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Zimmerman

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[54] **SELF-CONTAINED MOBILE ASPHALT MIXING AND APPLYING APPARATUS**

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[52] **U.S. Cl.** **404/110,** 259/157

[51] **Int. Cl.** **E01c 19/12**

[58] **Field of Search** 404/110, 83, 92, 80, 108; 259/153, 157

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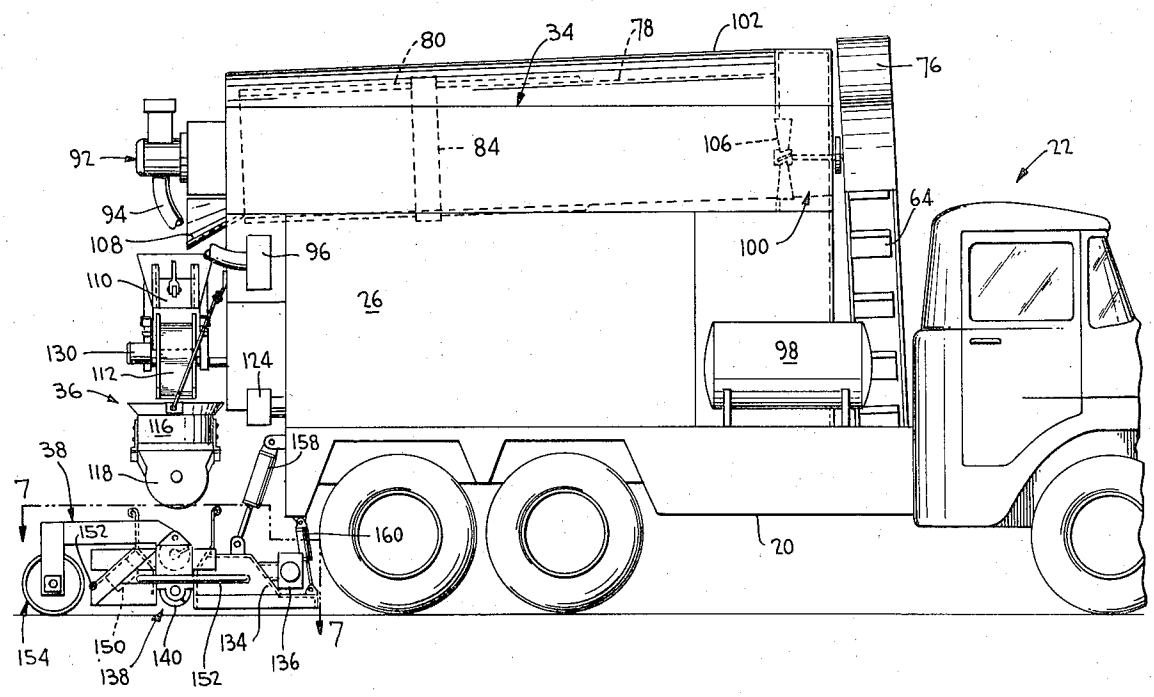
Attorney, Agent, or Firm—Holman & Stern

[57] **ABSTRACT**

A bituminous concrete mixing and applying apparatus is disclosed which is constructed in an entirely self-contained and mobile fashion whereby bituminous concrete can be mixed and applied at the job site. The apparatus comprises an elongated mobile frame, such as a truck frame, upon which storage compartments are disposed for separately storing aggregates such as sand, stone, gravel, and the like, as well as liquid bitumens, such as asphalt, tar, or the like. A conveyor means is provided beneath the storage compartments for the aggregates for conveying such aggregates out from the storage compartment through a metering device and into a heating and drying mechanism whereat the aggregates are heated, dried and agitated. The dry aggregates as well as the liquid bitumens which similarly have been heated are discharged into a discharge mechanism or hopper assembly disposed on the mobile frame whereat bituminous concrete is formed. This bituminous concrete is applied to an underlying road surface to provide a covering commonly termed macadam, blacktop, or asphalt, by means of a spreader mechanism which, in the preferred inventive embodiment, constitutes a heating chamber, a plurality of spreading auger conveyors, a vibrator, and a roller compactor. In essence, the instant invention constitutes a mobile bituminous concrete plant which can be sent directly to a job site to mix and apply the bituminous concrete.

