M. A. POPKESS.

MACHINE FOR TREATING EARTHY MATERIAL.

APPLICATION FILED MAR. 16, 1917.

1,337,953.

Patented Apr. 20, 1920.

6 SHEETS—SHEET 1.

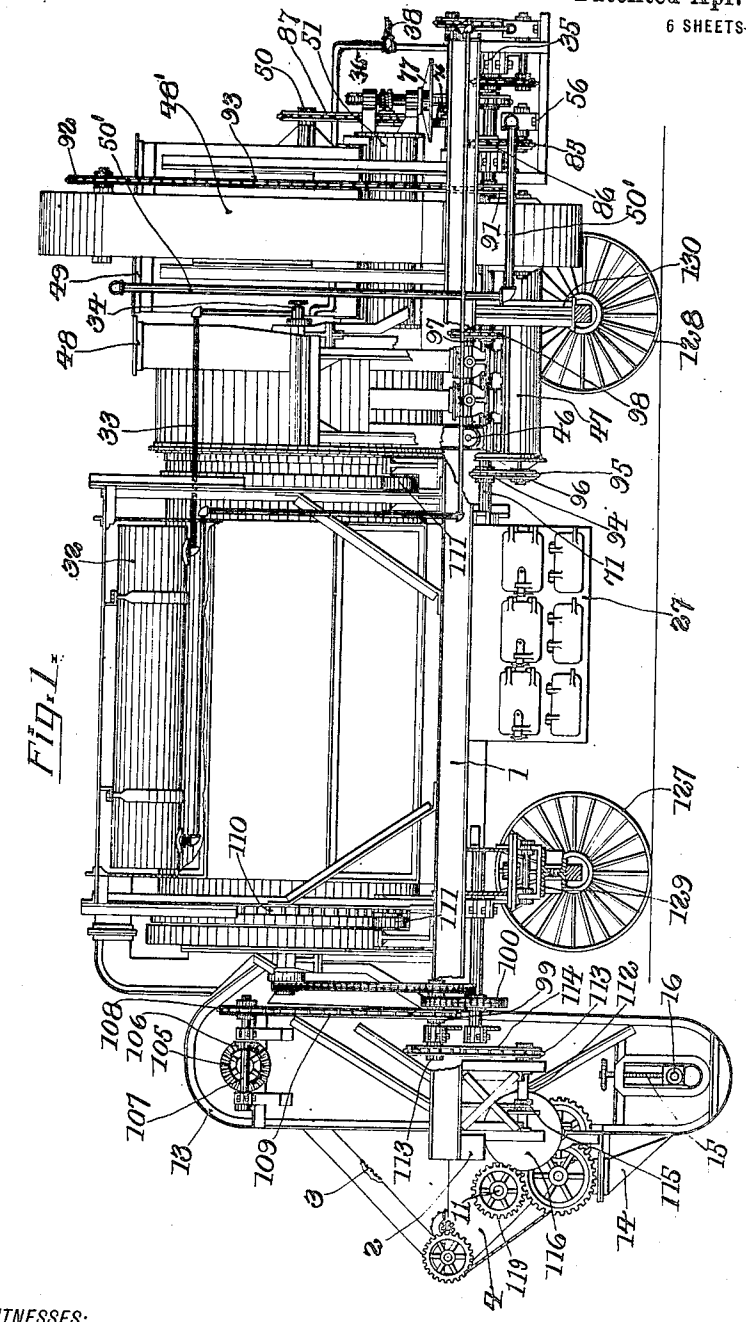


Fig. 1.

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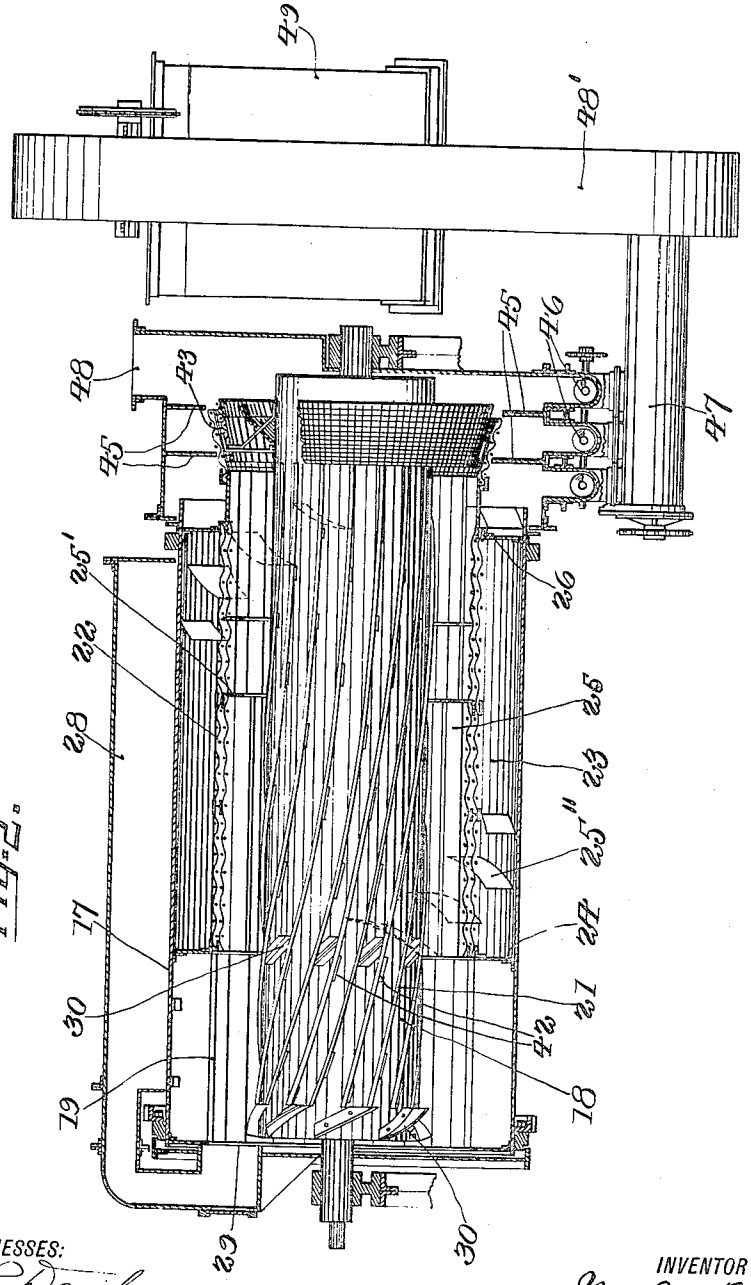


