Jan. 10, 1961 J. H. MAULDIN ET AL 2,967,696

ASPHALT MIXER AND DRIER

Filed Sept. 20, 1957 3 Sheets-Sheet 1

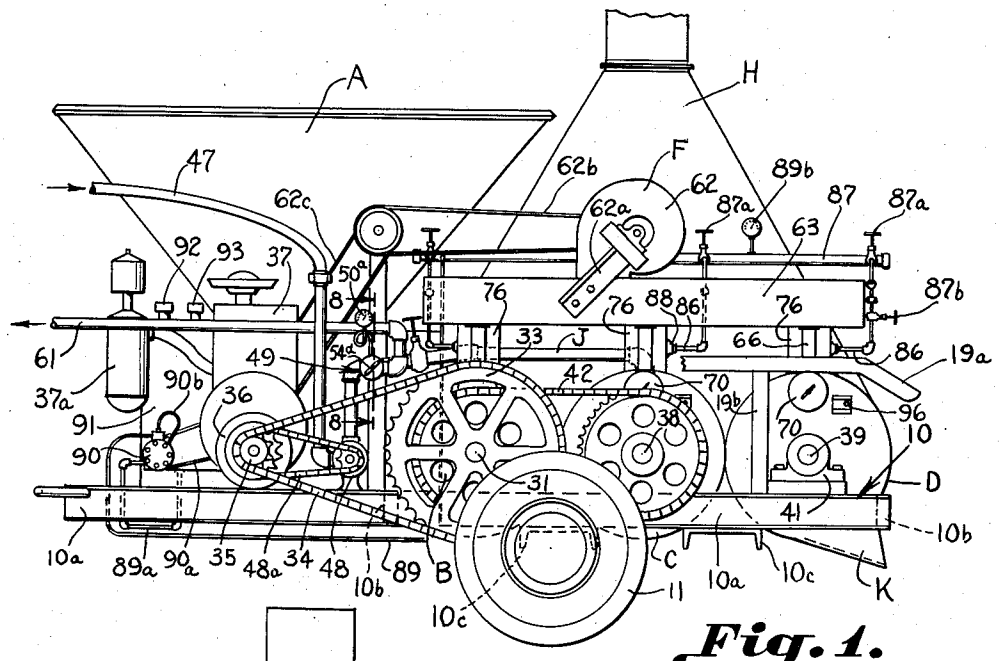

Fig. 1.

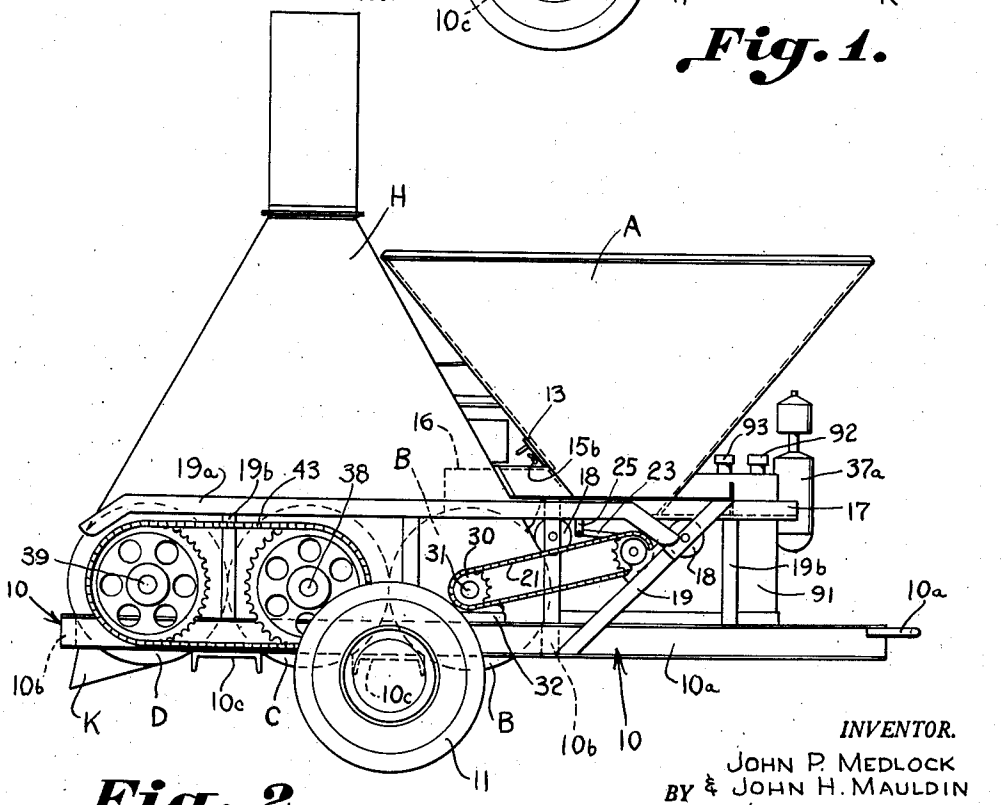

Fig. 2.

