

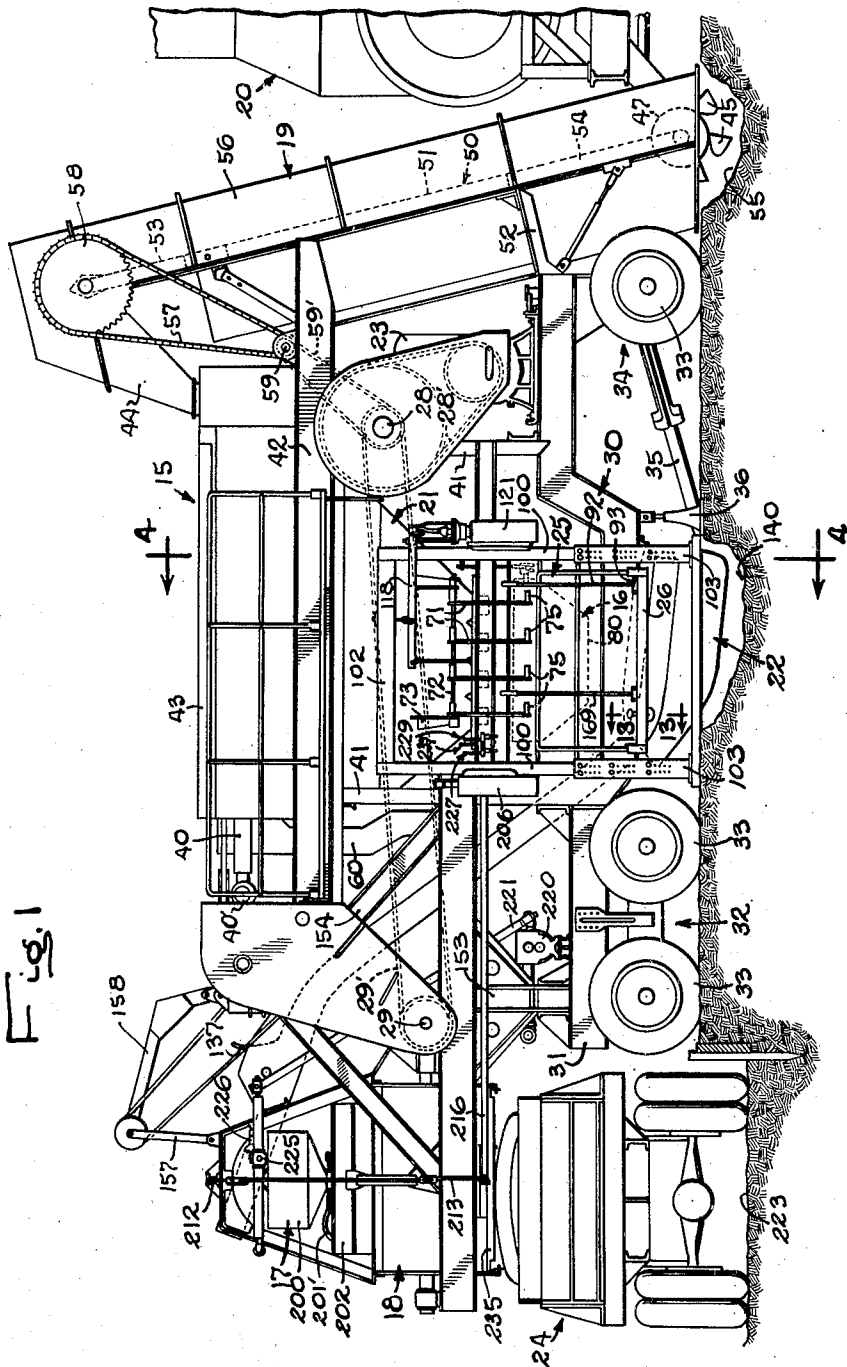
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H. C. POLLITZ
PORTABLE MIXING PLANT