Fig. 2.

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Fig. 3.

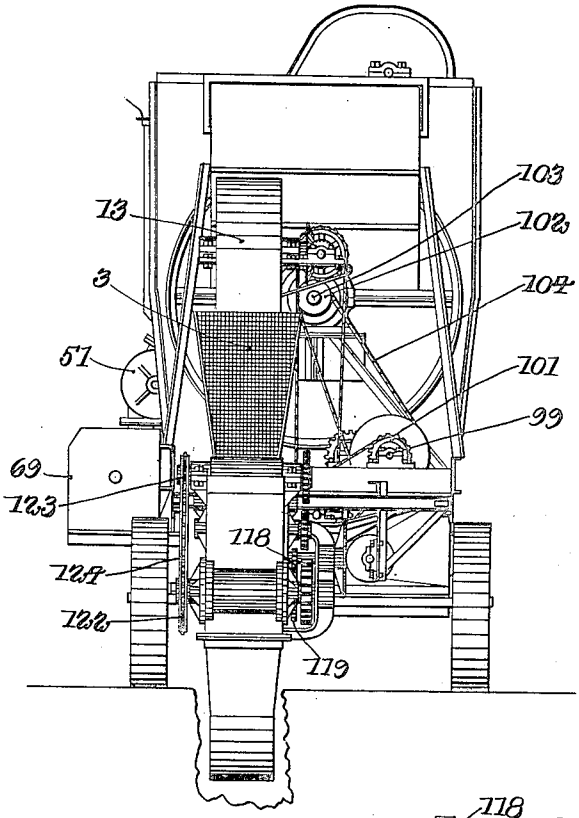
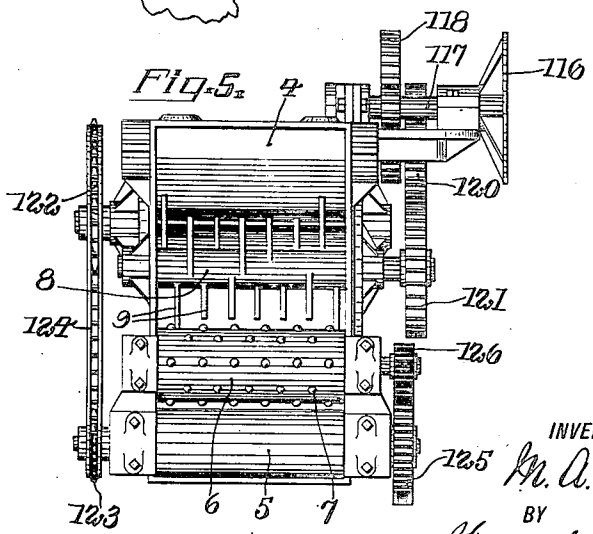


Fig. 5.



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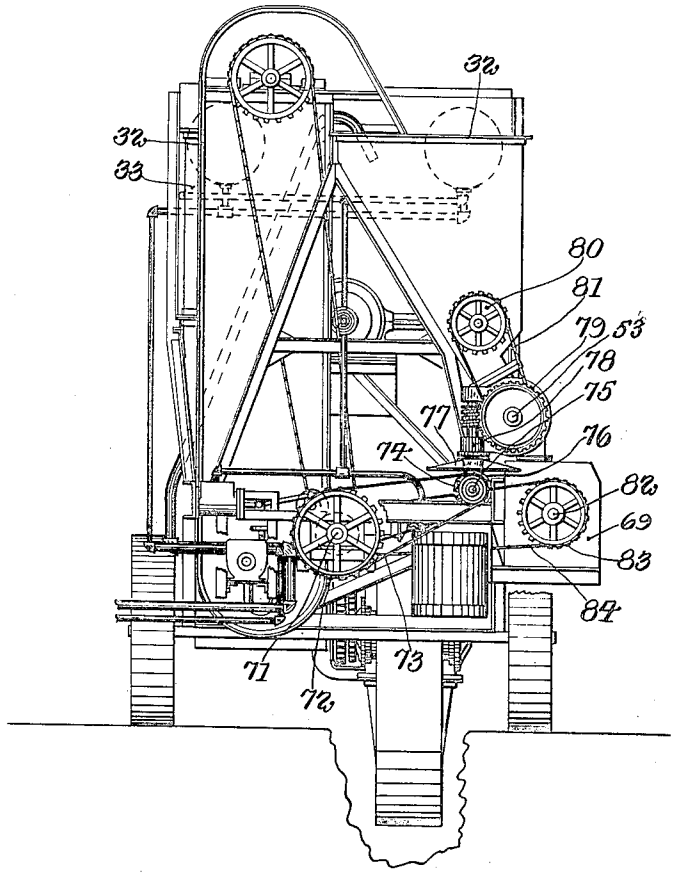
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6 SHEETS—SHEET 4.