INVENTOR.
JOHN P. MEDLOCK
BY & JOHN H. MAULDIN

ATTORNEY

Jan. 10, 1961 J. H. MAULDIN ET AL 2,967,696

ASPHALT MIXER AND DRIER

Filed Sept. 20, 1957 3 Sheets-Sheet 2

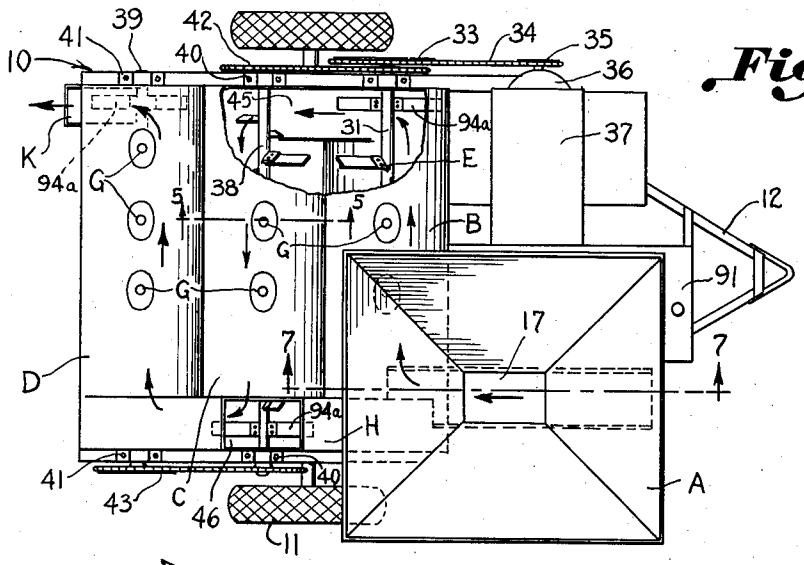

Fig. 3.

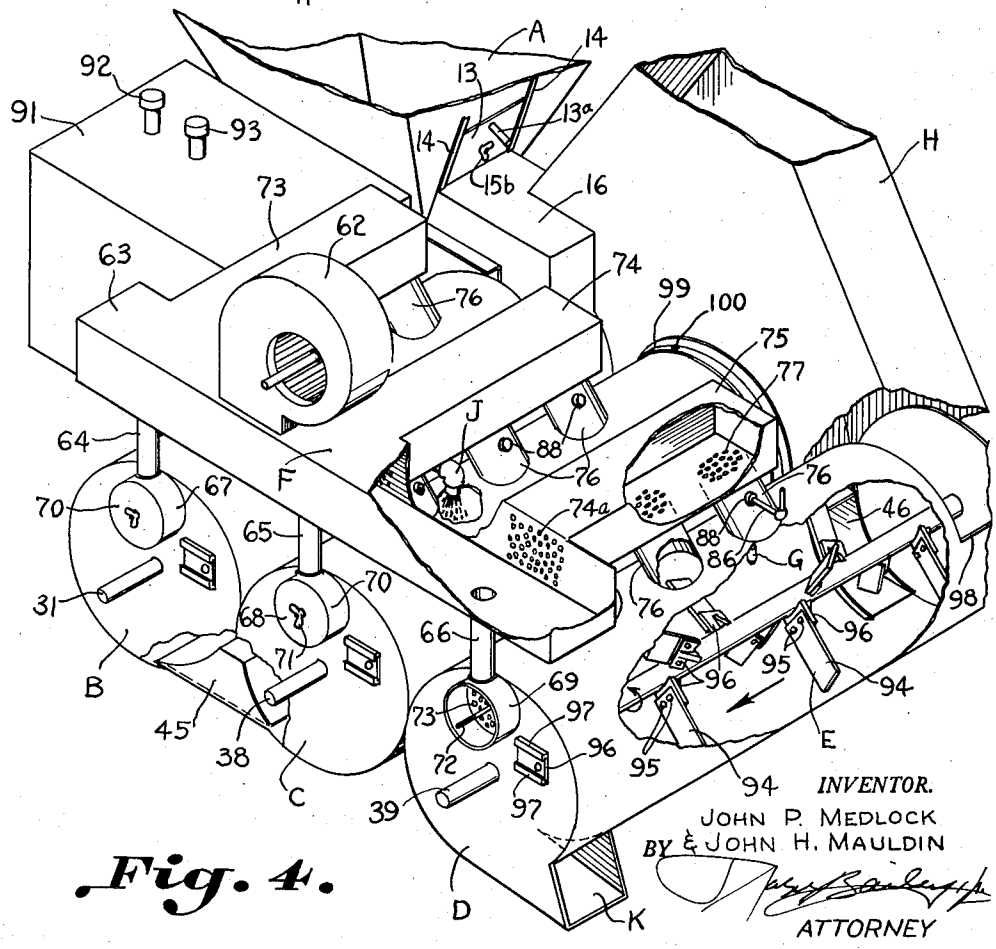

Fig. 4.