2,493,898

Filed April 23, 1947

7 Sheets-Sheet 1



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7 Sheets-Sheet 4

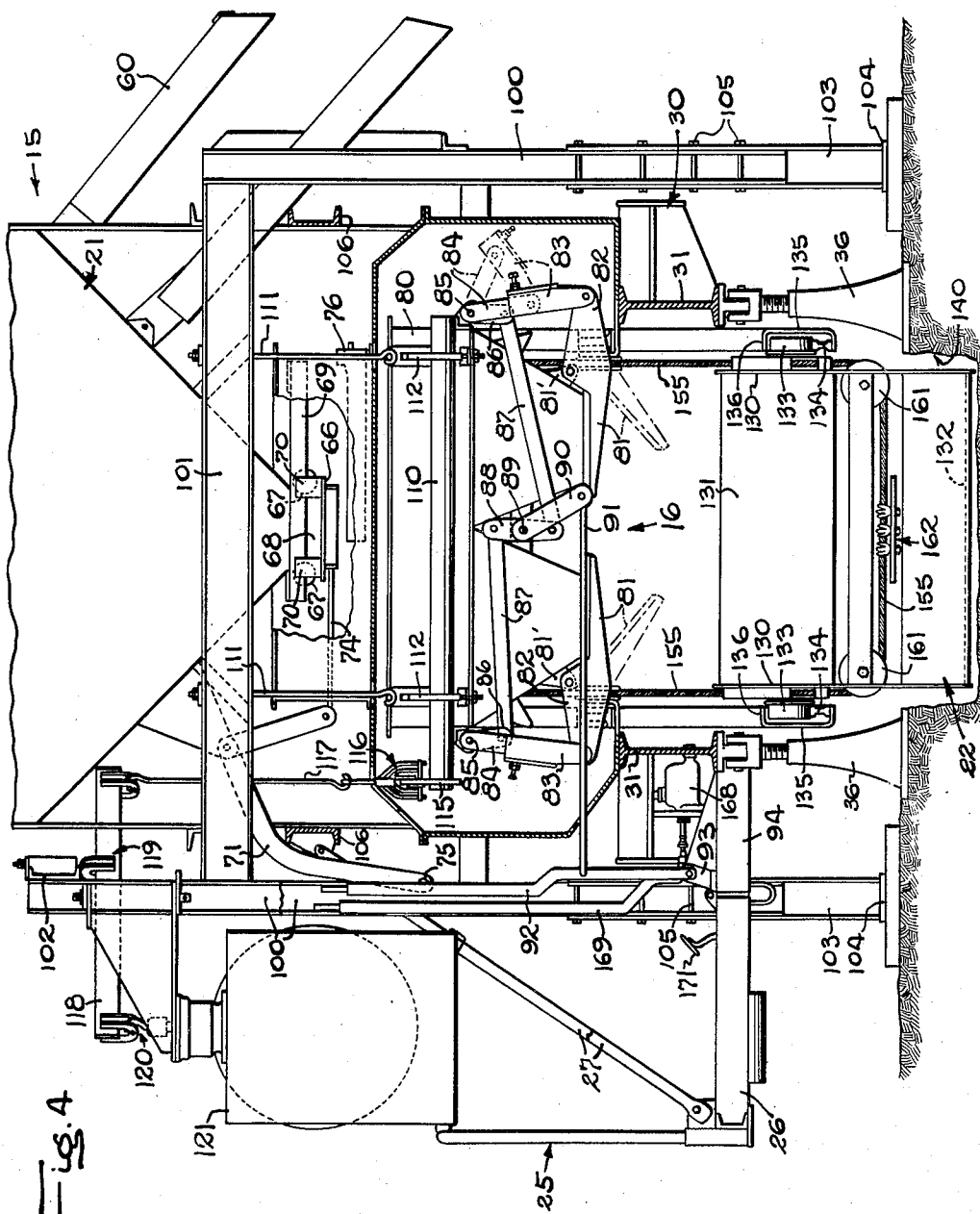


Fig. 4

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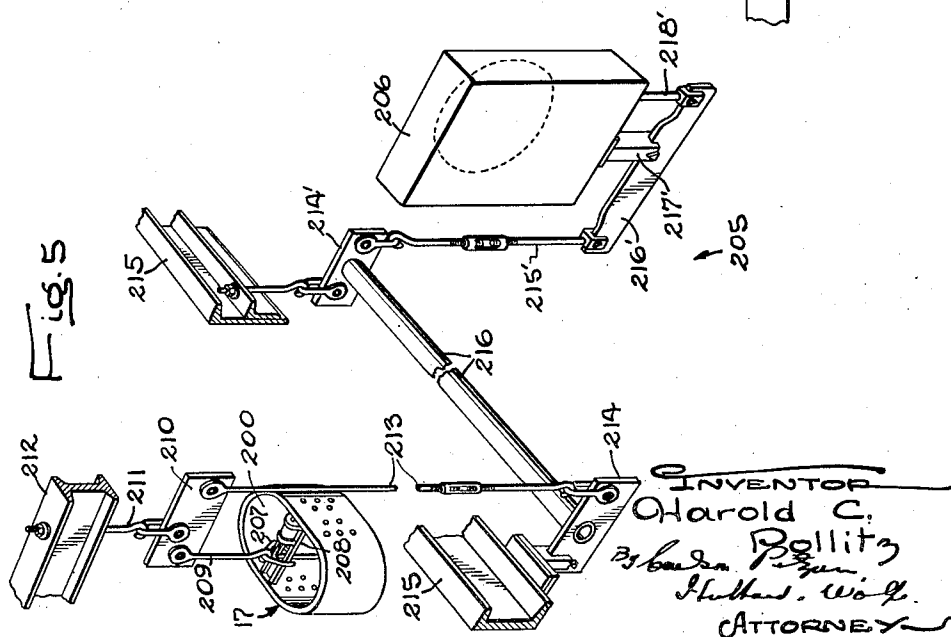
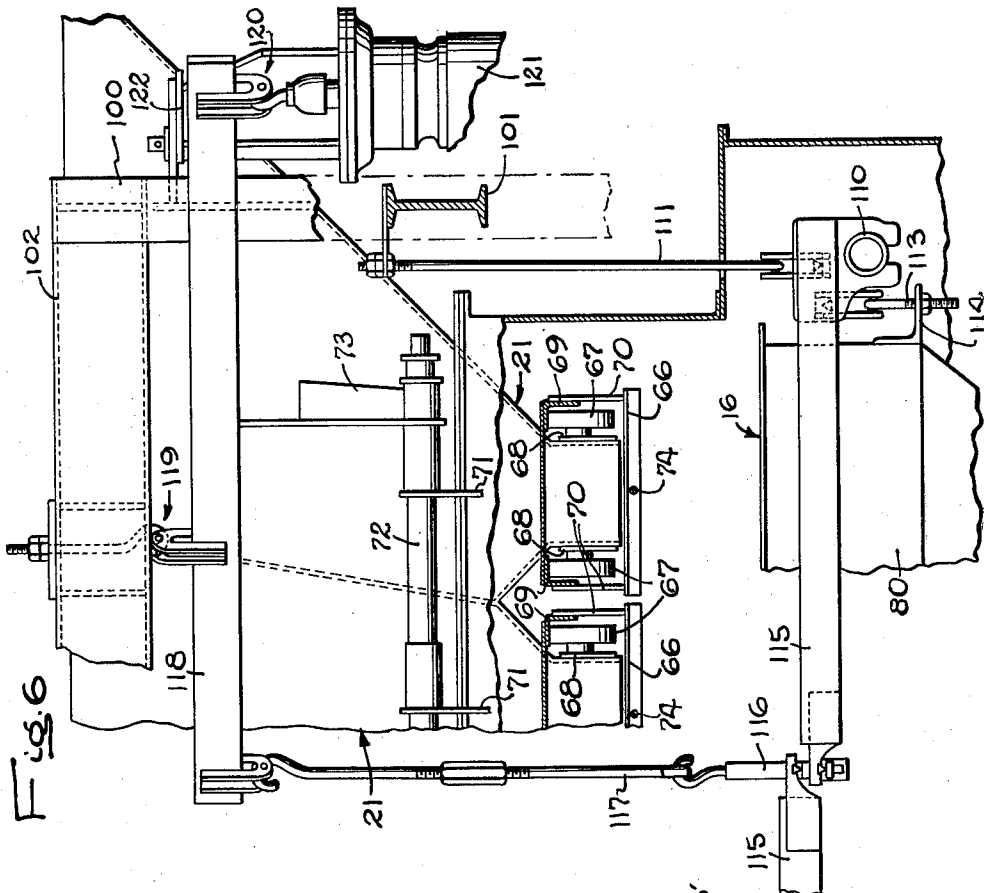
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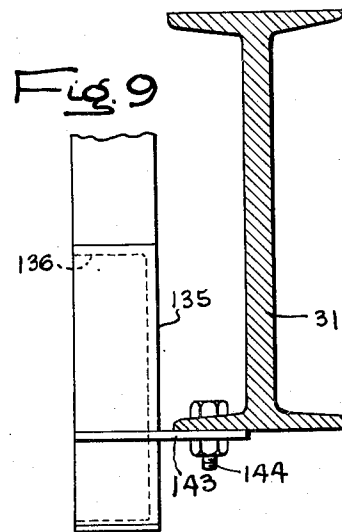
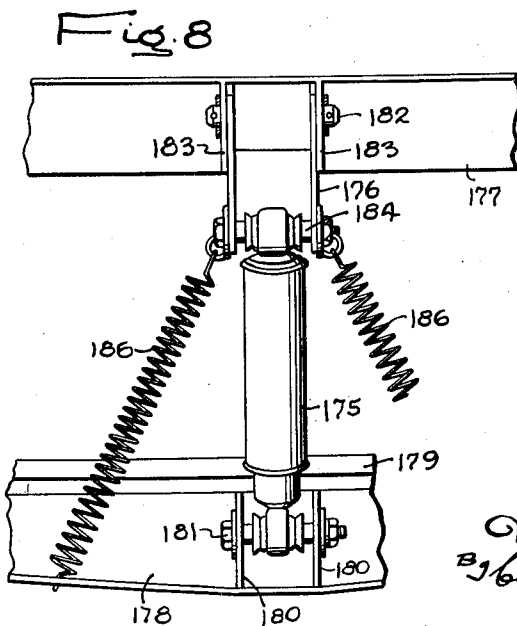
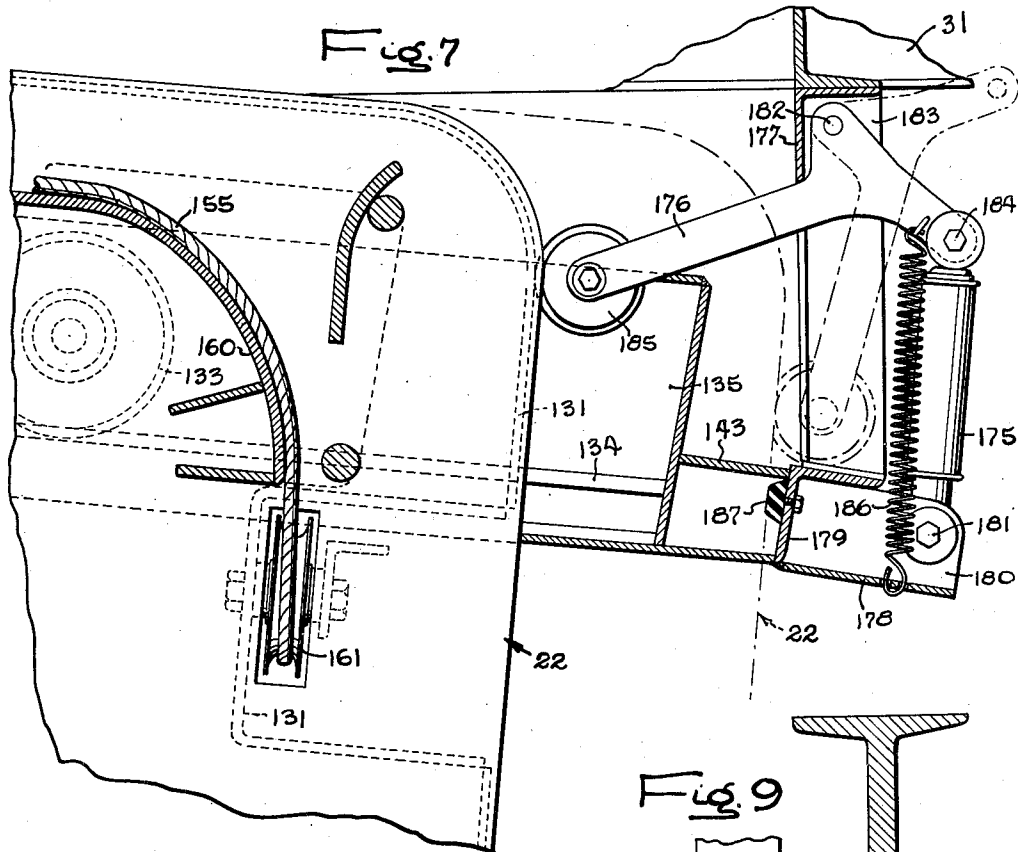
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H. C. POLLITZ
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2,493,898