Fig. 4.



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6 SHEETS—SHEET 5.

Fig. 6.

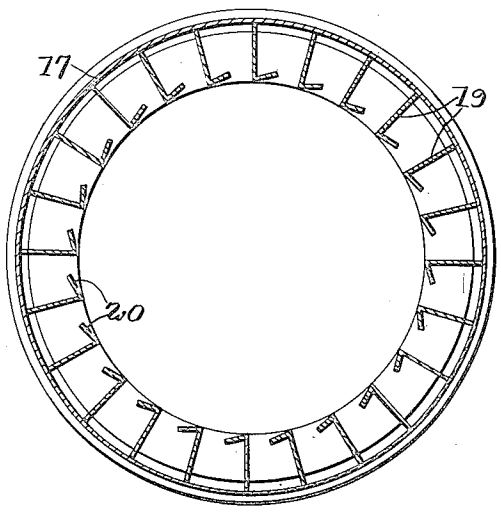


Fig. 7.

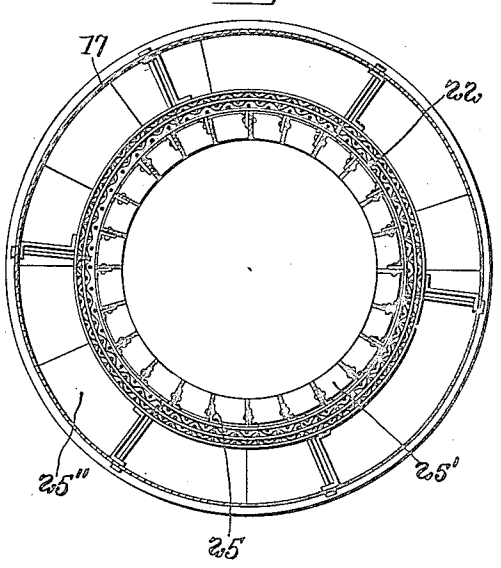


Fig. 8.

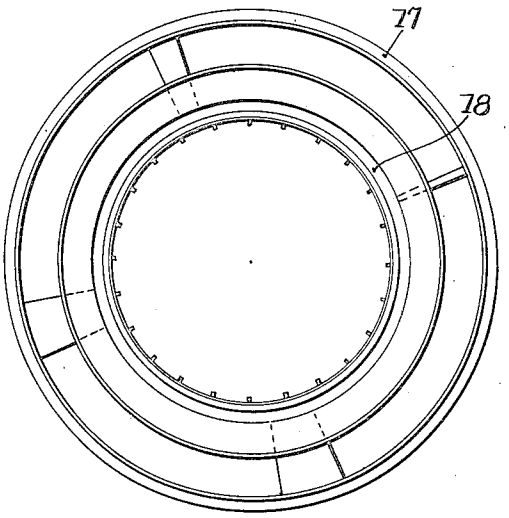
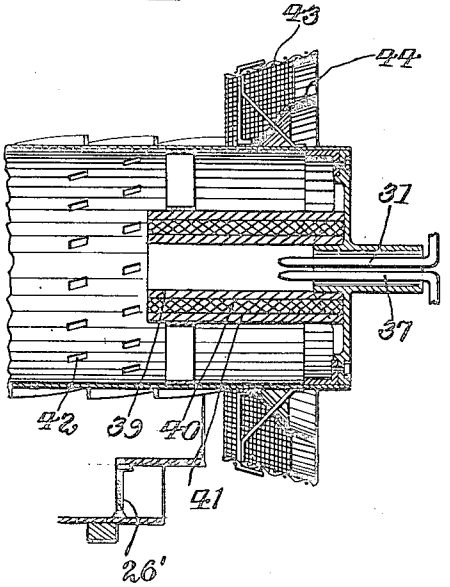


Fig. 9.



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6 SHEETS—SHEET 6.

Fig. 10.

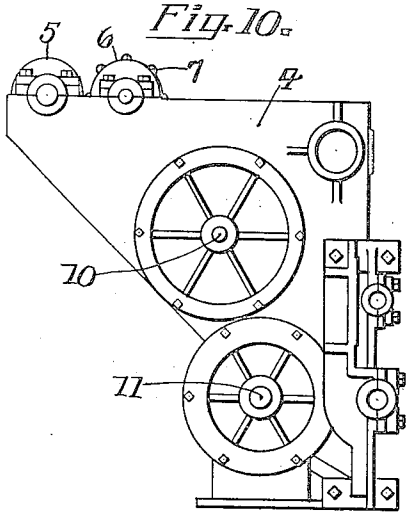


Fig. 11.

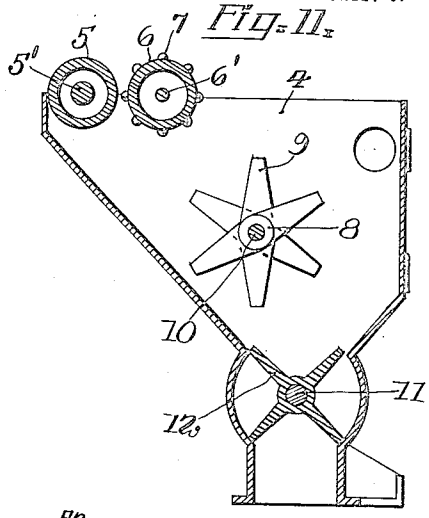


Fig. 12.