INVENTOR.
JOHN P. MEDLOCK
BY & JOHN H. MAULDIN

ATTORNEY

Jan. 10, 1961 J. H. MAULDIN ET AL 2,967,696

ASPHALT MIXER AND DRIER

Filed Sept. 20, 1957 3 Sheets-Sheet 3

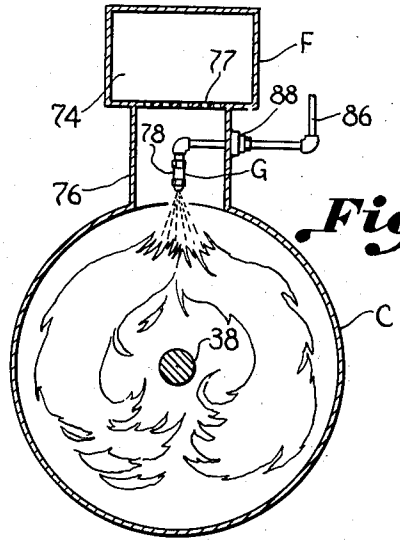

Fig. 5.

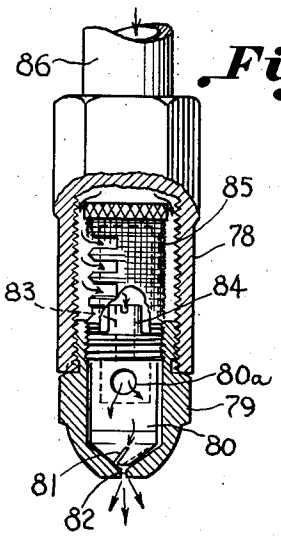

Fig. 6.

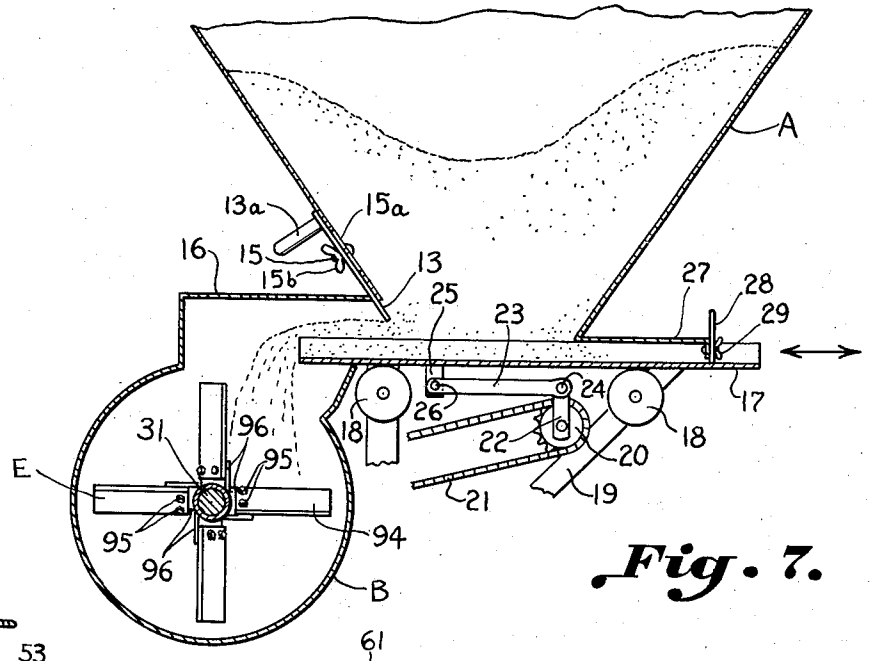

Fig. 7.

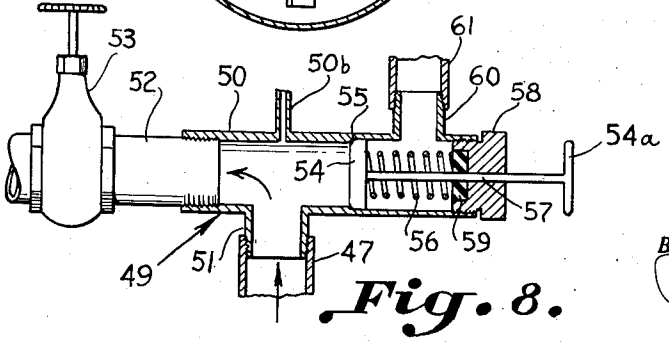

Fig. 8.

