts 24 are on axes from which the radii of the bottom portions 18 extend as best shown in Fig. 2, and each shaft is provided with a plurality of paddles 30 connected with the shafts 24 by means of arms 31. The paddles are arranged symmetric relative to a plane through the line 2—2, the paddles on one side of said plane being angularly disposed in one direction, while the paddles on the opposite side of this plane are angularly disposed in the opposite direction. These paddles are arranged so that the materials in the mixer body are agitated and are moved through cylindrical or spiral paths from the ends of said body. This material moves toward the central portion of the mixer body and is carried to the upper central portion thereof, as indicated by the dotted line 33 in Fig. 1. The liquid binder material is applied at this point and is sprayed onto the material through openings 34 in a tubular shaft or spray pipe 36 which extends longitudinally of the mixer body which extends along, or substantially along, the plane A—A, Fig. 2. This shaft 36 is substantially parallel to the shafts 24 and is located in the upper portion of the mixer body above the plane of said shafts 24.

The shaft 36 is rotatably mounted in bearings 40 in end walls 41 of an upper casing or body section, indicated generally at 43. One end of the shaft 36 is connected to the outlet 44 of a pump 45 of a pressure injection system which is indicated generally at 46. The pump 45 is driven by any suitable means such as an electric motor 47 through a belt 48. Liquid asphalt or the like enters the injection system through an inlet conduit 49 and the shaft 36 is connected to the outlet of said pump 45 by means of a suitable swivel coupling 50, such couplings being well known in the art.

The spray pipe or shaft 36 is provided with a helical flight conveyor 52 which has hardened edges and the conveyor is parallel to the shafts 24 and positioned to operate in the peak of the material built up by the paddles in the central region of the mixer body. The flight may be of any suitable length and may be from approximately one-half to two-thirds the length of the mixer with the flight positioned in the center an equal distance from each end of the mill of the body. It is to be understood, of course, that other lengths for the flight may be selected depending on the installation.

The flight is adapted to be operated first in one direction and then in the other and is actuated by any suitable source of power such as an electric motor 55. The motor is provided with a sprocket 56 and the shaft 36 is provided with a sprocket 57 with a chain connection 58 therebetween. The motor 55 is adapted to be connected to any suitable source of electric current and is provided with a reversing switch mechanism 55a which may be of any suitable well-known type so that the motor will operate a predetermined number of revolutions in one direction and then operate a predetermined number of revolutions in the opposite direction to correspondingly actuate the shaft 36.

It is to be understood, of course, that other power

means may be provided for driving the shaft 36 and such power means suitably controlled to effect reversing movement of the shaft 36. Means for effecting reversal of the shaft rotation may be provided between the source of power and said shaft.

When the apparatus is in operation, the shafts 24 rotate, one in a clockwise direction and the other counterclockwise, and the material in the mixer body is mixed and caused to assume a peak or ridge position in the center of the mill parallel to the shafts above the height of the mixer arms. The screw conveyor 52 operates in the upper portion of this accumulated material and, as it rotates in one direction, moves said material toward one end of the mixer body, and, as it rotates in the opposite direction, moves said material to the opposite end of said body. Thus the material within the mixer body is caused to circulate or move from the end toward the center and upwards and thence to be moved from the top of the pile toward the ends of said body.

During the mixing action, the binder, which comprises liquid asphalt or the like, is discharged from the openings of the shaft 36 and mixed with the aggregate.

An alternative arrangement for causing the aggregate along the upper ridge to be moved toward the ends of the mixer body may comprise a helical flight divided in the middle and formed right-hand on one side and left-hand on the opposite side. With this arrangement, the shaft 36 may be constantly rotated in one direction.

Another alternative arrangement for moving the material at the top of the pile formed in the body by the paddles 30 is to provide paddles on the shaft 36 which would operate to move the materials in one direction upon rotation of said shaft in such a direction and move the material in the opposite direction upon reverse rotation of the shaft 36. Further, a paddle arrangement may be provided whereby said paddles cause movement of the material at one side of the longitudinal center of the body toward one end of said body and the material at the opposite side of the longitudinal center of the body toward the opposite end. With these arrangements the shaft 36 would be operated continuously in one direction as in the case of the divided helical flight conveyor arrangement above described.