19 Claims, 9 Drawing Figures



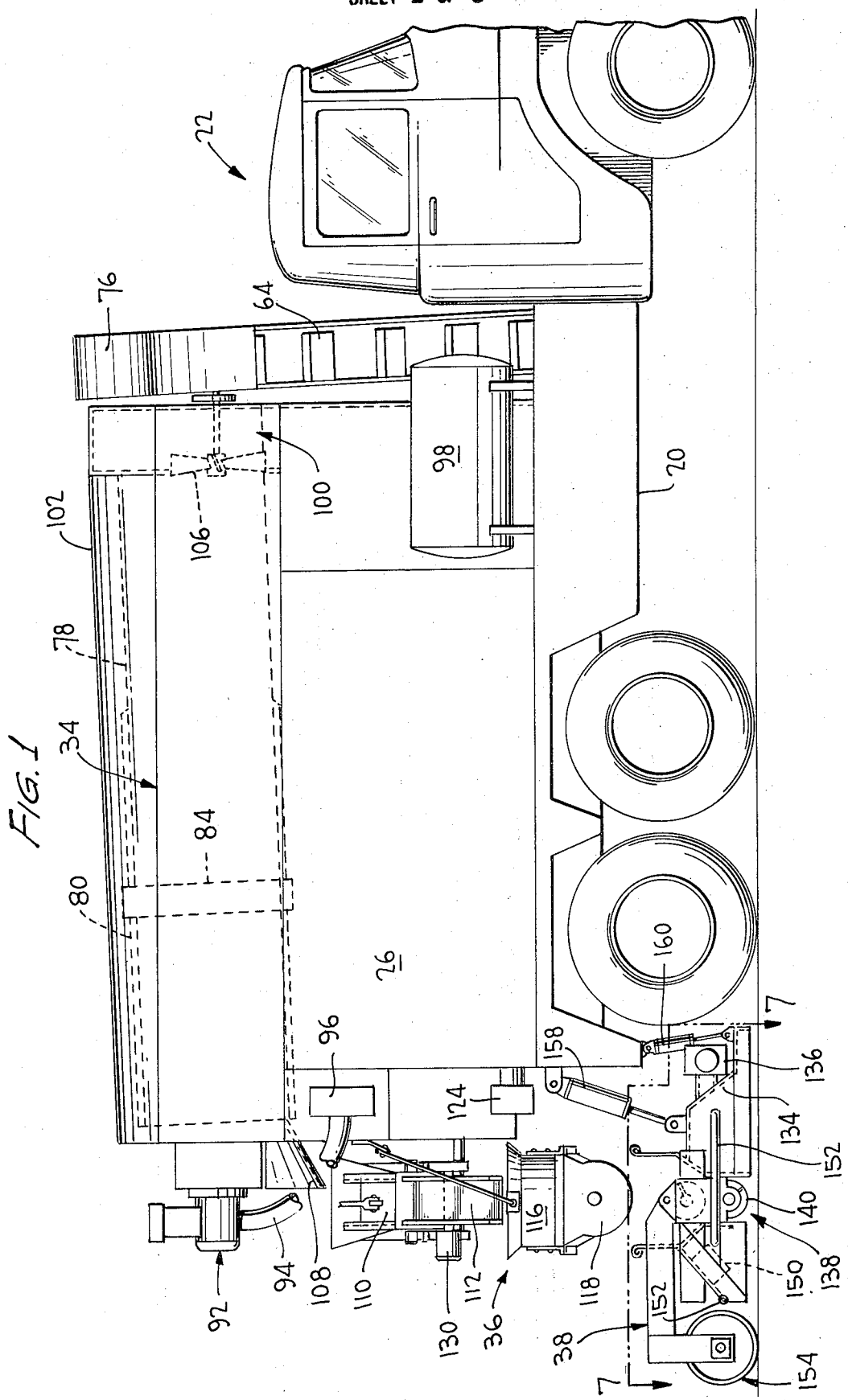

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FIG. 1

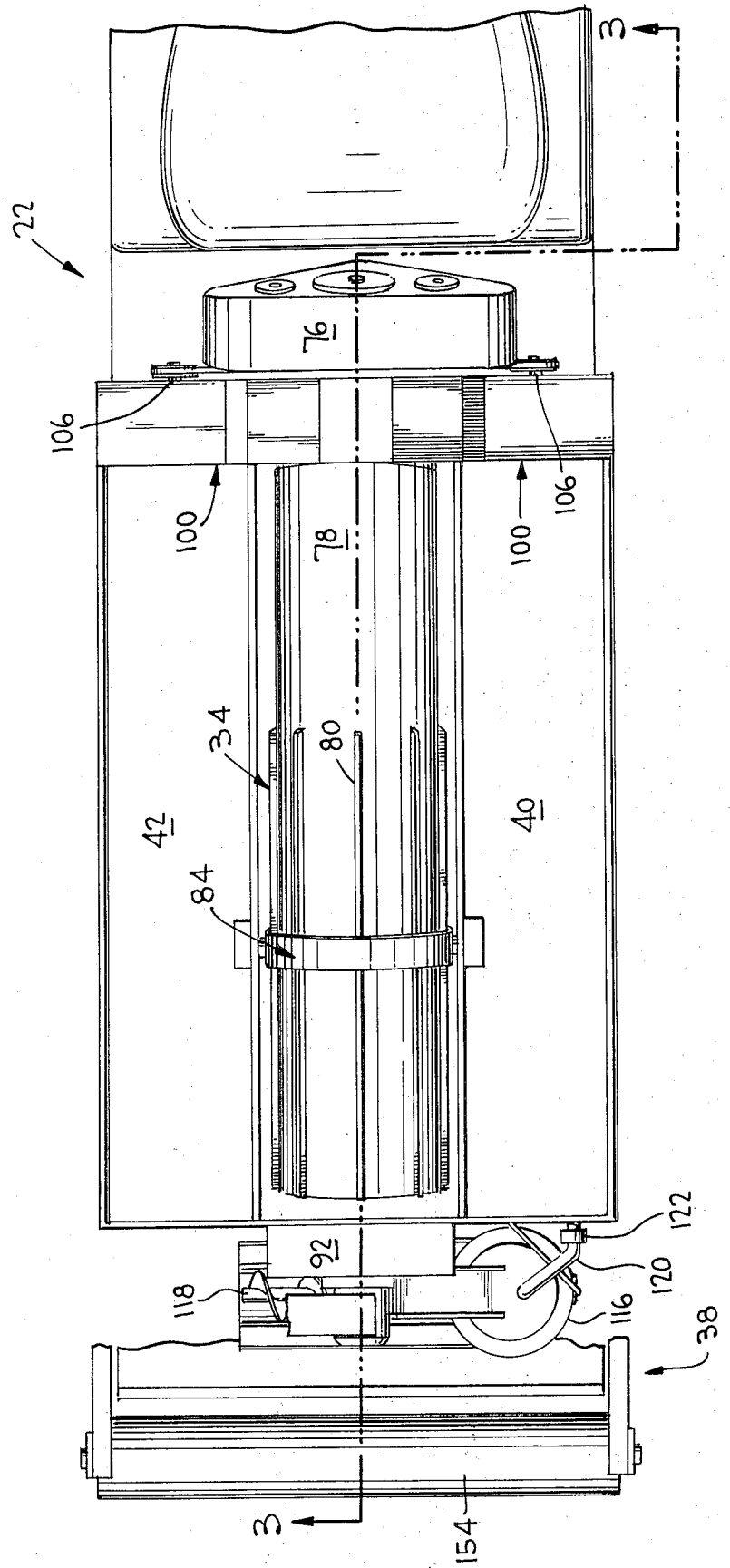

FIG. 2

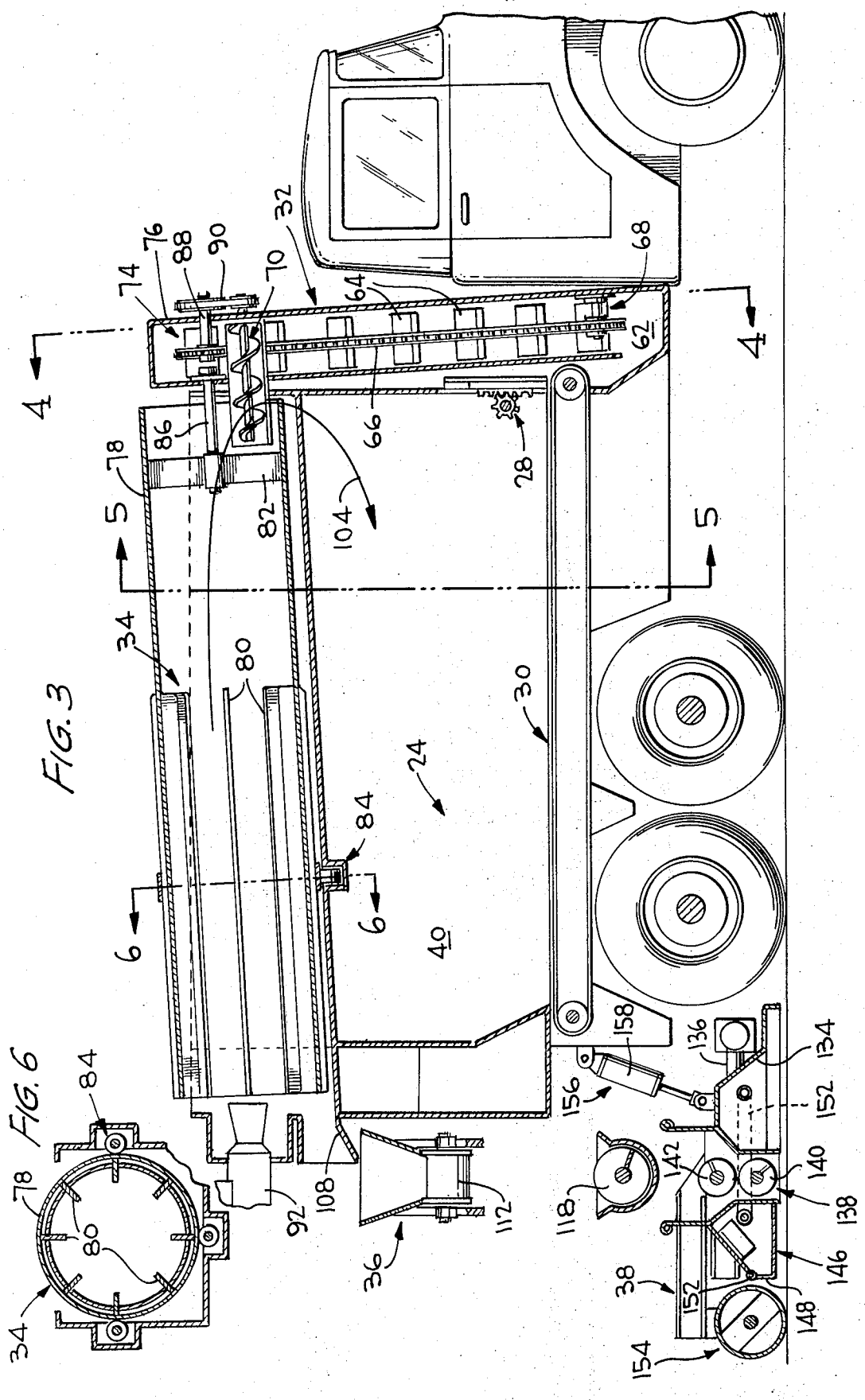
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FIG. 3

FIG. 6

FIG. 4