INVENTORS.
JOHN P. MEDLOCK
BY & JOHN H. MAULDIN
ATTORNEY

United States Patent Office 2,967,696
Patented Jan. 10, 1961

2,967,696

ASPHALT MIXER AND DRIER

John H. Mauldin, Greenville, and John P. Medlock, Taylors, S.C.; said Medlock assignor to said Mauldin

Filed Sept. 20, 1957, Ser. No. 685,096

5 Claims. (Cl. 259—158)

This invention relates to aggregate treating devices and more especially to a continuous feed drier and asphalt mixer.

Asphalt mixers in present use employ mixing chambers in which the agitators are disposed in the lower portion of the mixing chamber or pug mill so that there is enlarged space above the mixing area. The provision of this space within present pug mills was thought desirable in order to provide a means for removing moisture from the pug mill. It was thought that the use of cylindrical pug mills would not be desirable because of the binding which would be created between the agitating means and the aggregate or mix which would be compressed against the cylindrical walls. The relatively large space above the mixing area of present pug mills precludes the mixing of aggregate with liquefied bituminous binders of the type known as cutback asphalt which contains lighter hydrocarbons such as napthar or kerosene and gasoline. This is because the space above the mixing area permits vapor from the volatile hydrocarbons to collect therein and in the presence of a flame might result in an explosion. These asphalt mixers which are of the batch type have been large and bulky because of the necessity of providing the relatively large space above the mixing area. The relatively large pug mills are comparatively inefficient because the mixture is not confined thus making agitation more difficult with the result that less surface area of the aggregate is presented for mixing and drying. Since batch mixers necessitate the mixing of a relatively large amount of aggregate at one time, more power is required to operate the necessarily heavy machinery.

Accordingly, it is an object of this invention to provide a simplified asphalt mixer which will produce a more uniform mixture of asphalt and aggregate.

A further object of this invention is to provide an asphalt mixer which will serve as a device for drying the aggregate as well as mixing the aggregate with a liquefied bituminous binder in a continuous feed process.

An important object of this invention is the provision of an asphalt mixer and drier employing cylindrical drums in which rotatable agitating means are positioned within the drums and in which the aggregate may be treated in the presence of flame and a substantial draft.

A further object of this invention is the provision of a pug mill which will be effective in the removal of moisture and the lighter hydrocarbons such as napthar, kerosene, and gasoline from the mixture of aggregate and liquefied bituminous binder.

Another object of this invention is the provision of an asphalt mixer which affords a uniform continuous supply of liquefied bituminous binder to be mixed with aggregate which is being fed continuously and at a uniform rate through the pug mill.

Still another object of this invention is the provision of an asphalt mixer which is of simplified construction and which will produce a relatively large amount of asphalt with a minimum of supervision and use less moving parts and hence be less subject to breakdowns.

Another object of this invention is the provision of an asphalt mixer which includes a pug mill which provides a uniform distribution of flame and air through the mixture of aggregate and liquefied bituminous binder which is being mixed in the pug mill and which is flowing axially therethrough at a uniform rate.

A further object of this invention is the provision of an asphalt mixer having a pug mill to which a relatively large volume of air is provided under a constant draft at relatively low velocity in the presence of a flame which is uniformly distributed throughout the cross section of the pug mill so as to provide an effective means of removing moisture and the lighter hydrocarbons from the mixture of aggregate and liquefied bituminous binder.

Another object of the invention is to produce an asphalt mixer having means for drying aggregate and mixing aggregate with a liquefied bituminous binder in a continuous process and yet which is compact enough to be pulled on a trailer behind an asphalt truck without difficulty.

Some of the methods provided to carry out the invention will be hereinafter described.

The invention will be more readily understood from a reading of the following description and by reference to the accompanying drawings forming a part thereof wherein some illustrative examples of the invention are shown, and wherein:

Figure 1 is a side elevation showing an asphalt mixer and drier constructed in accordance with the present invention.

Figure 2 is a side elevation showing the opposite side of the asphalt mixer and drier from that shown in Figure 1.

Figure 3 is a plan view showing the asphalt mixer shown in Figure 2 with parts omitted and parts broken away for clarity of illustration.

Figure 4 is an enlarged perspective view of the asphalt mixer shown in Figure 3 looking from the right hand end of Figure 1, with parts omitted and parts broken away for clarity of illustration.

Figure 5 is an enlarged sectional view taken on the line 5—5 in Figure 3.

Figure 6 is an enlarged sectional elevation of the nozzle shown in Figure 5 with parts broken away.

Figure 7 is an enlarged sectional elevation taken on the line 7—7 in Figure 3, and

Figure 8 is an enlarged sectional elevation of the asphalt valve taken on the line 8—8 in Figure 1.