PORTABLE MIXING PLANT

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7 Claims. (Cl. 259—154)

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The invention relates to apparatus for preparing paving materials and more particularly to apparatus for proportioning and mixing dry aggregates with bituminous or other liquid binders.

The general object of the invention is to provide apparatus of the above general character capable of performing the various operations required in the preparation of bituminous paving materials efficiently and at minimum cost.

A more specific object is to provide apparatus having means for grading bulk aggregates, preparing accurately proportioned batches of aggregates and liquid binder, thoroughly mixing the aggregates and binder, and delivering the finished product to a truck or carrier, all of which means are incorporated in a unitary structure which can be readily moved from one job to another and which can be changed from operating to transporting condition, and vice versa, very quickly and with a minimum of labor.

Other objects and advantages of the invention will become apparent from the following detailed description of the preferred embodiment illustrated in the accompanying drawings, in which:

Figure 1 is a side elevational view of material handling apparatus embodying the features of the invention and showing the apparatus set up for use.

Fig. 2 is a side view of the apparatus in transporting condition.

Fig. 3 is a fragmentary longitudinal sectional view of the apparatus.

Fig. 4 is a transverse sectional view of the apparatus taken in a vertical plane substantially on the line 4—4 of Fig. 1.

Fig. 5 is a perspective view showing the elements of the liquid batching means.

Fig. 6 is a fragmentary sectional view showing details of the aggregate batching means.

Fig. 7 is a fragmentary sectional view taken in a vertical plane through the lower end of the skip track and skip.

Fig. 8 is a detailed view of the shock absorber associated with the skip track.

Fig. 9 is a sectional view of the skip track taken in a vertical plane substantially on the line 9—9 of Fig. 2.

Fig. 10 is a section taken on the line 10—10 of Fig. 3 showing the drum shaft and associated parts.

Fig. 11 is a section through the liquid batching means.

Fig. 12 is a fragmentary elevation of some of the controls.

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Fig. 13 is a section taken along the line 13—13 of Fig. 1.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

General arrangement

In carrying out the invention, I provide in a unitary portable structure, hereinafter referred to as an asphalt mixing plant, all of the material handling and treating instrumentalities for performing operations required in the preparation of bituminous paving material. The improved structure includes an aggregate supply and grading unit 15 (Figs. 1-3) for receiving bulk aggregates and grading them according to fineness, an aggregate batching unit 16 (Figs. 3, 4 and 6) for making up properly proportioned batches of the aggregates, a binder batching unit 17 (Figs. 1, 2, and 5) for measuring the liquid binder, and a batch-type mixing unit 18 (Figs. 1-3) for thoroughly mixing the aggregates and the binder. To facilitate operation of the apparatus, the bulk aggregates are delivered to the supply and grading unit 15 by an elevator 19 arranged to pick up the aggregates at ground level as delivered by truck or upon their discharge from a conventional drier 20 (Fig. 1).

Included in the supply unit 15 is a multiple compartment bin 21 (Figs. 3 and 6) adapted to receive and separately store the graded aggregates and from which such aggregates may be selectively discharged into the batching unit 16. The aggregate batches are then transported from the batching unit 16 to the mixing unit 18 by suitable conveying means, herein shown as a batch container or skip 22 traversable from a loading position below the batching unit, as shown in Fig. 1, to a dumping position above the mixer, as shown in Fig. 3.

As will be seen by reference to Figs. 1, 3 and 4 of the drawings, the operating elements of the supply and grading unit 15, the bin 21 and the aggregate batching unit 16 are arranged one above the other and the skip 22 is adapted to run beneath the batching unit for gravity flow of the aggregates. The mixing unit 18 is supported in an elevated position in overhanging relation to

the other elements of the mixing plant, thus permitting the mixed material to be dumped directly into a truck 24 or other carrier, and the binder batching unit 17 is mounted above the mixer for gravity discharge of the same.

A prime mover, herein shown as an internal combustion engine 23 (Figs. 1-2) supplies the power for operating the supply unit 15, the mixing unit 18, the elevator 19, the skip 22 and other elements of the apparatus, as will appear presently. Power is transmitted to the machine elements through two drive shafts 28 and 29, located respectively adjacent the front and rear ends of the apparatus. The front shaft 28 is driven directly from the engine 23 by a multiple V-belt 28', while the rear shaft 29 is driven from the front shaft by a chain 29', or other suitable means.