There is another arrangement wherein the material in the mixer body may be moved toward one end by the paddles on the shafts 24 and a part, at least, of the upper portion of the mass of material moved in the opposite direction by the moving means disposed above the plane of the shafts 24. This will effect a more thorough mixing of the aggregate and binder materials.

A V-shaped baffle, indicated generally at 60, may be provided over the helical flight, as best shown in Figs. 2 and 3. This baffle has its apex at the top and is provided with end flanges 61 which are secured by bolts 62 or other suitable means to the ends of the section 43. The baffle 60 serves to divide the stream of aggregate discharged into the mixing machine from a hopper 64 and may also serve as a cover of said flight.

I claim:

1. A method of producing paving material, which includes the steps of: mixing an aggregate and moving two bodies thereof toward each other so that said bodies merge together and move upward; moving material from the upper part of the merged bodies, first in one direction and then the other, the directions of movement being opposite the direction of movement of said contiguous bodies; and applying a liquid binding material to the aggregate.

2. In apparatus for mixing paving material, the combination of: mixing means for mixing an aggregate so that same is divided into two contiguous bodies which

move in separate spiral paths which merge together and move upward along the contiguous parts of said bodies; means for moving the material of said bodies outward in directions opposite the direction said material moved in said paths; and liquid applying means for applying, under pressure, a liquid binding material in streams to said aggregate during the aforesaid mixing operation at the upper part of said contiguous parts of said bodies, where said material of each body is moved outwardly, said mixing action being continued to thoroughly coat said aggregate.

3. In apparatus for mixing paving material; mixing means for mixing an aggregate so that same is divided into two contiguous bodies which move in separate spiral paths which merge together and move upward along the contiguous parts of said bodies; means for positively moving the material of said bodies in directions opposite the directions said material moved in said paths; and liquid applying means for applying, under pressure, a liquid binding material to said aggregate during the aforesaid mixing operation at the upper part of said contiguous parts of said bodies, where said material of each body is moved outwardly, said mixing action being continued to thoroughly coat said aggregate.

4. In apparatus for mixing paving material: a mixer body; mixing means in said body for mixing an aggregate so that same is moved in two bodies in separate paths which merge together and move upward along the contiguous parts of said bodies; material moving means for moving the material of said bodies outward and out of contact when the upper end of their merged and contiguous travel is reached; and liquid applying means for applying, under sufficient pressure to obtain penetration into said aggregate, a liquid binding material in streams to said aggregate during the aforesaid mixing operation at the upper part of said contiguous parts of said bodies.

5. In apparatus for mixing paving material and the like: a mixer body; mixing means in said body for mixing an aggregate therein and moving same inwardly and upwardly into a body of mixed material; material moving means for moving material at the top of said body of material outwardly; and liquid applying means for applying a binding material to said aggregate.

6. In apparatus for mixing paving material and the like: a mixer body; agitation and mixing means in said body extending longitudinally thereof, said agitating and mixing means being adapted to mix an aggregate in said body and move same from their ends to a central upper region of said body; and material moving means extending longitudinally of said body and moving material from the upper central region of the mixer body toward the respective ends thereof.

7. The invention defined by claim 6 including actuating means for operating the material moving means; and means for reversing said actuating means.

8. In apparatus for mixing paving material and the like: a mixed body; a pair of shafts in said body extending longitudinally thereof, said shafts being spaced laterally apart in substantially the same horizontal plane; mixing and agitating means for each of said shafts, said mixing and agitating means being arranged on said shafts so as to move aggregate material in said body from the ends thereof in paths so that said material is moved toward the center and upper region of the body; a tubular perforate shaft above the plane of the first mentioned shafts, said tubular shaft being rotatably mounted and adapted to receive binding material therein for discharge through the perforations thereof; material moving means on said hollow shaft adapted to move material from the upper central region of said body toward the respective ends thereof; power means for rotating said tubular shaft; and means for causing said

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power means to operate said shaft, first in one direction and then in the opposite direction.

9. A method of mixing paving material and the like in a mixed body, comprising the steps of: mixing an aggregate in said body and moving same from the ends toward the center thereof and upwardly; and simultaneously moving material from the upper part of the aggregate at the central region of the mixer body toward the respective ends of said body.

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UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 2,861,786

November 25, 1958

Walter M. Madsen

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 60, and column 5, line 4, for "mixed", in each occurrence, read -- mixer --.

Signed and sealed this 10th day of March 1959.

(SEAL)

Attest:

KARL H. AXLINE  
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Commissioner of Patents