Referring now more particularly to Figures 1, 2, and 3, of the drawings, the asphalt mixer constructed in accordance with the present invention includes a substantially rectangular chassis **10** which is mounted on wheels **11**. A hopper A is carried adjacent one corner of the rectangular chassis **10** and serves to feed aggregate into a first horizontally disposed cylindrical drum B, which is carried by the rectangular chassis **10**. The aggregate is fed into one end of the drum B from whence it is moved axially by the action of agitating means within the drum B. The drum B is interconnected with a second parallel aligned drum or pug mill C adjacent its end remote from that into which the aggregate is fed and the drum C is in turn interconnected on its opposed end with a third drum D which is also parallel and aligned with the drum C. The interconnected drums B, C, and D are therefore carried by the rectangular chassis **10** and are preferably positioned closely adjacent each other and disposed in the same horizontal plane.

The aggregate is moved longitudinally within the drum B toward the end of the drum B which is interconnected with the drum C by the agitating means in the form of blades or paddles E which are so constructed as to effect such movement of the aggregate. It will be noted that

each of the drums B, C, and D are provided with such paddles E which are adapted to feed the aggregate in a tortuous path through the three drums at a uniform rate. The drums or pug mills B, C, and D are provided with a blower system F for creating a forced draft from one end of the drums to the other to provide a means for distributing flame within the drums. Such flame is produced by burning oil which is fed into the drums through a plurality of spaced nozzles G a number of which communicate with each of the drums B, C, and D.

In a preferred form of the invention, such as is shown in the drawings, the aggregate, which normally consists of sand and gravel, is fed into the hopper A and thence into one end of the drum B. Within the drum B, the aggregate is dried due to the agitation of the paddles E in the presence of the forced draft from the blower system F, which enters one end of the drum B and passes through the drum and out through the chimney H, to spread the flame from the nozzles G throughout a substantial portion of the drum B. A similar draft is created in each of the drums or pug mills all of which are connected with the blower system F on one end and the chimney H on the other end so that the drums serve as flues for the draft and flame carried thereby. The dried aggregate then passes into the pug mill C where the liquified bituminous binder is added through the pipe J at a continuous rate as will be described in greater detail below. Flame is provided by the oil burner nozzles G in a similar manner as described in connection with the drum B and it is apparent that the asphalt and aggregate are mixed at a uniform rate in the presence of a flame which is forced throughout the pug mill C by the forced draft passing through the pug mill. This results in the removal of additional moisture which may be present as well as the lighter hydrocarbons which are present in the liquified bituminous binder which are substantially burned by the flame from the nozzles G. The mixture of aggregate and binder then passes into the pug mill D where it is further agitated and treated with flame as in the pug mill C. A discharge chute K is provided at the end of the drum C so that the mixture may be discharged when the mixing process has been completed preparatory to being spread on the highway or other surface to be treated by the mixture.

The trailer chassis **10** is preferably rectangular and constructed of suitable structural shapes such as longitudinal channel members **10***a* which are welded to suitable transverse members **10***b*. The chassis is provided with a pair of transverse support members **10***c*. A trailer hitch **12**, for connection behind an asphalt tank truck (not shown) which carries a supply of asphalt for the mixer, has connection with the front of the frame **10**. The liquefied bituminous binder which is preferably used is of the type known as cutback asphalt which includes lighter hydrocarbons such as naphtha or kerosene and gasoline in its composition. These volatile hydrocarbons may be readily burned out of the mixture so that the aggregate may be fed rapidly through the mixer.

The hopper A is substantially funnel-shaped and is provided with a door **13** which is slidably positioned between suitable guides **14** carried by the hopper. Threadable means **15** pass through a slot **15***a* and by means of a wing nut **15***b* lock the sliding gate **13** in a desired position. Referring more particularly to Figure 7, it will be noted that this gate **13**, which may be adjusted by the handle **13***a*, is capable of adjusting the rate of admission of aggregate from the hopper into the drum B. A passageway **16** constructed of suitable sheet material has connection with the drum B on one end and with the hopper A through an opening, the size of which is controlled by the gate **13**, at the other end. Aggregate may be fed into the hopper A in any suitable manner (not shown).

Means for feeding the aggregate from the hopper A is provided in the form of a horizontally disposed tray **17** which is mounted beneath the hopper A for reciprocation on the rollers **18**. The tray **17** serves as a closure for the open bottomed hopper A and as an agitating means for feeding the aggregate into the passageway **16**. The rollers **18** are rotatably mounted on the frame **19** which supports the hopper A upon one corner of the chassis **10**. A gear **20**, which is driven by the chain **21**, rotates carrying a link **22** which is fixed on one end with respect to the gear **20**. The free end of the link **22** is pivotally connected to the link **23** as at **24** on one end thereof and to the bracket **25** on the other end thereof. The bracket **25** is fixed to the reciprocating tray **17** thus forming a reciprocating drive for the tray **17**. The aggregate is prevented from escaping from the open bottomed hopper A on the other end of the reciprocating tray **17** by the plate **27** and the abutment **28** which depends from the plate **27** and which is fixed to a depending portion of the plate **27** by the wing nut **29**.