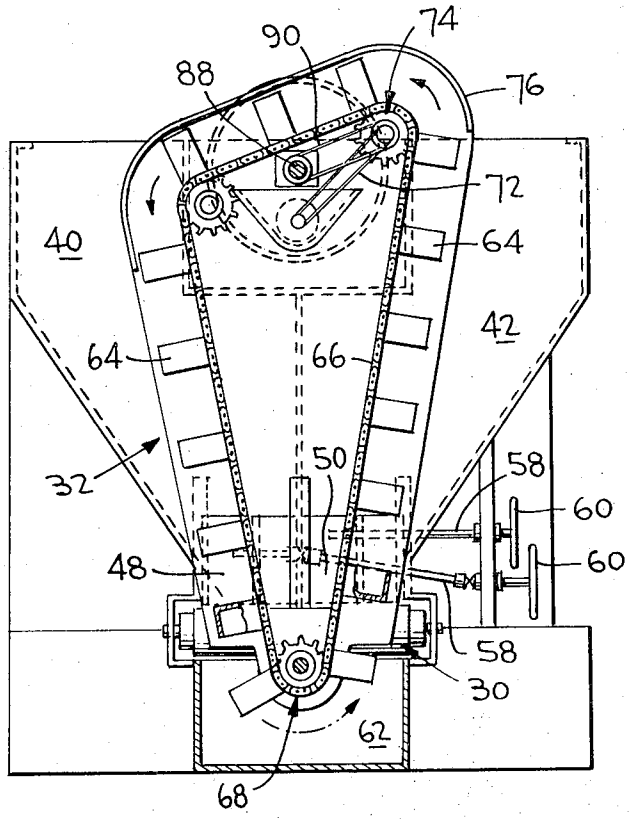
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FIG. 8

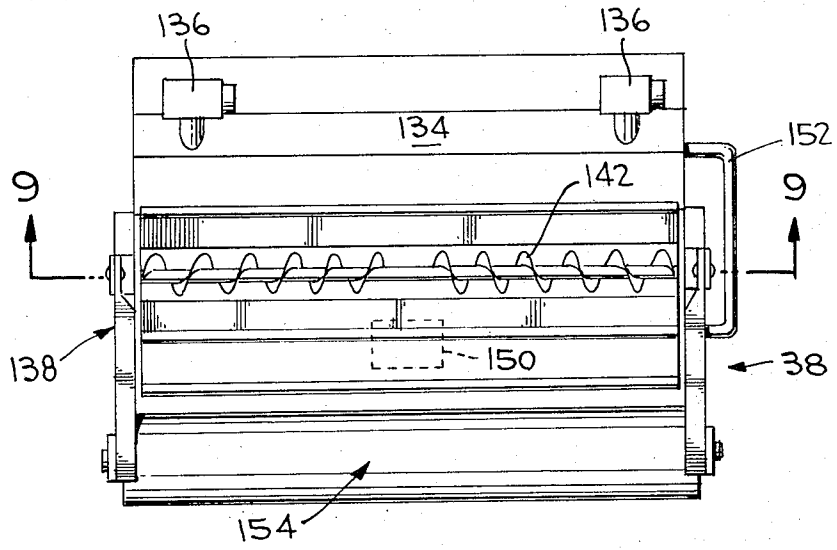
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FIG. 5

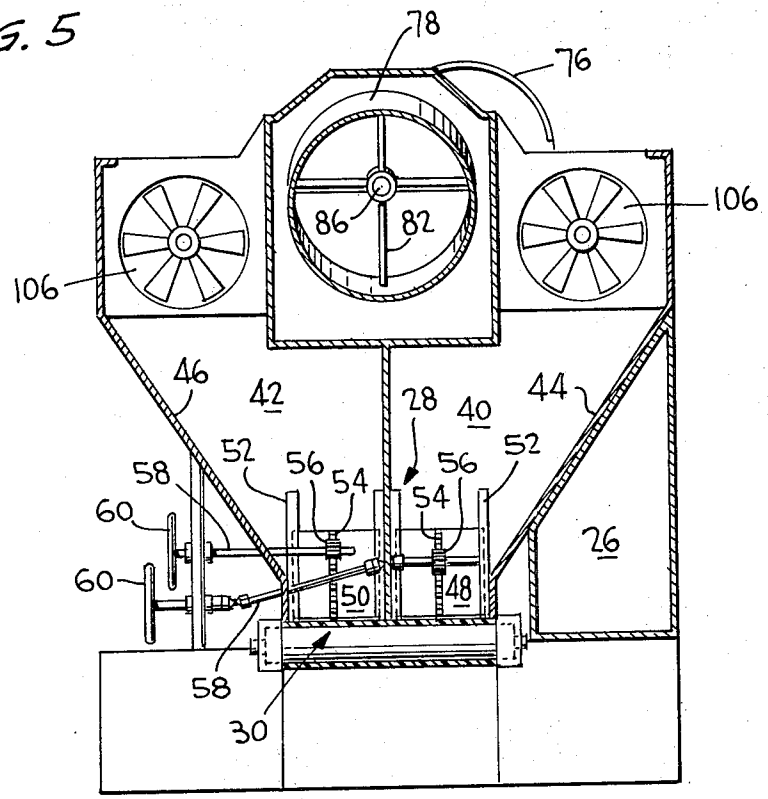
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FIG. 9