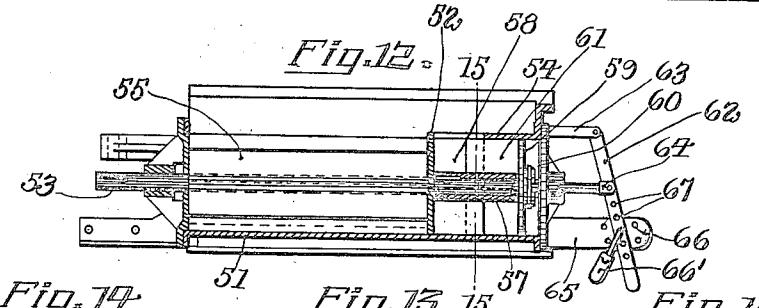


Fig. 14.

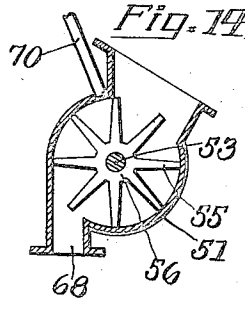


Fig. 13.

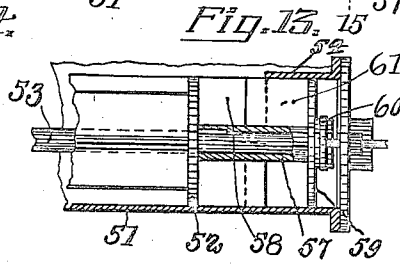


Fig. 15.

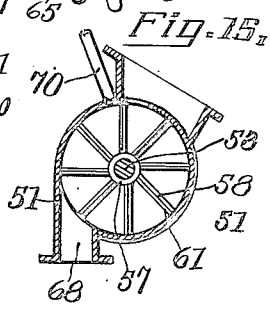
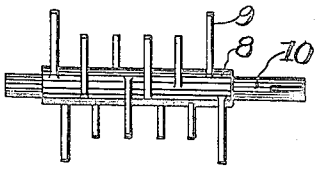


Fig. 16.



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UNITED STATES PATENT OFFICE.

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MACHINE FOR TREATING EARTHY MATERIAL.

1,337,953. Specification of Letters Patent. Patented Apr. 20, 1920.

Application filed March 16, 1917. Serial No. 155,282.

To all whom it may concern:

Be it known that I, MICHAEL A. POPKESS, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented new and useful Improvements in Machines for Treating Earthy Material, of which the following is a specification.

This invention relates to the building of good roads, that is, to the production of an economical and efficient material, which is, in itself, capable of supporting traffic and resisting wear while, at the same time, serving as a waterproof surfacing material, homogeneous and dense in its composition, yet somewhat malleable and elastic, so that any indentations made therein will be eradicated by the traffic subsequently passing thereover.

More specifically stated, the present invention consists in a machine for treating earthy material to convert it into such a paving or coating material as described above. The material, which is the product of the present machine, is similar to those covered by my Patents Nos. 1,008,433, issued November 14, 1911, and 1,220,681 issued March 27, 1917, and the machine is an improvement on the machine of my Patent No. 1,240,481, issued Sept. 18, 1917. The said material can be spread and compacted upon the surface or base to be coated, the thickness of the layer depending upon the conditions to be met, or can be molded into blocks of any desired shape.

The operation of the present machine is distinguished from those of my said prior patented machines in that the fine dust is separated from the coarser ingredients as fast as it is formed, and fed separately to the mixer, whereby it is not overheated and does not lose all its moisture, heat being subsequently applied during the mixing whereby the asphalt takes the place of the moisture as the latter is driven off; in this way, uniformly fine dust is obtained, accurately measured quantities of which are mixed with accurately measured quantities of asphalt.

By the term "earthy material" as used herein, I mean to include any kind of soil, loam or clay, with or without sand, gravel, friable rock, etc., in small or large quantities. The machine comprises means for either ejecting the larger, unpulverized particles or for feeding them with the collected fine dust to the mixer and incorporating them in the final product, in which they serve as a filler.

In making a paving material of the kind produced by this machine, it is very essential that the proportion of asphalt to dust be that best suited to the particular sort of material being treated and to the conditions and uses to which the product is to be put, and further that such proportion be not deviated from, as long as the quality of material and the conditions remain approximately the same. For this reason, the present machine is provided with a measuring device for the dust, by means of which successive batches of uniform volume are fed to the mixer in a continuous stream. A similar measuring device, the size of which can be varied, is provided for the asphalt, and when the proper size has been determined for certain conditions, the device can be locked and sealed against unauthorized adjustment. The measuring device for the dust could, of course, also be made adjustable in size, if found desirable, but it is not practically necessary. While means are provided for heating the material while it is being pulverized, such means need not be used in all cases, the heating being performed during the mixing operation. In the machine of my said prior Patent No. 1,240,481, means were provided for redisintegrating the material after it had been mixed with the asphalt, but such means are not used in the present machine, as I have found it unnecessary to use said means or step.

The new machine is similar to that described in said Patent No. 1,240,481 in that it comprises a rotary drum, a screen cylinder within and carried by the same, a rapidly revolving pulverizer within the screen, heating means (which may or may not be used), and means to mix the pulverized material with bitumen. This machine further comprises improved means for securing a uniform mixture with just the right proportions of dust and bitumen, improved means for heating the material as it is being pul-

verized, improved means for separating the fine dust from the gases before they pass off through the stack, and certain other advantageous modifications, all of which will be understood from the following description, with reference to the drawings, in which:

Figure 1 is a side elevation;

Fig. 2 is a side view, partly in section;

Fig. 3 is a front elevation;

Fig. 4 is a rear elevation;

Fig. 5 is a top plan of the feeding mechanism for the earthy material;

Fig. 6 is a cross-section of the front end of the drum with the pulverizer removed;

Fig. 7 is a cross-section center portion of the drum and screen with the pulverizer removed;

Fig. 8 is an end view of the drum and pulverizer;

Fig. 9 is a longitudinal section of the rear end of the pulverizer, showing the dust collecting screen attached thereto;

Fig. 10 is a side elevation of the feeding mechanism for the earthy material;

Fig. 11 is a vertical section of the same;

Fig. 12 is a longitudinal section of the dust and asphalt dispensing apparatus;

Fig. 13 is an enlarged detail view of a part of the measuring device;

Fig. 14 is a vertical cross-section of the dust section of said device;

Fig. 15 is a similar view of the asphalt section, and

Fig. 16 is a detail view of the agitator shown in Fig. 11.