Referring more particularly now to Figure 2, the chain **21** is shown as being driven by a gear **30** which is fixed to an axially mounted shaft **31** which extends through the drum B. The shaft **31** is rotatably mounted in suitable brackets **32** adjacent each end thereof. Referring to Figures 1 and 3, it is seen that the shaft **31** is driven on its end remote from the gear **30** by a gear **33** which is in turn driven by the chain **34** from the gear **35**. The gear **35** is carried by the power take-off **36** of a motor **37** which may be of any suitable type capable of delivering a constant torque as will be described in greater detail below.

Axial shafts **38** and **39** are positioned within the drums C and D, respectively, and are mounted adjacent their ends in suitable brackets **40** and **41**, respectively, which have connection with the chassis **10**. The shaft **38** is driven by a suitable chain drive **42** from the shaft **31**. The shaft **39** is driven by suitable chain drive **43** from the shaft **38** on the end of the shaft **38** remote from the motor **37**. Suitable guards **19***a*, which are provided to cover the various chain drives described above, are supported by suitable frame members **19***b* which have connection with the chassis **10**. Each of the shafts **31**, **38**, and **39** carry angled paddles or agitators E within their respective drums as will be described in greater detail below.

It is evident, therefore, that means have been provided for feeding aggregate from the hopper A into the drum B at one end of the drum B so that the paddles or agitating means E will move the aggregate toward the other end of the drum B. The feeding of the aggregate is maintained automatically by the motor **37** and may be adjusted by the positioning of the gate **13**. An adjustment of the speed of the motor **37** which would effect the reciprocation of the tray **17** and would also bring about a commensurate reduction in the speed of rotation of the shaft **13** and the paddles E carried thereby.

The drums B and C are shown interconnected adjacent their ends remote from the hopper A by the passageway **45**. The aggregate which is fed through the drum B is introduced through the passageway **45** into the drum C where it is fed axially in the opposite direction by the oppositely angled paddles or agitators E. The aggregate is, therefore, moved axially through the drum C to a second passageway **46** for interconnecting the drums C and D. The aggregate is then fed through the drum D to the chute K where it is ready for use.

The liquefied bituminous binder is added to the aggregate through the pipe J at a point within the drum C where it is thoroughly mixed with the aggregate before the aggregate is passed into the drum D for further treatment in the presence of the forced draft and flame as will be more fully described below. The liquefied bituminous binder is pumped through the line **47** from the tank car (not shown) by the pump **48** into the pipe J. A valve for supplying a uniform amount of asphalt to the pipe J is broadly indicated at **49** and is shown in de-

tail in Figure 8. The pump 48 is driven by the chain drive 48*a* from the motor 37.

The valve 49 includes a housing 50 which has a suitable connection 51 for the line 47 from the source of liquefied bituminous binder. Liquefied bituminous binder is fed into the housing 50 through this connection 51 and into an extension of the housing 52 before passing through a gate valve 53 which may be of any standard construction. It is preferable that a gate valve be employed because it may be positively controlled and because there is less chance of its being fouled by the relatively heavy bituminous binder passing therethrough. At the opposite end of the housing 50 a plunger 54 is resiliently urged against a seat 55, formed within the housing, by a coil spring 56. The plunger 54 is provided with a valve stem 57 which passes through a plug 58 which is threadably carried by the housing 50. The handle 54*a* is provided for moving the plunger back and forth to prevent sticking of the plunger. A suitable packing gland 59 is held in position by the spring 56 and prevents asphalt from passing between the plug 58 and the valve stem 57. A suitable connection 60 for a return line 61 which passes back to the tank car or other suitable source of liquefied bituminous binder is provided.

The purpose of the valve described above is to provide asphalt under a constant pressure to the pipe J. A gauge 50*a* is provided to indicate the pressure obtaining in the housing 50 and communicates therewith through the line 50*b*. It is evident that should the pressure within the housing 50 exceed the desirable amount that the spring 56 will be compressed by the plunger 54 being pressed thereagainst so as to move the plunger 54 to the right in Figure 8 thus permitting the flow liquefied bituminous binder through the connection 60 and the return line 61 back to its source. This provides a supply of liquefied bituminous binder at a uniform pressure to the pipe J and the amount of asphalt provided is controlled by the gate valve 53 described above.

The draft producing means F includes a blower 62 which is preferably of a rotary type for building up static air pressure within the horizontal longitudinally disposed duct 63 which is positioned above the ends of the drums B, C, and D remote from the chimney H so that a large volume of air at low velocity may be introduced into the chamber B. A bracket 62*a* is provided for supporting the blower 62 which has suitable connection with the duct 63. The blower 62 is driven by a belt drive 62*b* which is in turn driven by the belt drive 62*c* from the drive shaft (not shown) of the motor 37. The duct 63 has connection through the pipes 64, 65, and 66 with cylindrical air chambers 67, 68, and 69 carried by the drums B, C, and D, respectively. The drums 67, 68, and 69 are provided with covers 70 which may be removably secured to the drums as by wing nuts 71 which are threadably positioned on the threaded elements 72 which have connection with the drums B, C, and D. The ends of the drums B, C, and D which are enclosed by the air collection drums 67, 68, and 69 are each provided with a plurality of apertures 73. These apertures facilitate the introduction of a large volume of air into the respective drums or pug mills at a relatively low velocity. This is desirable because a large volume of the air is required to sustain the burning of the flame and to remove the gases and vapors from the respective drums.