Controls for such power driven elements, together with controls for the gates, valves, etc., regulating the flow of materials and suitable weight indicators for the batching units, are centralized at a common control station 25 (Figs. 1, 2 and 4), thus enabling all operations of the apparatus to be controlled by one attendant. As shown in Fig. 4, the control station 25 is provided with a platform 26 for the attendant to stand upon, such platform being located only slightly above ground level. The platform is mounted so that it may be folded up against the side of the frame, as shown in Fig. 2, when the apparatus is to be transported. Removable braces 27 serve to steady the platform and hold it in a horizontal position when the apparatus is set up for operation.

To facilitate transportation of the mixing plant from one job to another, the various elements thereof are mounted on a wheeled chassis 30 adapted to be towed by a truck or tractor. The chassis 30 includes a generally rectangular frame 31 fabricated from I-beams and other suitable structural shapes welded together and adequately reinforced to provide the necessary strength and rigidity.

The frame 31 is supported adjacent its rear end by a truck 32 having tandem axles of the oscillating type, each equipped with dual wheels 33 so as to maintain the wheel load within the limits prescribed by public highway regulations. A two-wheeled truck 34 supports the front end of the frame 31, the truck being pivotally connected with the frame to permit turning and having a drawbar 35 for connection with the towing truck or tractor. The axle of the front truck is also provided with dual wheels 33 and all truck wheels are desirably equipped with pneumatic tires to comply with highway regulations and to permit rapid movement of the plant.

In the particular embodiment illustrated, the front and rear sections of the frame 31 are offset upwardly from the central section to provide adequate clearance for the trucks. The lower central section of the frame accommodates the aggregate supply and batching units and, by reason of its depressed construction, the over-all height of the apparatus is held at a minimum. This arrangement is advantageous when the apparatus is to be transported over public highways, and further reduction in both overhead and lateral clearances are obtained by mounting the platform 26 and other elements of the apparatus so that they may be retracted for transportation, as will be described hereinafter. Jacks 36 are provided on the frame 31 so that a part of

the weight of the mixing plant may be supported directly on the ground when the plant is in operation, thus relieving the weight on the pneumatic tires and providing a solid foundation for the various operating elements.

Aggregate supply and grading unit

The use of bulk aggregates which are usually more readily available and cheaper than sized aggregates, is made possible by the provision of the aggregate supply and grading unit 15. The unit includes a shaker screen 40 (Figs. 1-3), which may be of any suitable and well known construction, supported on upright members 41 and longitudinal members 42 rigid with the frame 31. The screen is enclosed by a dust-tight cover 43 having an opening at its forward end for a spout 44 through which the bulk aggregates are delivered by the elevator 19. In operation the screen is oscillated continuously by driving mechanism including an eccentric 40' having a driving connection with a countershaft 41'.

The elevator 19 in its preferred form is of the bucket type comprising a series of scoop-like buckets 45 secured to an endless flexible member or chain 46 running over sprocket wheels 47 carried by shafts 48 and 49 journaled respectively at upper and lower ends of an elongated inclined frame 50. To permit the elevator to be collapsed for transportation, the frame 50 is constructed in three sections including an intermediate section 51 rigidly supported on the chassis frame 31 by brackets 52. An upper frame section 53 is pivotally secured to the intermediate section so that it may be swung between the operating position shown in Fig. 1 and the transporting position shown in Fig. 2. The lower frame section 54 is constructed so that it may be telescoped over the intermediate section and thus raised substantially above the front truck 34 of the chassis when the apparatus is to be transported. When extended, as shown in Fig. 1, the lower end of the elevator projects below ground level so as to operate in a shallow pit 55 dug for its accommodation.

The elevator 19 is preferably provided with a dust housing 56 which may be readily detached when the elevator is to be collapsed. As shown in Fig. 1, the housing extends the full length of the extended frame 50 and projects over the top of the same to terminate in the spout 44 opening above the screen 40.

In operation, the elevator is driven by means of a chain 57 (Fig. 1) running over a sprocket wheel 58 on the shaft 48 and a companion sprocket wheel of an intermediate drive shaft 59 journaled on the frame structure and driven from the front drive shaft 28 by a chain 59'. Accordingly, aggregates dumped into the pit 55 from a truck or from the drier 28 are carried upwardly and discharged through the spout 44 onto the shaker screen 40.

The screen 40 is constructed in the usual manner with openings of progressively increasing size from front to rear so that the fine material is initially passed, followed by the coarser material according to size. Material too large to pass through the screen is discharged through a chute 60 (Figs. 1-3) leading off from one side of the apparatus. The aggregates passing through the screen 40 are collected and separately stored in the compartments of the bin 21 which is supported below the screen by the frame members 42 and cross-members 60' (Fig. 3) extending therebetween. The bin is preferably constructed

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of sheet metal and, as shown in Figs. 3 and 4, has its bottom wall inclined toward an apex in which are located suitable outlets for the various compartments in the bin. In the exemplary apparatus, the bin is partitioned by transverse walls to provide four compartments 61, 62, 63 and 64 disposed longitudinally of the bin so that the finest material is deposited in the bin 61, material of intermediate sizes in bins 62 and 63, and the coarser material in bin 64.

Means is provided whereby one of the compartments may be withdrawn from service when aggregates of only three different grades or sizes are required. For this purpose one of the partitioning walls, in this instance the wall between the compartments 61 and 62, is provided with a pivoted deflector plate 65 capable of being swung into a position to close the upper end of the compartment 62. When it is desired to use the compartment 62, the deflector plate is swung to a generally upright position, thus opening the compartment 62 for the reception of material passing through the screen 40.

As indicated heretofore, each bin compartment is provided with a bottom opening outlet through which the stored aggregates may be discharged by gravity into the aggregate batcher 16. The discharge of material from the compartments is regulated by means of individual gates, each comprising a flat metal plate 66 dimensioned to close the outlet of the associated compartment. The plate 66 is supported for movement horizontally into or out of registration with the compartment outlet by roller 67 journaled on metal plates 68 (Fig. 6) rigid with the bin 21 and coacting with angular track members 69 secured to the plate 66 by means of brackets 70.

Each of the plates 66 is provided with a suitable actuator for moving it between the open and closed positions. As herein shown, the actuators comprise bell crank levers 71 (Figs. 1, 2 and 4) supported for rocking movement on a shaft 72 carried by brackets 73 attached to the bottom of the bin 21. Each lever is connected at one end to its associated slide plate 66 by means of a link 74 and is provided at its other end with a hand grip 75 for manual operation. As will be seen by reference to the drawings, the actuating lever shaft 72 is disposed horizontally at the side of the bin 21 adjacent the control station 25 and the actuating levers 71 are thus positioned so that they may be easily reached by an attendant while standing on the platform 26.

As it is desirable to continuously check the quality of the aggregates used in preparing paving material, means is provided whereby samples may be conveniently taken of each grade of aggregate as it is delivered to the aggregate batcher 16. The sampling means, as shown in Fig. 4, comprises a series of drawer-like trays 76 slidably supported in the framework of the apparatus below the bin 21 and at the side thereof opposite the control station 25. The trays are adapted to be inserted under the outlets of the respective bin compartments to catch samples of the material discharge therefrom and may be readily withdrawn for removal of the collected samples.