The machine is mounted on a wheeled frame to facilitate transportation, the frame comprising side bars 1 and cross bars 2, only one of which latter can be clearly seen in the drawings because of the details of the machine; it will be understood, however, that a number of these cross bars 2 are employed to connect the side bars 1. At the front of the machine is mounted an inclined screen 3 beneath which is a bin or hopper 4, shown in detail in Figs. 5, 10 and 11. At the top of the hopper at the front end is a pair of rollers 5 and 6, mounted on shafts 5′ and 6′, one of said rollers being provided with projections 7 upon its periphery. The hopper contains an agitator comprising a sleeve 8 carrying a series of staggered blades 9 and mounted upon a shaft 10 journaled in the sides of the hopper. At the bottom of the bin is a measuring device 12 carried on a shaft 11 and comprising a series of radial blades 12 forming measuring pockets.

A chute 14 leads from the bottom of the hopper to an elevator 13 which delivers the material into a telescoping chute (not shown) at its upper end. The elevator is of the usual type and a detailed description of the same is believed to be unnecessary. Suitable means, such as a screw spindle 15, are provided for raising or lowering the lower shaft 16 of the elevator to regulate the tension of the sprocket chains. The telescopic chute communicates with the interior of the rotary drum 17, within which is mounted a rotary pulverizing reel 18. The inner periphery of the front end of said drum carries a series of lifting blades 19 having flanges 20, as shown in Fig. 6. The pulverizer 18 is provided with a series of external spirally arranged blades 21, and, at its front end, with spiral blades 30 of steeper pitch; it has openings 42 in its periphery. Mounted within the drum and extending from the rear end of the blades 19 to near the rear end of the drum is a screen cylinder 22, which is rigidly secured to the drum by braces, as shown in Figs. 2 and 7. The annular space 23 between the drum and the screen cylinder is closed at the front end by an annular plate 24. A plurality of lifting blades 25 are secured longitudinally upon the inner periphery of the screen cylinder 22 and two or more circumferential blades 25′ are also secured thereto, as shown in Fig. 2. On the inner periphery of the drum, between it and the screen cylinder, a plurality of spiral blades 25″ are mounted, which blades feed the dust toward the rear end of the machine as the drum rotates. The last four blades 25″ at the rear of the drum are of successively increasing length to insure the feed of a definite amount of dust from the rear end of the drum at each rotation. An annular plate 26 is secured at the rear of the drum, and is provided with an opening closed by a hinged door 26′, see Fig. 9.

Mounted upon the frame of the machine at any suitable point is a furnace 27, the gases from which are conducted into the flue 28 through a pipe (not shown), the flue 28 communicating with the front of the drum 17 through the opening 29. I also provide an oil burner 31, passing through the bearing at the rear end of the pulverizer and connected with oil tank 32 by means of pipe 33, a suitable control valve 34 being arranged at any convenient point in said pipe. The machine may be operated by a steam engine, indicated at 35, and a pipe 36 provided with a control valve 38, is connected to the exhaust of the engine and carried into the rear bearing of the pulverizer where it terminates in a nozzle 37 alongside the oil nozzle 31. Said nozzle terminates in a combustion chamber mounted within the pulverizer and comprising an inner lining of firebrick 39, an asbestos packing 40 and an outer metal shell 41 made in two semi-circular sections having flanges by which they are bolted around the firebrick and asbestos, securely holding them in place.

A dust collector 43, to catch the finest dust, is mounted on the rear of the pulver-

izer, the same being made of foraminous material and preferably frusto-conical in shape. A frusto-conical baffle plate 44 is mounted within the dust collector and serves as a guide for the dust. A series of fixed partitions 45 consisting of annular plates, surround said dust collector and between said partitions, at the bottom, are three worm conveyers 46 running transversely of the machine and leading to a worm conveyer 47, running longitudinally of the machine. A stack 48 is arranged at the rear end of the machine. The conveyer 47 communicates with an elevator 48′ which delivers the dust into a bin 49, containing two compartments separated by a partition, one of the compartments being for the reception of the dust and the other for the reception of liquid asphalt. The liquid asphalt is pumped into its compartment from a tank, which may be carried on the machine if desired, by means of a pump 50 through pipe 50′. The asphalt may be normally liquid, or may be solid, or semi-solid, at ordinary temperatures, in which case it is heated to liquefy it. A measuring device for both the dust and the asphalt is placed below the bin 49 and in communication therewith, the device comprising a cylindrical casing 51 divided into two sections by a partition 52, one for the dust and the other for the asphalt. A shaft 53 extends through the measuring device. The casing 51 is provided with an open top partially closed by a guard plate 54 over a portion of the asphalt section. Within the dust section, shaft 53 carries a sleeve 56, provided with radial blades 55. A similar sleeve 57 is keyed to the shaft in the asphalt section and carries a like number of radial blades 58 which, however, extend only part of the length of the asphalt section. A disk 59, carried by a collar 60, is slidably mounted on sleeve 57 and carries radial blades 61, equal in number to the blades 58 and adapted to enter between the latter. The collar 60 is keyed to the sleeve 57 to prevent relative circumferential movement of the blades 58 and 61. A lever 62, pivoted in a bracket 63, is connected by a link 64 to the collar 60. A bracket, provided with a series of holes 66, is mounted on the casing 51 and the lever 62 is provided with a number of holes 67, which can register with the holes 66, allowing a padlock 66′, or other locking means to be employed for the purpose of locking the measuring device at any desired adjustment to determine the amount of asphalt to be used with each batch of dust. The under side of the casing 51 is provided with an opening 68 extending throughout its length and communicating with a worm conveyer and mixer 69, running along the side of the machine and heated by the gases from the furnace 27 or by the exhaust from the engine. An air-vent pipe 70 is arranged in the casing 51 adjacent the opening at the top of the same, one of such pipes being provided in each of the dust and asphalt sections.