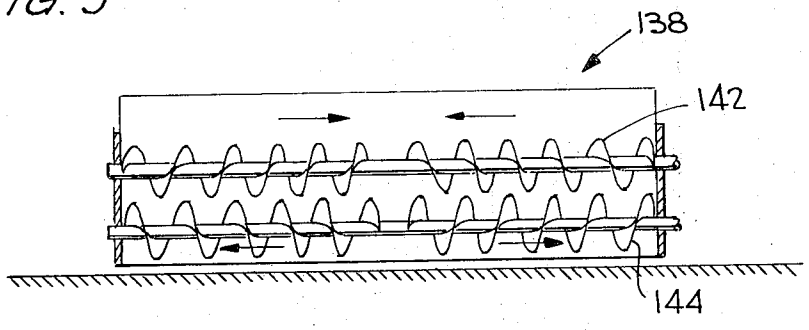
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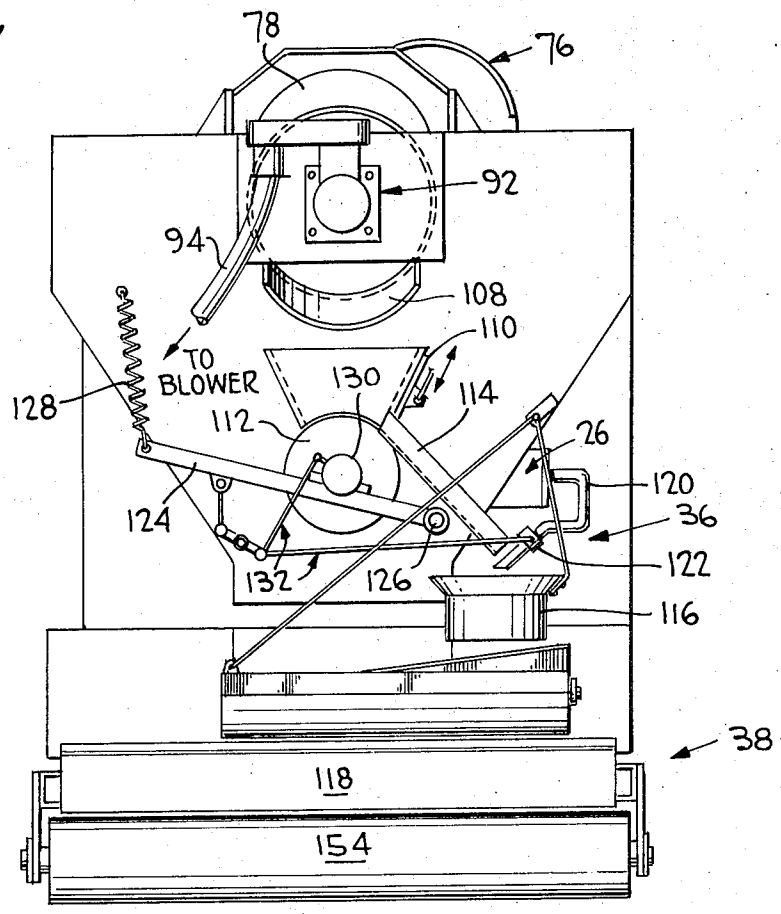
FIG. 7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SELF-CONTAINED MOBILE ASPHALT MIXING AND APPLYING APPARATUS

BACKGROUND OF THE INVENTION

This invention generally relates to paving machines and particularly concerns a self-contained, mobile bituminous concrete mixing and applying apparatus for operation directly at a job site. Bituminous concrete, as this technical term is utilized herein, relates to a resilient road surfacing material commonly designated macadam, blacktop, or asphalt, as distinguished from rigid Portland cement, concrete road surfaces having a Portland cement binder.

Numerous roadways are in existence today which, upon occasion, require the usual maintenance and repair or "patching." For large maintenance jobs amounting to resurfacing of entire roadway sections, such maintenance can economically and feasibly be effected by large paving machines. For the smaller, relatively minor maintenance jobs amounting to patching and the like, it is not feasible to provide and transport heavy roadway building equipment to effect such maintenance.

As such, most road repair jobs are effected by hand. For example, a typical procedure is to load bituminous concrete on the back of a pick-up truck or other similar vehicle and then send a crew consisting of a number of men out to the road location whereat the repair is desired. The bituminous concrete is then physically shoveled into the hole or crack in the roadway to form a repair, the bituminous concrete subsequently being manually tamped into place to complete the repair.

This manual method has its obvious disadvantages. For example, not only must a multi-member crew be provided, but the crew would have to know beforehand the amount of material that would be needed for the particular job, since the bituminous concrete, once mixed and placed upon the vehicle, cannot be maintained in a pliable state for a long period. The shortness of time that pre-mixed bituminous concrete remains pliable also makes it difficult to effect a repair at a location remote from the mixing plant requiring a relatively long driving time to reach. Additional problems are encountered, particularly when attempting to do winter repairs work. In this respect, a hot bituminous concrete repair is, of course, preferable to a cold repair due to its better adhesion properties. Yet, such a hot repair cannot readily be utilized in winter months since the hot mixed bituminous concrete, assuming it is to be available, cannot be maintained at the elevated temperature on the truck for long. It is primarily for this reason that most winter roadway repairs utilize the cold method, which is wasteful and invariably necessitates additional subsequent repair work, since a cold repair does not stand up to wear or temperature variations as well as a hot repair.

Additionally, a pre-mixed bituminous concrete batch that is taken out to the repair job may be of the same high quality and/or consistency as bituminous concrete actually mixed at the job site.

SUMMARY OF THE INVENTION

It should thus be apparent that a need exists in the road repair and resurfacing field by which the repair of roadways can be modernized and otherwise facilitated to thus eliminate the archaic manual methods now in use. It is the primary objective of the instant invention to provide an apparatus by which this need can be filled.

It is a further objective of the instant invention to provide a novel apparatus which can transport bituminous concrete ingredients in separate compartments to the job site, whereat the apparatus can automatically proportion, mix and apply bituminous concrete, thus assuring the provision of a consistent high quality bituminous concrete patch from job to job, without waste.