Horizontally disposed ducts 73, 74, and 75 are positioned above respective drums B, C, and D and communicate with and are secured in perpendicular relation to the longitudinally disposed duct 63 at one of their respective ends through a plurality of apertures 74*a* which are provided to introduce a large volume of air at relatively low velocity into each of the perpendicular ducts. Each of the ducts 73, 74, and 75 is provided with a plurality of tubes or chambers 76 which communicate with the perpendicular ducts 73, 74, and 75 through apertures 77 on one end and with their respective drums B, C, and D at their other end. The ends of the tubes 76 communicate with the respective drums B, C, and D through openings cut out of the respective drums. A continuous forced draft of air is thus provided throughout the entire length of each of the drums B, C, and D which affords a relatively large volume of air at low velocity to each of the drums which passes therethrough and out of the chimney H.

Fuel oil for producing a flame is introduced into each of the drums B, C, and D through suitable nozzles G which preferably spray the oil in a fine mist as is best shown in Figure 5, to produce a flame which is spread evenly in a spiral path throughout each of the drums. The nozzles G are preferably located centrally of the air tubes 76 at about the point where the tubes 76 join with their respective drums. The preferable type of nozzle is manufactured by Monarch Mfg. Works, Inc. of Philadelphia, Pennsylvania and is designated as Model F–80. This nozzle, which is best shown in Figure 6, includes a housing 78 into which the tip 79 is threadably mounted. The tip 79 carries a traveler 80 having diagonal passageway 81 across the tip thereof so as to spray oil in a fine mist through the orifice 82 of the tip portion. Oil is introduced into the traveler 80 through an orifice 83 within a fixed plug 84. The oil passes through the orifice 80*a* within the traveler 80 and around the traveler 80 and through passageway 81 to the discharge orifice 82. The screen 85 serves as a filter for oil introduced therethrough into the plug 84 from the casing 78. The oil is introduced into the nozzles G by the pipes 86 which, as is best seen in Figure 1, is supplied with oil through a reservoir pipe 87. The pipes 86 have suitable connections with the air tubes 76 in the form of fittings 88. A number of valves 87*a* are provided for controlling the flow of oil from the collection pipe 87 into each of the pipes 86 which deliver oil to the nozzles G. An additional valve 87*b* is provided to cut the burner off near the delivery chute K to prevent flame or excessive heat from passing out the delivery chute K should this become necessary.

Oil is pumped into the collection pipe 87 through the line 89 by the pump 90 which pumps oil from the tank 91 through the line 89*a*. A pressure gauge 89*b* communicates with the collection pipe 87. The pump 90 is driven by the belt drive 90*a* from the motor 37 and is provided with a by-pass line 90*b* for the oil to circulate through the pump 90 when the valves 87*a* are closed. The tank 91 is shown, in Figure 1, to be a partitioned tank having two openings 92 and 93, a portion of the tank being made to contain gasoline for the motor 37, which is shown to be gasoline operated, and the other to contain oil to supply the burners. A suitable air filter for the motor 37 is shown and indicated at 37*a*.

Referring again to the paddles or agitators E, it will be noted that each of the paddles E includes a blade portion 94 which is secured as by bolts 95 to an angled projection 96 which is fixed, preferably by welding, to the respective shafts 31, 38, and 39. These blades 94 are staggered about the periphery of the shaft and carried at spaced intervals along the respective shafts and are angled with respect to the longitudinal axis of the shaft so as to impart agitation to the aggregate as well as to move the aggregate axially within the drums B, C, and D in desired directions as described above to produce the tortuous passage of the aggregate through the drums. When the paddles or blades 94 become worn, they may be removed by removing the bolts 95 and replaced with new paddles.

The paddle blades 94 extend outwardly closely adjacent the periphery of the drums B, C, and D so as to move substantially all of the aggregate through the drums. It was thought prior to this invention that such a structure would result in binding of the agitating means because of a compression of the asphalt mixture against such a cylindrical wall. This has been found not to be the case in practice and that only a small amount of asphalt mixture collects in the bottom portion of the

drums and this serves a useful function in insulating the drums while not impairing the operation thereof. It should be noted at this point that paddles **94***a* are parallel to the axis of the shafts **31**, **38** and **39** for pushing the mixture into the passageways **45** and **46** and into discharge chute K. The shafts **31** and **38** and **39** are rotated preferably at 55 r.p.m. so as to impart an effective agitating action to the aggregate but which will not be so violent as to extinguish the flame from the nozzles G.