As previously stated, the machine as illustrated is driven by an engine 35, which is preferably a steam engine, although any type of engine may be used, if desired. The main driving shaft 71 of the engine extends longitudinally of the frame, and a sprocket wheel 72 is arranged thereon which, through the medium of a chain 73, drives a sprocket 74 on the stub shaft 75. Slidably mounted on the stub shaft 75, and keyed thereto is a friction roller 76 which drives a friction disk 77 mounted on a worm shaft 78. A worm gear 79 on the shaft 53 is driven by said worm shaft 78. Mounted on the shaft 53 is a sprocket which drives the shaft 80 of the agitator in the dust bin, by means of a chain 81. The shaft 82 of the worm conveyer 69 is provided with a sprocket 83 driven by a chain 84 passing over a sprocket wheel on the main shaft 71. The pump 50 is provided with a sprocket wheel 85 on the end of its shaft, by means of which the pump is driven from the main shaft 71 through sprocket 86 mounted on said shaft and a chain 87 connecting sprockets 85 and 86.

The elevator 48′ is driven by sprockets 91 and 92 and chain 93, the sprocket 91 being mounted on the main shaft 71 and sprocket 92 on one of the shafts of the elevator. Conveyer 47 is driven by means of the sprockets 94 and 95 and the chain 96. A countershaft 97, connected to the main shaft through sprocket and chains 98 imparts motion to the conveyers 46 through the medium of suitable gearing (not shown).

At the front of the machine, the main shaft 71 drives a counter shaft 99 through the sprockets and chain 100. The counter shaft 99 carries a sprocket 101 driving sprocket 102 on the shaft 103 of the pulverizer by a chain 104. The elevator 13 has a bevel gear 105 upon one end of its upper shaft meshing with a bevel gear 106 carried by the shaft 107, said shaft being driven from the countershaft 99 by sprocket wheel 108 and chain 109. The shaft 99 extends rearwardly a short distance and carries a small gear (not shown) meshing with the circular rack 110 formed on the outer periphery of the drum 17, whereby it is rotated at a much lower speed than the pulverizer. A plurality of rollers 111, mounted in suitable bearings on the frame of the machine and disposed below the horizontal center of the drum support the same while it is rotated.

A countershaft 112 is driven from countershaft 99 by sprockets 113 and a chain

114. A friction roller 115 is keyed to shaft 112, and slidably mounted thereon, to regulate the speed of friction disk 116 driven by said roller. The friction disk 116 is mounted upon a shaft 117 arranged in bearings carried by the frame of the bin 4, and has arranged thereon a gear 118, meshing with a gear 119 upon shaft 11, see Fig. 5. A second gear 120 on said shaft 11 meshes with a gear 121 on shaft 10 driving said shaft. Upon the opposite end of shaft 11 is a sprocket 122 connected to a sprocket 123 on the shaft 5′ of roller 5 by a chain 124. The opposite end of shaft 5′ carries a gear 125 meshing with gear 126 on the shaft 6′ of roller 6.

The entire machine is mounted on the front wheels 127 and the rear wheels 128, which are journaled on the trucks 129 and 130 respectively, the front truck being provided with steering means (not shown) of any ordinary type. For transporting the machine from place to place, driving means may be employed and operated by the engine 35. Under such conditions clutches of any type should be placed on the shaft 71 and the drive shaft connected with the wheels so that they can be operated independently when desired.

The operation of this machine is as follows:—

The soil material is shoveled on or thrown onto the screen 3, the finer particles passing through the screen and the larger particles, such as lumps of dirt or rock, passing off the screen onto the ground. The lumps of dirt and stone, which are just small enough to pass through the screen, will roll downwardly thereon before passing through the same and will fall upon the rollers 5 and 6, one of which rotates at a much higher speed than the other, due to the difference in the size of gears 125 and 126, and the projections 7 upon the roller 6 crush these lumps and stones, which then fall toward the bottom of the hopper 4. The agitator 8 stirs the material constantly, prevents it from arching within the hopper and causes it to feed downwardly into the measuring device 12, which feeds uniform batches of material to the chute 14 at regular intervals. The speed of the measuring device, as well as those of the agitator 9 and rollers 5 and 6, are adjustable through the medium of friction disks 115 and 116. The material falls into the elevator 13, is carried up and deposited by the same in the telescopic chute which conveys it to an opening in one end of the drum 17. The lifting blades 19 in said drum lift the material and drop it upon the pulverizer 18, whereby it is disintegrated and pulverized by the impact of the blades 21 which also tend to carry it rearwardly. As the material is thrown outward by the action of blades 21, it strikes the flanges 20 of the blades 19, which assist in its disintegration. This operation is repeated a great many times as the material is carried rearwardly and when it comes within the screen 22, the finer particles are separated from the coarser particles by passing through the screen into the annular collection space 23. The annular plate 24, separating the space 23 from the front end of the drum, prevents the coarser particles of material from passing into said space. The blades 25, arranged upon the inner periphery of the screen, lift the coarser particles. similarly to the blades 19, and drop them upon the pulverizer, whereby the disintegrating action is repeated as the material is fed toward the rear of the drum. The blades 25″ constantly feed the dust rearwardly and finally it is fed out into one of the conveyers 46 through the opening in the plate 26. The dust, forced against the plate 26 by the action of the blades 25″, opens the door in said plate which is arranged on the rising side of the drum, said door being normally closed. The four blades at the rear end of the drum increase progressively in size, as stated before, to insure a definite quantity of dust being fed from the drum during each rotation.