Aggregate batching unit

The aggregate batching unit 16 is utilized to proportion the aggregates of different sizes withdrawn from the bin 21 for each batch of paving material to be mixed. To this end the unit comprises a hopper 80 supported below the bin 21 by weighing mechanism operative to provide a vis-

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ual indication of the weight of the material deposited in the hopper. The hopper 80, as herein shown, is in the form of a generally rectangular sheet metal box open at the top and having its bottom portion shaped to provide two longitudinally extending tapering compartments. Outlets at the lower ends of the compartments are fitted with suitable closures, herein shown as elongated metal gates 81 (Fig. 4) pivotally supported on brackets 81' carried on the side walls of the hopper. The arrangement is such that the gates are adapted to swing between the closed and open positions shown respectively in solid and broken lines in Fig. 4. When the gates are swung to open position, the contents of both hopper compartments are thus directed inwardly to the skip 22 and spillage of the material is effectually prevented.

Closure actuating means is provided whereby the gates 81 may be opened or closed simultaneously by the attendant while standing on the control station platform 26. Each gate 81 is formed with an outwardly projecting arm 82 connected by toggle links 83 and 84 with a rock shaft 85 supported on the side walls of the hopper 80. The link 84 in this instance is nonrotatably secured to the shaft 85 so as to rock therewith when the shaft is actuated through the connection provided by a rigid arm 86 and link 87 to one end of a cross arm 88 nonrotatably secured to a rock shaft 89 journaled in bearings carried between the depending tapered compartments of the hopper. As will be seen by reference to Fig. 4 of the drawings, the links 87 for the respective gates are connected to opposite ends of the arm 88 so that the two toggle link sets are opened or closed at the same time. The shaft 89 is operatively connected by an arm 90 and link 91 with a hand lever 92 pivotally supported by a bracket 93 on a stationary frame member 94 to which the platform 26 is hingedly connected. The arrangement is such that the gates 81 are closed when the hand lever 92 occupies the upright position in which it is shown in Fig. 4, the lever being pulled to the left to open the gates.

As indicated above, the hopper 80 is supported by weighing mechanism. This mechanism is carried by an auxiliary frame which is relatively movable with respect to the main framework of the mixing plant so that the mechanism may be quickly and easily adjusted to a level position. As shown in Figs. 1-4 and 6, the auxiliary frame comprises four upright posts 100 disposed in pairs on opposite sides of and adjacent the central portion of the frame 31. Corresponding posts of each pair are connected at their upper ends by crossbeams 101 and the posts located at the control station side of the frame are additionally connected by a longitudinal beam 102.

Each of the posts 100 is provided at its lower end with a telescoping leg section 103 terminating in a flat foot 104 of relatively large area adapted to rest on the ground and support the entire batching unit when the apparatus is in operation. The legs and posts may be operatively connected by bolts or pins 105 inserted through aligned holes in the respective parts. Preferably, a series of such holes are provided in each part and are so spaced that a wide range of adjustment is permitted.

When the apparatus is to be transported, the legs 103 are retracted to the position shown in Fig. 2 and are secured in such position by the pins 105. The auxiliary frame is then supported by the crossbeams 101 resting on beams 106

(Fig. 4) extending longitudinally of and forming a part of the plant framework.

The weighing mechanism by which the hopper 80 is supported on the auxiliary frame may be of more or less conventional character. As herein shown, the hopper is suspended from torsion bars 110 (Figs. 4 and 6), which in turn are supported from the crossbeams 101 by depending adjustable links 111. Two of the bars 110 are provided, one adjacent each end of the hopper, and each bar is provided with a pair of rigid, laterally projecting arms 112 connected by depending links 113 with angle bars 114 secured to the ends of the hopper. The arrangement is such that the weight of the hopper and its load tends to rock the torsion bars about their longitudinal axes. To reduce frictional resistance, the movable joints between the parts are fulcrumed on the usual knife-edge bearings.

Projecting inwardly from the respective torsion bars 110 are a pair of long arms 115 (Fig. 6) provided at their adjacent ends with knife-edge bearing elements adapted to engage a common fulcrum member 116 which is connected by an adjustable link 117 with one end of a scale beam 118. The scale beam is suspended intermediate its end from the beam 102 of the auxiliary frame by a suspension member 119 and its other end is connected by a link 120 with a weight indicator 121 preferably of the dial type.

To facilitate the batching operations, the indicator 121 is located at the control station adjacent one end of the platform 26, where it is readily visible to the attendant while manipulating the aggregate releasing levers 71. As shown in Fig. 4, the indicator 121 is carried by a bracket 122 pivotally supported on one of the posts 100 of the auxiliary frame. By reason of its pivotal support, the indicator and bracket may be swung into a position closely adjacent the side of the main frame of the plant, as shown in broken lines in Fig. 2, when the plant is to be moved. It will be understood, of course, that under such conditions the indicator is disconnected from the scale beam, the connecting means being formed to facilitate such disconnection. The beam may then be shifted to an out-of-the-way position and made fast to the framework in any preferred manner.

Batch conveyor

The aggregate batches upon discharge from the weighing hopper 80 are received in the skip 22 and conveyed to the mixing unit 18 under control of the attendant. The skip 22 is made of sheet metal and has upright side walls 130 and an upright rear wall 131. It is closed at the bottom by a wall 132 which is flat adjacent the rear end of the skip and inclined upwardly at its forward end so as to prevent spillage of material during movements of the skip while permitting the material to be discharged when the skip is tipped up to the position shown in Fig. 3.

Support for the skip is provided by flanged wheels 133, two being provided at each side thereof. The wheels run on an inclined track formed by spaced parallel rails 134 (Figs. 3 and 4) which extend from a point below the forward end of the hopper 80 to a point directly above the mixing unit 18. In the exemplary apparatus, the rails 134 are carried by inwardly facing channel members 135 suitably supported on the framework of the plant and having flanges 136 overlying the wheels 133 so as to prevent them from leaving the rails. Adjacent the upper end of the

track the guide flanges 136 are turned upwardly, as at 137, to permit the skip to tilt to the dumping position in which it is shown in Fig. 3. Fixed stops 138 secured to the channels 135 for engagement by the front pair of wheels 133 limit the upward movement of the skip to the position shown.

In order to minimize the over-all height of the plant, the rails 134 and channels 135 are constructed in sections, one of which extends beneath the hopper 80. This section is pivotally supported by brackets 139 to swing between operating and transporting positions shown respectively in solid and broken lines in Fig. 3. When the pivoted track section is in its lower position, sufficient clearance is provided for the skip 22 to enter below the hopper 80 (as shown in Fig. 1).

In setting up the plant for operation, a shallow pit 140 is dug below the pivoted track section to accommodate the skip. When the plant is to be moved, the skip is withdrawn to the intermediate portion of the track where it may be blocked in place by a cross member 141 of wood or other suitable material inserted between the rear wall of the skip and a suitable portion of the framework. The pivoted track section may then be swung up to provide ample road clearance, as shown in Fig. 2. To hold the track section in the raised position, the channels 135 are provided at their lower end with forwardly and laterally projecting lugs 143 (Figs. 7 and 8) adapted to abut one of the cross members of the frame 31 and to be temporarily secured thereto as by bolts 144.