It is a further objective of the instant invention to provide a bituminous concrete mixing apparatus which is, in addition, capable of applying the mixed bituminous concrete automatically to the surface of the roadway to be repaired.

It is yet another objective of the instant invention to provide a bituminous concrete mixing and applying apparatus which is entirely self-contained and which is mobile, which apparatus is capable of operation with a reduced crew, such as one man.

It is another objective of the instant invention to provide an improved self-contained bituminous concrete mixing apparatus by which a hot bituminous concrete repair can be effected at any time of the year, even during the winter months.

Still another objective of the instant invention is the provision of a novel improved bituminous concrete mixing and applying apparatus by which quality repair of roadways can be achieved at low cost.

These and other objects which will become apparent as the description proceeds are implemented by the novel invention, which, as aforestated, constitutes a self-contained mobile bituminous concrete mixing and applying apparatus. In the preferred inventive embodiment, the apparatus is disposed upon a mobile frame, such as a truck, and incorporates a plurality of separate compartments for separately storing the aggregates and liquid ingredients of a bituminous concrete mix. For example, separate compartments are provided for the storage of fine and coarse aggregates, as well as for the storage of liquid bitumen, such as asphalt itself.

The aggregates are removed from the storage compartments therefor at the job site through metering gates or the like which ensures a predetermined amount and ratio of the aggregates. The aggregates are then conveyed to a heating and drying mechanism also disposed on the mobile frame, which mechanism in the preferred inventive embodiment constitutes a rotatable heating and drying drum. The aggregates are dried and are raised to a temperature of approximately 400° F. in the rotating drum mechanism and are dropped into a hopper containing a further metering mechanism from which the ingredients are discharged into a pug mill type mixing conveyor. A liquid bitumen is added to the mixing conveyor, the bitumen being separately maintained in a separate storage compartment which may be heated. The amount of dry aggregates vis-a-vis the liquid bitumen is carefully controlled by means of the metering mechanism associated with the hopper and by means of a bitumen metering device. In this fashion, bituminous concrete is provided having controlled consistency and quality.

The bituminous concrete, i.e., the mixture of the aggregates and the bitumen, is then fed into a spreader mechanism preferably carried behind the mobile frame by which the bituminous concrete is applied to the sur-

face of an underlying roadway. In the preferred inventive embodiment, the spreader mechanism constitutes a forwardly disposed heating chamber so as to heat the underlying road surface thereby assuring good adhesion for the bituminous concrete. A plurality of auger conveyors are also provided for evenly distributing the bituminous concrete over the underlying and heated surface. The distributed bituminous concrete is then settled by means of a vibrating mechanism and finally is compacted by a roller rearwardly disposed on the spreading mechanism.

The combination bituminous concrete mixing and spreading apparatus generally described above separately stores all the ingredients of the bituminous concrete so that the problems associated with premature hardening of a pre-mixed batch are entirely eliminated. Further, a predetermined amount of bituminous concrete having a controlled consistency and quality is mixed at the job site through the utilization of the apparatus of the instant invention, therefore eliminating the prior art problems of predetermining the amount of bituminous concrete that will be needed for any given job. The repair effected by the machine of the instant invention can utilize the hot technique even during winter months and, importantly, operation of the apparatus of the instant invention can be effected by one man, if so desired.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention itself will be better understood and additional features and advantages thereof will become apparent from the following detailed description of one preferred inventive embodiment, such description making reference to the appended sheets of drawings, wherein:

FIG. **1** is a side elevational view of a truck constructed to incorporate the self-contained bituminous concrete mixing apparatus of the instant invention;

FIG. **2** is a top plan view of the bituminous concrete apparatus of FIG. **1**;

FIG. **3** is a side elevational view of the apparatus of FIG. **1** partially broken away and in cross-section for illustrative clarity;

FIG. **4** is a front elevational view of the apparatus of FIG. **3** taken along lines **4—4** thereof;

FIG. **5** is an elevational view in section of the apparatus of FIG. **3** taken along lines **5—5** thereof;

FIG. **6** is an elevational view in section of the portion of the apparatus of the instant invention taken along lines **6—6** of FIG. **3**;

FIG. **7** is a rear elevational view of the bituminous concrete apparatus depicted in FIG. **1**;

FIG. **8** is a top plan view of the bituminous concrete spreading mechanism carried behind the apparatus as depicted in FIGS. **1** and **3** of the drawings; and

FIG. **9** is an elevational view, in section for clarity, of the auger or spreading conveyor of the bituminous concrete spreading apparatus depicted in FIG. **8**, taken along lines **9—9** thereof.

DETAILED DESCRIPTION OF A PREFERRED INVENTIVE EMBODIMENT

Referring now to the drawings, and particularly to FIG. **1** thereof, the novel bituminous concrete apparatus of the instant invention can be seen disposed upon the bed or mobile frame **20** of a truck generally designated by the reference numeral **22.** The bituminous concrete apparatus comprises a first storage means generally designated by the reference numeral **24** for storing coarse and fine aggregates such as sand and gravel, and a second storage means generally designated by reference numeral **26** for storing liquid bitumen, such as liquid asphalt or tar. The aggregates within the first storage means **24** are removed and dispensed therefrom through a first metering means generally designated by reference numeral **28** (see FIG. **3**) via a conveyor mechanism having a first substantially horizontal section generally designated by reference numeral **30** and a second substantially vertical section generally designated by reference numeral **32,** into a heating and drying means generally designated by reference numeral **34** wherein the aggregates are dried and are raised to an elevated temperature and transported towards the rear or left-hand side of the apparatus as viewed in FIGS. **1** and **3.** The aggregates are then dispensed into a hopper generally designated by reference numeral **36** containing a further metering mechanism from which the aggregates are discharged into a pug mill type mixing means **116 - 118** into which the bitumen is likewise metered so as to form bituminous concrete therein of controlled quality and consistency. The bituminous concrete so formed is then discharged into a spreading means generally designated by reference numeral **38** disposed rearwardly of the mobile frame, spreading means **38** depositing the bituminous concrete onto the surface of the underlying roadway so as to effect a proper repair of the roadway.

In the preferred inventive embodiment, the first storage means generally designated by reference numeral **24** comprises a plurality of separate compartments such as compartments **40** and **42** as can best be seen from the top plan view of the apparatus depicted in FIG. **2.** Each of the compartments **40** and **42** define substantially rectilinear chambers with the outside walls **44** and **46** thereof (see FIG. **5**) being downwardly and inwardly inclined much in the manner of a hopper. Separate coarse and fine aggregates, such as sand and gravel or the like, are separately stored within each of the individual storage compartments **40** and **42.** Loading takes place from the top of the compartments as shown in FIGS. **2** and **5.**

The bottom sides of each of the separate storage compartments **40** and **42** are open and are disposed immediately above an elongated substantially horizontal conveyor section generally designated **30,** which conveyor **30** can, for example, comprise a belt conveyor driven in a clock-wise manner when viewing FIG. **3** by any suitable drive mechanism which has not been illustrated for purposes of illustrative clarity. In this respect, the drive mechanism **30** could be coupled via a gearing arrangement to the substantially vertically disposed conveyor section **32** to be described hereinbelow.