The blades 30 on the pulverizer create an induced draft in the flue 28, drawing the heated gases and air from the furnace 27 into the drum, through opening 29 which communicates with the space between the pulverizer and drum at the front end, which space in turn communicates with the space between the pulverizer and the screen cylinder. It will be noted that, when the machine is not running, the draft of the fire is stopped which prevents the furnace from overheating and burning the drum or framework of the machine. The draft caused by the blades 30 forces the heated gases rearwardly through the machine whence they are carried off by the stack 48. The gases of combustion from the burner 31 are fed forwardly in the drum and are drawn outwardly by the draft, passing through openings 42 in the periphery of the pulverizer, said openings being larger at the forward end, so that the greatest degree of heat will be obtained at the point where the material is first fed into the machine. If desired, the steam jet 37 may be omitted and a dry process of disintegrating and pulverizing the material be employed. But in some cases I find that it is desirable to add a slight amount of moisture to the pulverized earth and in such cases the steam from the jet is employed. The gases of combustion, or the gases of combustion and steam, as the case may be, pass through the openings 42 in the pulverizer and unite with the heated gases fed into the machine

through the opening 29. In passing through the drum, the gases assist in carrying the finer particles through the screen 22, while the circumferential blades 25′ prevent the gases from carrying off the dust caught in the pockets formed by the blades 25 and 25′. The plate 26 at the rear of the drum prevents the gases from passing out of the machine with the separated dust, the gases passing through the dust collector 43 and being maintained near its periphery by the baffle plate 44 which facilitates the extracting of the dust from the gases. The dust separated from the gases by the dust collector passes into one of the worm conveyers 46 and any materials too coarse to pass through the screen 22, or dust collector 43 are fed from the rear of the dust collector and fall by gravity into the rear conveyer 46. When it is desired to separate this material from the dust thus obtained, the rear conveyer 46 is arranged to deposit the material outside of the machine, but in other cases all of the conveyers 46 communicate with the worm conveyer 47 through which the material is carried to the elevator 48′ which deposits the earth in the dust compartment of the bin 48. The dust compartment is provided with an agitator, (not shown), mounted upon the shaft 80, to prevent the dust from arching and to constantly feed it downward toward the measuring devices. This measuring apparatus as described, is provided with radial blades forming pockets similar to those formed by the measuring device 12, and the partition 52, which is stationary, regulates the quantity of dust to be delivered as the machine revolves, the proportion of asphalt being varied by the regulation of the disk 59 restricting the size of the pockets in the asphalt section. When the desired proportions have been decided, the disk 59 may be locked in its adjusted position to prevent others than the expert in charge of the work from changing the proportions. Each of the sections being provided with a vent pipe 70, the air escapes as the pocket is filled. The material feeds into the pockets from the bin 49 when the blade 55, or 58 as the case may be, passes the edge of the opening in the top of the casing 51, the air escaping at the top through pipe 70. The speed of the measuring device may be varied at the will of the operator through the medium of friction disks 76 and 77, thereby varying the output of the machine. The material passes from the measuring device through the outlet 68 into the worm conveyer 69 in which the asphalt and dust are thoroughly mixed and from which the paving material is delivered upon the roadway or into a receptacle.

It will be seen that the greatest degree of heat occurs inside the screen cylinder, so that the fine dust which passes through said cylinder is not subjected to so high a degree of temperature.

What I claim is:—

1. In a machine of the class described, the combination with means to pulverize the material, of a divided bin at the rear end of the machine, means to convey the pulverized material into one compartment of said bin, the other compartment being adapted to receive liquid asphalt, a rotary measuring device at the outlet of said hopper, comprising two sections, one of fixed capacity for the dust and the other of adjustable capacity for the asphalt, means to vary the capacity of the asphalt section, means to lock said means in adjusted position, and a mixer into which the measured dust and asphalt drop from said measuring device.

2. In a machine of the class described, the combination with means to reduce earthy material to fine dust, of a receptacle into which it is fed, an adjoining receptacle for liquid asphalt, a horizontal cylindrical casing beneath said receptacles, a partition dividing said casing into two sections, one of which communicates with the dust receptacle and the other with the asphalt receptacle, a shaft journaled longitudinally in said casing, a sleeve carrying radial blades fast on said shaft in each of said sections, a head slidably keyed on said shaft in the asphalt section and having the same number of radial blades as the sleeve in said section, the blades on said head being arranged to telescope with the blades on said sleeve to vary the volume of the asphalt section, a lever to move said head, means to lock said lever in adjusted position, air vent pipes at the top of said sections and a worm conveyer arranged to receive the measured dust and asphalt from said casing and to initimately mix the same.

3. In a machine of the class described, the combination of a revoluble drum, a screen cylinder secured within the same, a rotary pulverizer within said cylinder, means to conduct heated gases into the annular space between the pulverizer and screen, and blades on the front end of the pulverizer to suck in said gases and force them through said space.