For traversing the skip 22 from the loading position to the dumping position, hoisting means including a pair of cable winding drums 150 (Figs. 3 and 10) is provided. The drums are carried by a shaft 151 journaled in brackets 152 carried by uprights 153 forming a part of the framework of the apparatus. To provide the necessary strength and rigidity the uprights 153 are reinforced by diagonal braces 154. A cable 155 has its opposite ends anchored to the respective drums and the bight is carried over a pair of sheaves 156 mounted on a head frame at the upper end of the skip track and then looped around the skip 22, as shown in Figs. 4 and 7.

The sheave supporting head frame as herein shown comprises upright side members 157 pivotally supported on the framework above the binder batcher 17 and forwardly extending bracing members 158 detachably connected to the uprights 153. The arrangement is such that the sheaves 156 are firmly supported substantially in alignment with the inclined portion of the skip track so as to maintain the cable 155 in a straight run throughout the movements of the skip. By detaching the bracing members 158 from the framework the head frame may be folded in the retracted position shown in Fig. 2, thus reducing the over-all height of the plant to a minimum and adapting it for transportation over public highways.

To equalize the strains on the two runs of the cable 155 the cable runs are led over rounded guides 160 (Figs. 3 and 7) welded to the sides of the skip and thence over grooved rollers 161 (Figs. 4 and 7) rotatably supported on the back wall 131 of the skip. Intermediate the rollers 161 the cable is anchored to the skip by clamping devices 162.

In the exemplary mixing plant the drum shaft 151 is adapted to be driven by a clutch 165 having

its driven member 165' rotatably mounted on the shaft. The member 165' is driven in this instance by a chain 166 from the rear drive shaft 29. The clutch is preferably arranged for hydraulic actuation by fluid supplied from a master cylinder 168 (Fig. 4) having a piston actuated by a hand lever 169. Fluid is delivered to the clutch actuator through a passage extending axially of the shaft 151 and connected by a fitting 166' with a conduit 167' communicating with the master cylinder. As shown in Fig. 4, the cylinder 168 is supported on the framework 31 at one side of the apparatus adjacent the control station and the actuating lever 169 is mounted for convenient access by the attendant while standing on the control platform 26.

The skip 22 is adapted to return to loading position by gravity upon release of the driving clutch and the shaft 151 is therefore desirably provided with a suitable brake 169' (Fig. 10) for controlling or interrupting such descent. The brake means may be of the usual automotive type operated by fluid under pressure supplied by way of a conduit 170' from a master cylinder 170 mounted on the underside of the platform 26, as shown in Fig. 13. The piston of the master cylinder is actuated by a foot pedal 171 projecting through the platform 26 so that it may be conveniently reached by the attendant.

Means is provided for stopping the skip 22 with a minimum of shock upon its descent to the loading position. As shown in Figs. 7 and 8, this means comprises a shock absorber 175 of the usual cylinder and piston type supported on the frame 31 of the chassis adjacent the lower end of the skip track. The shock absorber has an actuating member 176 positioned for engagement by the rear wall 131 of the skip as the latter moves into the loading position.

Support for the shock absorber 175 is provided by a channel member 177 adapted to be bolted or otherwise removably secured to the frame 31. In the exemplary embodiment, the cylinder portion of the shock absorber is pivotally secured to a bracket comprising an elongated flat plate 178 and an angle bar 179 welded to the lower flange of the channel 177. Spaced lugs 180 rigid with the plate and the angle bar are suitably apertured to receive a pivot stud 181 upon which the shock absorber cylinder is mounted.

The actuating member 176, as herein shown, is in the form of a bell crank lever pivotally supported intermediate its ends on a stud 182 seated in apertured lugs 183 rigid with the channel member 177. The forward end of the member 176 is connected by a pin 184 with the flanged portion of the shock absorber. The other end of the member 176 extends rearwardly through a slot in the channel member 177 and is provided with a contact element or roller 185 for engagement by the skip.

When the skip 22 is away from the loading position, the shock absorber plunger is retracted into its cylinder and the actuating member 176 is held in the position shown in Fig. 7 by a pair of springs 186 connected between the plate 178 and the forward end of the actuating member. As the skip approaches the loading position it engages the roller 185 and rocks the actuating member to the position shown in broken lines of the drawing. In this movement the plunger of the shock absorber is shifted longitudinally of the cylinder, whereby the skip is gradually decelerated. A bumper 187 of rubber or other resilient material carried by the angle bar 179

for engagement by the skip cushions the final impact as the skip is brought to a stop.

Binder batching unit

5 The binder batching unit 17, as shown in Figs. 5 and 11, comprises a general oval tank or bucket 200 open at the top and having a frusto-conical bottom with an outlet closed by a gate or valve 201. The bucket 200 is preferably constructed with double walls so that steam may be circulated thereabout to keep the contents hot and in a fluid condition. Steam may be supplied to the bucket by way of a flexible conduit 201' connected with a suitable boiler (not shown). 15 When oil or non-asphaltic binders are used, the steam connection may be closed. A spreader tank 202 (Figs. 1 and 2) located below the outlet 201 receives the discharged material and distributes it evenly to the mixing unit 18.

20 To enable the contents of the batcher to be measured, the bucket 200 is supported from an upright frame 212 by weighing mechanism 205 (Fig. 5) connected with a suitable dial type indicator 206 mounted on the framework at the control station 25. As herein shown (Fig. 11), the tank 200 is supported by a hook 207 anchored to a cross-bar 208 extending across the top of the tank and engaging a clevis 209 carried at one end of a scale lever 210. The lever is supported intermediate its ends by a hook and clevis connection 211 from the frame 212. The other end of the lever 210 is connected by a link 213 with one end of a lever 214 fulcrumed at its other end on a beam 215 supported on and projecting rearwardly from the chassis frame 31. The intermediate portion of the lever 214 is operatively connected by a tubular torsion bar 216 with a similar lever 214' suspended at one end from the beam 215 and having its other end connected by an adjustable link 215' with a scale lever 216'. 40 The scale lever is fulcrumed on a depending boss 217' rigid with the housing of the indicator 206 and is operatively connected with the indicating mechanism thereof by a link 218'. The arrangement is such that the weight of the material deposited in the bucket 200 is visually indicated to the attendant standing on the platform 26 at the control station.

Liquid binder is delivered to the bucket 200 by 50 a pump 220 (Fig. 3) of any suitable character through a flexible conduit, such as a jointed pipe 221, which is preferably steam-jacketed to permit the handling of asphaltic or other material requiring heating. In the exemplary structure the pump 220 is mounted adjacent the rear end of the chassis frame 31 and is arranged to be driven from the countershaft 41' by the chain 222. The countershaft may be driven by a chain or other suitable connection from the rear drive shaft 29. Preferably, a suitable clutch operable by a hand lever 223 is interposed in the pump drive so that it may be started or stopped at will. In the exemplary apparatus a pipe 224 with a suitable coupling 224' is provided for connecting the intake side of the 65 pump to a tank car or the like from which the supply of liquid binding material is obtained.