Due to this construction, the aggregates such as sand and gravel rest directly upon the surface of the horizontal conveyor section **30** and, in operation thereof, the aggregates are carried forwardly towards the front or right-hand side of the apparatus as viewed in FIGS. **1** and **3.** The actual amount and the ratio of the various aggregates that are dispensed from the storage compartments **40** and **42** is controlled by a first metering means generally designated by reference numeral **28.** Attention is directed to FIG. **5** of the drawings wherein the detailed construction of the first metering means **28** can be seen. In the preferred inventive embodiment,

the first metering means **28** comprises vertically slidable gates **48** and **50** respectively associated with compartments **40** and **42.** The vertically slidable gates **48** and **50** are disposed within channels or guides **52** and the vertical position of the respective gates **48** and **50** and thus the degree or amount of opening of the gates can readily be controlled.

For example, and in the preferred inventive embodiment, each of the gates **48** and **50** have a gear rack **54** associated therewith, each gear rack **54** being coupled to pinion gears **56** disposed on shafts **58** which can be rotated by the external hand wheels **60.** It should further be noted that the shaft **58** of the control mechanism for gate **48** is a flexible shaft, though it should be appreciated by those skilled in the art that other control mechanisms could readily be substituted for that specifically depicted in FIG. **5** of the drawings.

Thus, through rotation of the individual hand wheels **60,** the amount and ratio of the aggregates, such as sand and gravel, that is dispensed from the individual or separate compartments **40** and **42** can volumetrically be controlled.

The aggregates thus dispensed by the horizontal conveyor section **30** are discharged from conveyor section **30** into a trough or well **62** disposed forwardly of the apparatus. From this trough or well **62,** the discharged aggregates are carried upwardly by the substantially vertical conveyor section **32.** In the preferred inventive embodiment, conveyor section **32** comprises a bucket conveyor which incorporates a plurality of buckets such as designated by reference numeral **64** disposed upon a chain **66,** the chain **66** and thus the conveyor section **32** being driven by a gearing arrangement **68** which may constitute a power-takeoff from the truck upon which the bituminous concrete apparatus is mounted. The conveyor section **32** therefore serves to lift and carry upwardly the aggregates dispensed into the trough or well **62** from the individual storage compartments **40** and **42.** At the top of the conveyor **32,** the lifted aggregates are discharged into an underlying auger or screw generally designated by reference numeral **70.** The auger or screw **70** serves to carry the discharged ingredients rearwardly, i.e., from right to left when viewing FIGS. **1** and **3,** for example, into a heating and drying means **34** whereat the aggregates are dried and are raised to an elevated temperature as will be further described. The auger or screw **70** can be driven directly from the conveyor **32** by means of a chain or belt drive **72** as is depicted in FIG. **4,** the chain or belt **72** being disposed about an idler pulley **74** as is indicated. In the preferred inventive embodiment, the substantially vertical conveyor section **32** is covered by a shroud **76** and it should further be noted that conveyor section **32** makes a slightly acute angle with the vertical, i.e., leans towards the rear of the apparatus so as to facilitate discharge of the aggregates into the heating and drying means **34** and so as to facilitate the mechanical gearing and other coupling arrangements between the heating and drying means **34,** as will be described.

The function of the heating and drying means **34** is to dry and to raise the temperature of the aggregates deposited therein to approximately 400° F. and further to convey or transport the aggregates towards the rear of the apparatus for subsequent discharge. To this end, the heating and drying means of the instant invention in the preferred embodiment thereof will be seen to constitute an elongated hollow drum **78,** preferably constructed of steel and being reinforced with a plurality of ribs **80** which further extend into the interior of the hollow drum, and by a forwardly disposed cross-brace **82.** The hollow drum **78** is rotatable and is journalled for rotation at its rearward end by a journal bearing generally designated by reference numeral **84.** At the forward end of the elongated hollow drum **78,** a shaft **86** is attached to the cross-brace **82,** the shaft being journalled as at reference numeral **88** and being coupled for driving rotation to the idler pulley **74** of the substantially vertical conveyor section **32** by a chain or belt drive **90.** Therefore, as the substantially vertical conveyor section **32** is operated, rotation of the elongated hollow drum **78** is effected.

Disposed at the rear end of the hollow rotating drum **78** is a heating source, such as a forced air oil burner generally designated by reference numeral **92.** A source of air is coupled to the burner **92** by a line **94** as depicted in FIG. **7,** which line runs to a blower **96** disposed on the side of the apparatus as is depicted in FIG. **1.** A non-illustrated oil line for supplying the burner **92** is coupled to an oil tank **98** also disposed on the mobile frame or bed **20** of the truck **22.** Of course, fuel other than oil can be utilized to effect operation of the burner **92.** The heated air from the heating mechanism or burner **92** passes through the hollow rotating drum **78** from the rear towards the front thereof, the rotation of the drum particularly in conjunction with the protruding vanes or fins **80** serving to agitate the aggregates so as to effect a more even heating thereof and serving to transport or convey the aggregates from the front of the drum towards the rear thereof. To this end, and so as to assist in this transport process, it should be noted that the hollow drum **78** is not disposed exactly on the horizontal in the preferred inventive embodiment, but is slightly inclined from front to rear to effectively make a right angle with the substantially vertical conveyor section **32.**

The hot air blown into the rotating drum **78** is discharged through an air channel means **100** communicating between the hollow drum **78** and each of the storage compartments **40** and **42.** The air channel means **100** is partially formed by internal duct work leading to each of the storage compartments **40** and **42** and is further formed by a shroud or cover **102** which runs the length of the elongated hollow drum **78** and is disposed immediately above. Air flow into the drum **78** therefore follows arrow **104** as can best be seen in FIG. **3** into each of the storage compartments **40** and **42,** which air flow serves to pre-dry the ingredients in the compartments and settles any dust that may occur through operation of the rotating drum **78.** This air flow can be further assisted by the provision of fans **106** in the channel means communicating between each of the compartments **40** and **42** and the hollow rotating drum **78.** The drive for each of the fans **106** can be taken off the various gears provided for the substantially vertical conveyor **32** which, as has been described, is itself driven from the power takeoff **68** of the truck.