4. In a machine of the class described, the combination of a drum closed at its ends, means to rotate said drum slowly, flanged lifting blades secured to the inside of the front end of said drum, a screen cylinder secured to but spaced from the inside of the drum and running from the rear end of said blades to the rear end of the drum, spiral blades between the drum and cylinder, lifting blades secured within the cylinder, a pulverizing reel within said cylinder, means to rotate it at a higher speed than said drum and cylinder, spiral blades on

said pulverizer, shorter spiral blades of steeper pitch on the front end of the pulverizer, a flue to conduct heated gases into said drum, said steeper spiral blades acting as a fan to draw said gases in and force them through the space between the pulverizer and screen cylinder, a stack at the rear end of the drum, and means carried on the rear end of the pulverizing reel to prevent fine dust from being carried off through the stack.

5. In a machine of the class described, the combination of a drum, a screen cylinder carried by the same, a pulverizing reel inside said cylinder, said reel having apertures diminishing in size toward the rear of the machine, a flue to conduct heated gases into the front end of the drum, means to inject heated gases into the rear end of the pulverizer, spiral blades of steep pitch on the front end of the latter, said blades acting as a fan to draw the gases from said flue and through said apertures and force them through the drum between the screen cylinder and the pulverizer, and means on the rear end of the pulverizer to prevent the fine dust from being carried off with the gases.

6. In a machine of the class described, the combination with a rotary drum, a screen cylinder carried by and within the same, and an independently rotatable pulverizer within said cylinder, of means on the front end of the pulverizer to force gases through said drum and cylinder, and means carried by the rear end of said pulverizer to arrest the fine dust and separate it from the said gases.

7. In a machine of the class described, the combination of a drum, the screen cylinder carried by the same, and the pulverizer within the cylinder, of means to inject heated gases into the rear end of the pulverizer, the latter having apertures in its periphery increasing in size toward the front end, spiral blades on the front end of the pulverizer acting as a fan to draw the gases through said apertures and force them rearwardly between the screen cylinder and the pulverizer, a conical screen on the rear end of the pulverizer and a conical baffle plate within said screen, said screen and plate acting as a dust separator.

8. In a machine of the class described, the combination with means to pulverize the material, means to separate out the fine dust as fast as it is formed, means to feed said dust rearwardly, means to induce a current of heated gases through the machine from front to rear, transverse conveyers to receive the dust and coarser material respectively, a mixer, means to deliver measured batches of dust and asphalt to said mixer, and a dust collector to separate the fine dust from the gases before they pass off.

9. In a machine of the class described, the combination of a drum and means to rotate it slowly, a screen cylinder of smaller diameter carried by said drum, spiral blades between said drum and cylinder, longitudinal lifting blades within said cylinder, a pulverizer reel within said cylinder and means to rotate it rapidly, spiral blades on said reel to break up the material, annular radial plates secured at intervals within said screen cylinder to form pockets to temporarily retain the dust, spiral blades of steeper pitch on the front end of said reel to create a draft through the drum, a conical dust collector mounted on the rear end of said reel, and means to introduce heated gases at the front end of the drum.

10. In a machine of the class described, the combination of a drum and means to rotate it slowly, a screen cylinder of smaller diameter carried by said drum, spiral blades between said drum and cylinder, longitudinal lifting blades within said cylinder, a pulverizer reel within said cylinder and means to rotate it rapidly, spiral blades on said reel to break up the material, spiral blades of steeper pitch on the front end of said reel to create a draft through the drum, a conical dust collector mounted on the rear end of said reel, means to introduce heated gases at the front end of the drum, means to introduce heated gases and steam into said reel, said reel being provided with apertures in its periphery toward its front end, means to collect the pulverized material, means to measure it and the asphalt, and means to mix the same intimately together.

11. In a machine of the class described, the combination with the pulverizing means, of means to feed the material thereto, comprising an inclined screen, a hopper below the same, a pair of crushing rolls in the front top part of said hopper, a rotary agitator in said hopper below said rolls, a rotary measuring device below said agitator in the throat of said hopper, and means to convey the material from the bottom of said hopper to said pulverizing means.

12. In a machine of the class described, the combination with the rotary drum and the revolving pulverizer reel, of a combustion chamber axially mounted in the rear end of said reel, an oil burner and a steam nozzle projecting into said chamber, said reel having apertures in its periphery, and blades on the front end of said reel to draw the gases from said nozzles through said apertures and force them rearwardly of said drum outside said reel.

13. In a machine of the class described, the combination of a rotary drum, means closing said drum at its ends but having inlet and outlet openings respectively, means to feed screened and crushed material in uniform batches to said feed openings,

longitudinal lifting blades in the front end of said drum, a screen cylinder carried by said drum and beginning at the end of said blades, similar blades within said cylinder, spiral blades between said drum and cylinder, the rearmost of which increase progressively in length, a pulverizing reel provided with spiral blades and extending throughout said drum within said cylinder, means to rotate said drum and pulverizer, the latter at a higher rate of speed, a mixer, a measuring device for dust and asphalt delivering into said mixer, and means to convey the dust from said drum to said measuring device.

14. Apparatus for treating earthy material to adapt it for paving purposes and the like, comprising the combination with means for disintegrating the material, a receiver for the same, means within said receiver to agitate the material, a mixer, a measuring device to convey predetermined quantities of the material from said receiver to said mixer, means to allow air to escape from said measuring device while it is being filled, and means for introducing asphalt into said mixer.

15. Apparatus for treating earthy material to adapt it for paving purposes and the like, comprising the combination with means for disintegrating the material, a receiver for the same, means within said receiver to agitate the material, a mixer, a measuring device to convey predetermined quantities of the material from said receiver to said mixer, means to allow air to escape from said measuring device while it is being filled, a receptacle for asphalt, a measuring device to convey predetermined quantities of asphalt from said receptacle to said mixer and means for permitting air to escape from said asphalt measuring device while it is being filled.

In testimony whereof I have hereunto set my hand.

MICHAEL A. POPKESS.