For controlling the delivery of binding material to the batching bucket 200 the supply pipe 221 is provided at its discharge end with a valve 225 adapted to be opened or closed by remote control from the control station 25. For this purpose the valve may be provided with a conventional hydraulic actuator 226 (Figs. 1 and 2) connected with a manually operable master cylinder 75 mechanism 227 (Fig. 2) at the control station.

The gate or valve 201 for the bucket outlet may also be equipped with a hydraulic actuator 223 for remote operation under control of a master cylinder mechanism 229 at the control station. It will be understood, of course, that the pump 220 is continuously operating, so as not to be "frozen" by viscous bituminous liquids, and the valve delivering the binding material to the batching bucket is of a three way type, allowing continuous circulation of the binding material, i. e., from storage tank to pump, then to valve, and from valve either into batching bucket or back to storage tank, the latter also preferably by way of steam jacketed piping.

Mixing unit.

The mixing unit 18 in which the dry aggregates and liquid binder are intermixed and blended together is preferably of the pug mill type having a mixing member 230' rotatable about a vertical axis within a generally cylindrical hopper 230 (Figs. 1-3). The mixing member 230' is driven in this instance from the rear drive shaft 29 by an auxiliary shaft 231.

In the exemplary mixing plant the hopper 230 is mounted on an extension of the chassis frame 34 formed by the beam 215 and a similar beam arranged parallel thereto at the other side of the machine. The beams are anchored at their forward ends to the uprights 41 and are supported intermediately on suitably reinforced posts 153 extending upwardly from the chassis frame. The ends of the beams 215 thus project substantially beyond and overhang the rear end of the chassis so that a truck or other carrier may be driven under it and the mixed material delivered directly thereto by gravity. A shallow trench or runway 233 may be excavated below the mixing hopper when the apparatus is set up for operation to provide the necessary clearance for relatively high trucks.

For discharging the mixed material, the hopper 230 is provided with a bottom opening outlet closed by a slide or gate 235 (Fig. 3). The slide is arranged for power operation by an actuator 236, preferably of the cylinder and piston type, supported on the framework forwardly of the hopper. The actuator may be operated by steam from the same source used for heating purposes, or when steam is not available, compressed air from any suitable source may be employed. It will be appreciated that a compressor suitable for this purpose may be provided on the machine frame and driven from the prime mover 23, if desired. A manually operable valve 237 is provided at the control station for controlling the supply of steam or air to the actuator 236.

Résumé of operations:

Assuming that the mixing plant is set up as shown in Fig. 1, it is placed in operation by starting the engine 23 which drives the drive shafts 28, 29, 41' and 59. The intake pipe 224 of the pump 220 is connected to a tank car or other container holding the binding material and the pump is started by actuation of the clutch lever 223. When using a binder of the asphaltic type, the steam line from a suitable boiler is connected for supplying steam from the jacketed pipe 224 and the batching tank 200 whereby the binder is kept hot and in fluid condition. For use with oil or other non-asphaltic binders, the steam connection is simply omitted and the gate actuator 236 is connected to a compressed air line.

Dry aggregates dumped into the pit 55 are

carried by the elevator 19 of the supply and grading unit to the shaker screen 40. The elevator is driven continuously from the front drive 28 through the intermediate drive shaft 59 and the shaker screen is agitated by the eccentric 40', which is driven from the rear drive shaft 29 through the countershaft 41'. The material delivered to the screen 40 is classified according to fineness and distributed to the various compartments of the bin 21. In practice, the compartments are usually maintained substantially full so as to provide a reserve supply of aggregates.

To form a batch of dry aggregates, the attendant by manipulating the various hand levers 71 opens the bin compartments in succession until the desired quantity of each grade of aggregate is delivered to the hopper 80, as indicated by the scale indicator 121. Samples may be taken of each grade of aggregate from time to time by insertion of the sample drawers 76 below the respective compartment outlets.

When the required quantity of aggregates has been deposited in the hopper 80 of the batching unit, the gates 81 are opened by means of the hand lever 92. The batch is thereupon discharged by gravity into the skip 22, which is normally positioned at the lower end of its track 134.

To transport the aggregate batch to the mixing unit 18, the attendant actuates the master cylinder mechanism 168 to engage the driving clutch for the drum shaft 151. As the shaft rotates, the cable 155 is wound on the drum 150, thereby drawing the skip upwardly until the front wheels 133 engage the fixed stops 138. Further winding of the cable tilts the skip to the position shown in Fig. 3, thereby dumping its contents into the hopper 230 of the mixing unit. The drum shaft clutch is disengaged when the skip moves into the dumping position and the skip then returns by gravity to the loading position. Return speed of the drum is regulated by the drum shaft brake which is controlled by the attendant through the medium of the foot pedal 171 and the associated master cylinder mechanism 170.

During the forming of the aggregate batch, the attendant may also prepare a batch of binding material for mixing therewith. This is done by actuating the master cylinder mechanism 227 to open the valve 225 controlling the discharge of binding material from the pipe 221 to the batching bucket 200. The amount of material delivered to the tank is determined by observation of the scale of the indicator 206. When sufficient material has been delivered, the valve 225 is closed by actuation of the master cylinder mechanism.

After the aggregate batch has been dumped into the mixing unit as above explained, the outlet valve for the batching bucket 200 is opened by actuation of the master cylinder mechanism 229, thus permitting the binder to drain into the spreader tank 202 and from there into the mixer hopper 230. The aggregates and binder are then mixed and blended in well-known manner. Ordinarily such mixing is allowed to proceed for a predetermined time and the mixed material is then discharged by opening the gate 235. Such opening is controlled by the attendant at the control station by the setting of the valve 237 to admit steam or compressed air to the actuator 236.

By reason of the advantageous location of the mixing unit with respect to the chassis upon which the apparatus is mounted, a truck or other

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suitable carrier may be run below the unit to receive directly the material discharged therefrom. Unnecessary handling of the mixed material is thus avoided and the time required for the transfer of the material is reduced to a minimum.

To place the mixing plant in condition for travel, the elevator 19 and the head frame 157 of the skip are folded into out-of-the-way positions, as shown in Fig. 2. The skip 22 is drawn up to an intermediate position and blocked in place by means of the crosspiece 141. After removal of the shock absorber supporting channel 177 and release of the jacks 36, the hinged section of the skip track is raised to its upper position and secured to the frame 31 by the bolts 144 to afford sufficient road clearance.

As explained heretofore, during the operation of the apparatus the weighing hopper 80 is supported on the ground by the auxiliary frame, including the posts 100. To condition the apparatus for transportation, the leg sections 103 of the posts are released by withdrawal of the pins 105 and when raised to traveling position are locked in place by reinsertion of the pins. The scale beam 118 is swung to a retracted position or removed and other elements of the weighing mechanism are suitably secured to the frame to avoid damage while the apparatus is in motion. The indicator 121 is swung to a traveling position closely adjacent the side of the frame.

To reduce the lateral dimensions of the apparatus, the control platform 26 is folded upwardly along the side of the chassis frame. Thus both the vertical and horizontal dimensions of the apparatus are reduced to a minimum, well within the limits prescribed by public highway regulations. It is then only necessary to attach the drawbar 35 to a truck or tractor by which the apparatus may be towed. The provision of pneumatic tires on the supporting trucks permits the apparatus to be towed over public highways and at relatively high speeds.