The mixture is delivered from the chute K at a temperature of about 275° F. to about 325° F. so as to effectively heat the binder but so as not to burn the bituminous base of the binder. Should the temperature become excessive, this may be adjusted by reducing the volume of oil fed to the burners G or by increasing the flow of aggregate and binder.

The passageways **45** and **46** which interconnect the drums B and C, and C and D, respectively, are constructed of sheet metal material and are shown to be rectangular in cross-section. The passageways **45** and **46** project slightly into the respective drums through cutout portions in the drums and are preferably spot welded to the drums to provide a somewhat yieldable connection which will not be ruptured due to expansion and contraction of the drums when heated and cooled. Means are provided for gaining access to the drums for igniting the oil emitted from the nozzle G into the drums by means of openings in the ends of the drums which are normally covered by the gates **96** which are slidably positioned between suitable guides **97**.

The drums B, C, and D communicate with the chimney H through large cutout portions **98**. The chimney H, which is constructed of sheet metal material, is provided with projecting portions **99**, which are connected to the drums B, C, and D by suitable bolts **100** which pass through these projections **99**. It should be noted at this point that the drums B, C, and D have no direct connection with the chassis **10** but are maintained in position by their own weight between the transverse frame members **10***b* and the transverse support members **10***c* in a saddle type mounting. This provides for expansion and contraction of the drums when heated and cooled.

It is thus seen that an asphalt mixer and drier has been provided embodying a new concept of mixing asphalt which includes a continuous feed of mixture through cylindrical drums in a tortuous path as opposed to the concept of mixing a relatively large batch of asphalt in a closed system. While the drier portion of the mixer has been described above in connection with the mixing drums it is believed evident that the drier drum may be used alone or in connection with other drums for drying aggregate. This could be accomplished without any change in the structure shown by closing the valve controlling the supply of liquefied bituminous binder. In a similar way the mixing section could be employed separately and any desired number of drums could be used both in the drying and mixing operation.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and changes and variations will occur of those skilled in the art which may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. In an asphalt and aggregate mixer and drier and the like having an elongated mixing chamber, automatically operable means continuously feeding a supply of aggregate into said mixing chamber, automatically operable means positioned within said mixing chamber so as to agitate and to move the aggregate longitudinally within said mixing chamber, the combination including, an air duct, an air chamber communicating with said duct and with said mixing chamber, means providing a high static air pressure and a relatively large draft of air having a low velocity in said air chamber for introduction into said mixing chamber, and means introducing a flame into said draft of air positioned within said air chamber so that flame is distributed substantially uniformly throughout said mixing chamber.

2. The structure set forth in claim 1, including, means feeding a continuous supply of a liquefied bituminous binder to said aggregate within the mixing chamber.

3. The structure set forth in claim 1, wherein said means providing a high static air pressure and a relatively large draft of air having a low velocity in said air chamber includes an element having a plurality of relatively small apertures therein through which the duct communicates with said air chamber, and a chimney communicating with said mixing chamber adjacent the end thereof remote from said duct.

4. The structure set forth in claim 3 in which said means for introducing a flame into said draft of air includes a nozzle, and a source of fuel communicating with said nozzle, whereby flame is spread substantially uniformly throughout said mixing chamber.

5. A continuous feed asphalt and aggregate mixer and drier and the like including, a chassis, a plurality of parallel horizontally disposed elongated interconnected mixing chambers positioned on said chassis, means continuously feeding aggregate into said mixing chambers, means continuously feeding a liquefied bituminous binder to said aggregate within at least one of the mixing chambers, means continuously moving the aggregate longitudinally with respect to the mixing chambers while agitating said aggregate, said aggregate being moved in opposite directions in adjacent mixing chambers, means creating a relatively large draft of air at relatively low velocity in said mixing chambers including, air duct means, an air chamber communicating wtih said duct and with each mixing chamber, a blower discharging air into said duct means and the air flowing into the air chamber for building up static air pressure therein, a nozzle within said air chamber supplying a flame to said draft of air, whereby flame is distributed substantially uniformly throughout each of said mixing chambers, and means discharging the mixture of aggregate and binder from said chambers.

References Cited in the file of this patent

UNITED STATES PATENTS

498,957	Jardine	June 6, 1893
778,558	Truxal	Dec. 27, 1904
1,069,243	Fogler	Aug. 5, 1913
1,251,978	Levy et al.	Jan. 1, 1918
1,921,688	McLaughlin	Aug. 8, 1933
2,070,411	Powers	Feb. 9, 1937
2,103,299	Ravnsbeck	Dec. 28, 1937
2,287,897	Martin	June 30, 1942
2,305,938	Turnbull	Dec. 22, 1942
2,487,533	Eastman	Nov. 8, 1949
2,626,875	McConnaughay	Jan. 27, 1953
2,698,167	Baumgardner	Dec. 28, 1954

FOREIGN PATENTS

35,737	Denmark	Feb. 27, 1926