The now-heated aggregates moving rearwardly through the hollow rotating drum **78** are discharged therefrom through an outlet **108** provided at the rear end thereof into a hopper assembly **36** as can best be seen from a review of FIGS. **1, 3,** and **7.** The aggregates discharged into the hopper assembly **36** are dispensed

or metered therefrom by the provision of a further gate **110** in association with a rotating drum or conveyor **112** which is contemplated to rotate in a clock-wise direction as appears in FIG. **7.** Thus, the heated aggregates discharged into the hopper assembly onto the rotating conveyor **112** are dispensed from the hopper assembly through the slidable gate **110,** whereby the aggregates fall down a chute **114** into a pug mill type mixing means defined by a funnel mechanism **116** and an underlying lateral conveyor or auger **118** to be described hereinbelow. Also discharged into the funnel mechanism **116** and thereafter into the lateral conveyor **118** is the liquid bitumen which has been stored in storage compartment **26** and discharged through a pipe **120** through a metering valve **122** as can be seen in FIG. **7.** Further, the liquid bitumen within the storage compartment or tank **26** may likewise have been raised to an elevated temperature through the provision of a further oil burner **124'** which is fueled from the general supply tank **98.**

The ratio of the dry ingredients to the liquid ingredients discharged into the lateral conveyor or auger **118** can closely be controlled whereby the consistency and quality of the asphalt formed can be selected. In this respect, is should be noted that the hopper assembly and underlying rotating wheel or drum **112** are mounted on a pivotally disposed and spring-loaded lever or support arm **124.** Specifically, the support arm **124** is pivoted to the truck frame around bearing **126** and the other end of support arm **124** is coupled to the body of the truck by a spring mechanism **128.** In this fashion, the entire hopper assembly will move downwardly as aggregates accumulate therein, and, when empty, the hopper assembly would move upwardly, must as is shown in FIG. **7.** This movement of the hopper assembly and specifically of the lever or support arm **124** can be monitored as an indication of the amount of aggregates discharged from the heater and drying means **34.** To this end, it should be noted that operation of the rotating conveyor **112** is effected by an electric motor **130** which itself is controlled through mechanical linkage generally designated by reference numeral **132** coupled to the lever arm **124.** Thus, as the lever arm **124** swings downwardly, i.e., counterclockwise about its pivot **126** when viewing FIG. **7,** the electric motor **130** will be turned on by the linkage means **132.** Similarly, when the hopper assembly is empty, the electric motor **130** will be turned off, thus effecting a selective control over the rotation of the conveyor **112.**

The metering means or valve **122** disposed in the line **120** through which the liquid bitumen is discharged is likewise controlled via the mechanical linkage **132** by the position of the support or lever arm **124.** Thus, when the conveyor **112** is in operation effecting discharge of aggregates down the chute **114** into the funnel **116,** a controlled amount of liquid bitumen is likewise being dispensed or metered into the funnel **116.** Additional control over the quality and consistency of the bituminous concrete being produced can be effected by operation of the gate **110** controlling the volume amount of aggregates dispensed, as has been mentioned above. Of course, and as should be apparent to those skilled in the art, various other synchronization mechanisms can be utilized in place of the mechanical linkage **132** so as to control the aggregates and liquid bitumen dispensed into the funnel **116.**

The ingredients dispensed into funnel **116,** both wet and dry, are mixed in the lateral conveyor or auger **118** to thereby form what is termed herein bituminous concrete. Of course, it should be appreciated that the operation of the apparatus as abovedescribed can essentially be continuous until the supply of bituminous concrete can be produced so as to fit the requirements of the particular job at hand. From the lateral auger or conveyor **118,** the bituminous concrete is dispensed into a spreading means **38** disposed at the rear of the mobile frame **30** and carried along behind.

The spreading means or aparatus **38** comprises a heat chamber means **134** disposed forwardly of the mechanism to which is coupled an additional oil burner or other heater **136,** also fueled from the fuel supply tank **98.** In this fashion, the surface of a roadway underlying the spreading means or mechanism **38** can be heated. In the preferred inventive embodiment, two such burners or heaters **136** are provided to either side of the apparatus as can best be seen from a review of FIG. **8.**

The lateral conveyor means generally designated by reference numeral **138** is disposed rearwardly of the heat chamber means **134** for receiving the bituminous concrete from the lateral auger or screw conveyor **118** and for evenly distributing the bituminous concrete over the heated underlying road surface. The detailed construction of the lateral conveyor means **138** is best illustrated in FIG. **9** of the appended drawings, the lateral conveyor means comprising in the preferred embodiment two elongated augers **140** and **142** disposed one above the other, with auger **144** conveying the bituminous concrete outwardly towards either side of the apparatus and with auger **142** conveying the bituminous concrete inwardly from either side of the apparatus towards the center thereof. In this fashion, the even distribution of the bituminous concrete over the underlying roadway is assured.

A vibrator means generally designated by reference numeral **146** is disposed rearwardly of the conveyor means **138** for settling the distributed bituminous concrete. Specifically, and in the preferred inventive embodiment, the vibrating means **146** will be seen to comprise a triangularly shaped plate defining an inner chamber, to which plate a vibrator **150** is attached. It should further be noted that a hollow tube or duct **152** communicates between the interior of the heat chamber means **134** and the vibrator chamber **146** so as to further heat the bituminous concrete being settled, thus further assuring good adhesion properties and preventing the bituminous concrete from sticking to the chamber. The plate **148** of the vibrating means **146** is preferably hingeably mounted such as at pivot point **152.**

A compacting means generally designated by reference numeral **154** is disposed at the rear of the spreader means **38** for compacting the now settled bituminous concrete. In the preferred inventive embodiment, the compacting means **154** constitutes a weighted roller, as is shown.

The spreader means **38,** or perhaps more accurately the mechanism for actually applying the bituminous concrete to the underlying roadway, is attached to the rear of the truck **22** by mounting means generally designated by reference numeral **156.** In the preferred inventive embodiment, such mounting means constitutes a triangular mount defined by three hydraulic cylinders. In the preferred inventive embodiment, a cylinder such a cylinder **158** is disposed to either side of the

spreader apparatus **38.** In addition a cylinder such as cylinder **160** is disposed centrally of the spreading apparatus **38,** the hydraulic cylinders coupling the spreader apparatus to the mobile frame **20** of the truck **22** in a fashion such that the height of the spreader means **38** above the ground as well as its angle relative to the underlying ground surface can readily be controlled. Of course, the rear of the spreader means **38** is supported by virtue of the compacting means or roller **154.**

For illustrative clarity, a number of details of construction of the instant invention have not been illustrated in the drawings, though the fabrication of same can readily be effected by those skilled in the art. For example, each of the various burners or heaters provided are contemplated to have associated therewith electrical temperature sensors so that the temperatures thereof can carefully be controlled. Further, the positioning of the various metering gates above-described can be controlled through various well-known hydraulic means and, to this end, the novel invention is contemplated to include, if desired, hydraulic pump and suitable automatic controls therefor coupled to the power takeoff of the truck. Similar automatic controls and gearing can be provided to control the relative speeds of the various conveyors and the like so that the entire operation of the bituminous concrete producing apparatus can be automated.