It will be apparent from the foregoing that the invention provides a portable mixing plant of a novel and advantageous character capable of performing the various operations required in the preparation of bituminous paving material. Bulk aggregates are effectively graded and stored, thus eliminating the expense and difficulty of handling presized aggregates. All materials entering into the mixture may be accurately measured and delivered to the required points under control of an attendant at a central control station. Handling of the various materials is reduced to a minimum with a corresponding reduction in labor costs. Bituminous paving material may thus be prepared very cheaply and efficiently. Moreover, the mixing plant may be transported over public highways and may be changed from either travel to operating condition, or vice versa, very quickly and with a minimum of labor.

I claim as my invention:

1. In a portable mixing plant of the type described having means for mixing aggregates with liquid binding material, the combination of means for separating bulk aggregates according to fineness, a conveyor for delivering the aggregates to said separating means, a bin having a plurality of compartments for receiving and storing the separated aggregates, means supporting said bin substantially on a level with the mixing means, a weighing hopper disposed below said bin, said bin having gates operable to release aggregates from said compartments selectively to prepare a batch of aggregates in said hopper, means for transfer-

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ring the batch of aggregates from said hopper to said mixer including a skip movable from a loading position below said hopper to a discharge position above the mixer, power driven means for moving said skip, a weighing bucket for liquid binding material adapted to discharge the material into the mixer, closure means for controlling the discharge of binding material from said bucket, other closure means for controlling the discharge of mixed material from the mixer, a control station including an operator's platform located adjacent said bin providing convenient access to said gates for manual operation of the same, and means at said station for controlling the operation of both of said closure means, said platform being movable to a retracted position without disturbing said controlling means to condition the plant for traveling, all of said foregoing elements being assembled in a unitary structure supported on a wheeled chassis.

2. In a portable mixing plant of the type described having means for mixing aggregates with liquid binding material and for delivering the mixture directly to a truck or the like by gravity flow, the combination of a screening device for separating bulk aggregates according to fineness, a conveyor for delivering the aggregates to said device, a bin disposed below said device having a plurality of compartments for receiving and storing the separated aggregates, a weighing hopper disposed below said bin, and at a level substantially below that of the mixing means, said bin having gates operable to release aggregates for gravity flow from said compartments into said hopper, an inclined track extending beneath said hopper and to a point above the mixing means, a skip supported and guided on said track for movement from a loading position below said hopper to a discharge position above the mixing means, power driven means for moving said skip on said track, a control station located adjacent said bin providing convenient access to said gates for manual operation of the same, means at said station for controlling the operation of said power driven means, and other means at said station for controlling the discharge of material from said mixing means, all of said foregoing elements being assembled in a unitary structure supported on a wheeled chassis.

3. In a portable mixing plant of the type described having means for mixing aggregates with liquid binding material, the combination of a screening device for separating bulk aggregates according to fineness, a conveyor for delivering the aggregates to said device, a bin disposed below said device having a plurality of compartments for receiving and storing the separated aggregates, a weighing hopper disposed below said bin at a level substantially below that of the mixing means, said bin having gates operable to release aggregates for gravity flow from said compartments into said hopper, an inclined track extending beneath said hopper and to a point above the mixing means, a skip supported and guided on said track for movement from a loading position below said hopper to a discharge position above the mixing means, all of the foregoing elements being assembled in a unitary structure and supported on a wheeled vehicle, the section of said track beneath said hopper being pivotally supported to swing to a retracted position when the apparatus is to be transported.

4. In a mixing plant of the type described having assembled in a unitary portable structure means for mixing aggregates with liquid binding

material, a screening device for separating bulk aggregates according to fineness, a conveyor for delivering the aggregates to said device, a bin disposed below said device having a plurality of compartments for receiving and storing the separated aggregates, a weighing hopper disposed below said bin at a level below that of the mixing means, said bin having gates operable to release aggregates for gravity flow from said compartments into said hopper, an inclined track extending beneath said hopper and to a point above the mixing means, a skip supported and guided on said track for movement from a loading position below said hopper to a discharge position above the mixing means, a hydraulic shock absorber supported adjacent the lower end of said track and a bumper connected with said shock absorber and positioned for engagement by said skip as it approaches the lower end of the track, said bumper and said shock absorber being supported for convenient removal to condition the plant for travel.

5. In a portable mixing plant of the type described having means for mixing aggregates with liquid binding material supported in elevated position for gravity discharge into a truck or the like, the combination of a screening device for separating bulk aggregates according to fineness, a conveyor for delivering the aggregates to said device, a bin disposed substantially on the same level as said mixing means and below said device having a plurality of compartments for receiving and storing the separated aggregates, a weighing hopper disposed below said bin, said bin having gates operable to release aggregates for gravity flow from said compartments into said hopper, an inclined track extending beneath said hopper and to a point above the mixing means, a skip supported and guided on said track for movement from a loading position below said hopper to a discharge position above the mixing means, a head frame extending above the upper end of said track, sheaves journaled on said head frame, and means including cables running over said sheaves for pulling said skip up said track, all of the foregoing elements being assembled in a unitary structure and supported on a wheeled chassis, said head frame being retractable to reduce overhead clearance requirements when the mixing plant is being transported.

6. A portable asphalt mixing plant comprising, in combination, a chassis including an elongated frame having wheeled trucks at opposite ends for highway travel, a unit for mixing aggregates and liquid binding material supported at one end of said frame in an elevated position for gravity discharge into a truck or the like, a batching unit for supplying measured quantities of liquid binding material to said mixing unit by gravity discharge, an aggregate batching unit supported at

the other end of said frame including a multiple compartment aggregate bin, an elevator for carrying aggregates to said bin, said elevator extending below the level of the surface upon which said wheeled trucks are supported and being retractable substantially above the trucks when the plant is to be transported, a weighing hopper disposed below the level of said mixing unit directly beneath said bin to receive the aggregates discharged therefrom, means including a skip for transferring the aggregates from said weighing hopper to the mixing unit, a track for said skip extending below the hopper, a portion of said track being retractable to provide road clearance when the plant is traveling, a central station for controlling the operation of the plant, and a horizontally disposed platform for the operator at said stations, said platform being swingable to a vertical position closely adjacent said hopper to reduce the overall width of the plant when traveling.

7. A portable asphalt mixing plant comprising, in combination, a chassis including an elongated frame having wheeled trucks at opposite ends for highway travel, means for separating bulk aggregates according to fineness, said separating means being mounted on said frame in an elevated position adjacent one end of said chassis, a conveyor disposed at said one end of the chassis for receiving bulk aggregates at substantially ground level and for delivering the aggregates to said separating means, a bin supported on said frame below said separating means and having a plurality of compartments for receiving and storing separated aggregates, a weighing hopper disposed below said bin to receive the aggregates discharged therefrom, a mixing unit supported in an elevated position adjacent the other end of said frame for discharge directly into a vehicle, a skip for transferring aggregate batches from said hopper to said mixing unit, and an inclined track for said skip extending from a point below said hopper to a point above said mixing unit, the lower portion of said track being retractable to provide road clearance when the plant is traveling.

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