Having now described in detail the preferred constructional features of the instant invention, a brief summary of the salient features thereof herein will prove to be helpful in coalescing the understanding thereof of a person of ordinary skill in this art. The novel invention has been seen to comprise a self-contained mixing apparatus which is disposed upon an elongated mobile frame such as a truck body. Separate storage compartments are disposed on the frame for separately storing the aggregates and the liquid bitumen. A conveyor means is provided for conveying the aggregates from the various storage compartments therefor forwardly to the front end of the mobile frame, and upwardly from the front end of the frame into a heater and drying means for heating and drying the aggregates which is disposed above the storage compartments along subsantially the length of the frame. The heater and drying means incorporates an agitator means or vanes serving to move the aggregates heated therein from the front of the frame to the rear thereof, whereat the heated agregates are discharged into a discharge means disposed at the rear of the frame. The heated aggregates are now dropped downwardly into a mixing means into which the liquid bitumen is also dispensed, the amount of ingredients dispensed into the mixing means being carefully controlled and metered so as to form bituminous concrete. In the preferred inventive embodiment, this bituminous concrete is then spread and applied to the underlying roadway by means of a separate, though associated, apparatus which serves to first heat the underlying roadway, spread the bituminous concrete, settle the bituminous concrete, and compact same. The entire apparatus, as above-stated, is mobile and can readily be transported to the scene or site of a repair job, and operation of the apparatus can readily be effected by a minimum crew, thus resolving many problems that have faced the prior art.

It should be apparent from the foregoing detailed description that the objects set forth hereinabove have been successfully achieved. Moreover, while there has been shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims. Accordingly,

What is claimed is:

1. A self-contained bituminous concrete mixing apparatus comprising, in combination:

an elongated mobile frame;

a plurality of storage compartments disposed on said frame for separately storing aggregate and liquid bitumen;

an elongated hollow rotatable drum and a burner therefor disposed on said frame and defining means for heating and drying the aggregates, said drum being provided with agitator means therein for moving aggregates through the drum from one end thereof to the other during rotation of said drum;

means for effecting rotation of said drum;

conveyor means disposed on said frame adjacent said aggregate storage compartment for transporting aggregates from said compartment into said one end of said hollow drum;

receiving means disposed on said frame adjacent said other end of said hollow drum for receiving the heated and dried aggregates from said hollow drum and for discharging same;

mixing means disposed on said frame beneath said receiving means into which is discharged the heated and dried aggregates; and

means coupled to said liquid bitumin storage compartment for discharging liquid bitumen into said mixing means;

said mixing means effecting a mixing of the aggregates with the liquid bitumen to therein form bituminous concrete.

2. An apparatus as defined in claim **1,** wherein a plurality of compartments are provided for separately storing a plurality of different aggregates, and wherein metering means are operatively associated with said compartments so as to discharge to said conveyor means predetermined amount and ratio of said different aggregates.

3. An apparatus as defined in claim **2,** wherein the aggregates are coarse and fine, said apparatus further including an additional heater means for maintaining the bitumen within said storage compartment therefor at an elevated temperature.

4. An apparatus as defined in claim **1,** wherein said burner is disposed at an end of said drum, and wherein said drum is tilted from front to rear whereby the aggregates within the drum are more readily moved from the front of the drum to the rear thereof.

5. An apparatus as defined in claim **4,** further including a spreader means for spreading and compacting the bituminous concrete on a road surface.

6. An apparatus as defined in claim **1,** wherein said storage compartments include a plurality of separate chambers for separately storing aggregates disposed substantially along the length of the frame in a location to either side of and substantially immediately below said hollow drum defining said heater means, said conveyor means including an elongated substantially hori-

zontal section disposed immediately below said separate chambers for feeding the aggregates therein in a direction toward the front of said mobile frame, and controllable gate means in association with said horizontal section of said conveyor to meter the amount of aggregates removed from each of said separate chambers.

7. An apparatus as defined in claim **6,** wherein said conveyor means further includes a vertical section defined by a bucket conveyor for carrying aggregates discharged by said horizontal section upwardly and into said hollow drum.

8. An apparatus as defined in claim **1,** wherein said burner associated with said hollow drum defining said heater means is a forced air burner effecting a flow of heated air through said hollow drum and about the aggregates therein.

9. An apparatus as defined in claim **8,** further including air channel means communicating between said hollow drum and each of said storage compartments for storing the aggregates for effecting flow of air from said drum into said storage compartments whereby the aggregates within said storage compartments are further dried and whereby dust within said storage compartments is settled.

10. An apparatus as defined in claim **9,** further including an additional blower means disposed in said air channel means, said additional blower means aiding the air flow into said storage compartments for storing the aggregates.

11. An apparatus as defined in claim **1,** wherein said receiving means includes a hopper for receiving the heated aggregates from said drum, and a first dispensing means for controlling the amount of aggregates discharged from said hopper into said mixing means, wherein a second dispensing means is provided for controlling the amount of liquid bitumen discharged from said storage compartment therefor into said mixing means, and wherein means are provided to synchronize said first and second dispensing means.

12. An apparatus as defined in claim **11,** wherein said mixing means comprises an auger conveyor.

13. An apparatus as defined in claim **11,** wherein said first dispensing means comprises a conveyor disposed at the bottom of said hopper for carrying aggregates therein towards a discharge point whereat metering gates are provided, the speed of said conveyor, the closure of said gates, and the amount of liquid bitumen discharged by said second dispensing means being correlated.

14. An apparatus as defined in claim **13,** wherein said synchronizing means includes means to sense the weight of the aggregates within said hopper to control operation of said rotary conveyor and said second dispensing means.

15. A mobile apparatus for applying bituminous concrete to an underlying road surface, said apparatus comprising, in combination:

heat chamber means disposed forwardly of said apparatus for heating the underlying road surface;

lateral conveyor means disposed rearwardly of said heat chamber means for receiving bituminous concrete and evenly distributing same over the heated underlying surface;

hopper means disposed over and in feeding relation to said lateral conveyor for receiving bituminous concrete from some external source;

vibrator means disposed rearwardly of said conveyor means for settling the distributed bituminous concrete;

compacting means disposed at the rear of said apparatus for compacting the settled bituminous concrete; and

mounting means disposed forwardly of said apparatus for attachment of said apparatus to a separate motorized vehicle.

16. An apparatus as defined in claim **15,** further including means to heat said vibrator means.

17. An apparatus as defined in claim **16,** wherein a heating duct is disposed from said heat chamber means to said vibrator means.

18. An apparatus as defined in claim **15,** wherein said lateral conveyor means comprises two elongated augers disposed one above the other, one of said augers conveying the bituminous concrete outwardly toward either side of the apparatus toward the center thereof.

19. An apparatus as defined in claim **18,** wherein said compacting means comprises a roller, said roller supporting said apparatus on the underlying surface.

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