

Jan. 16, 1962

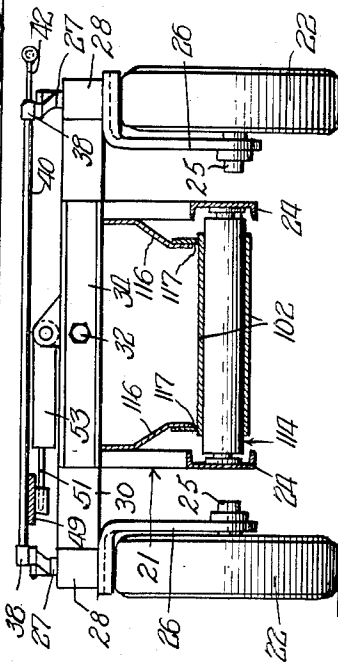
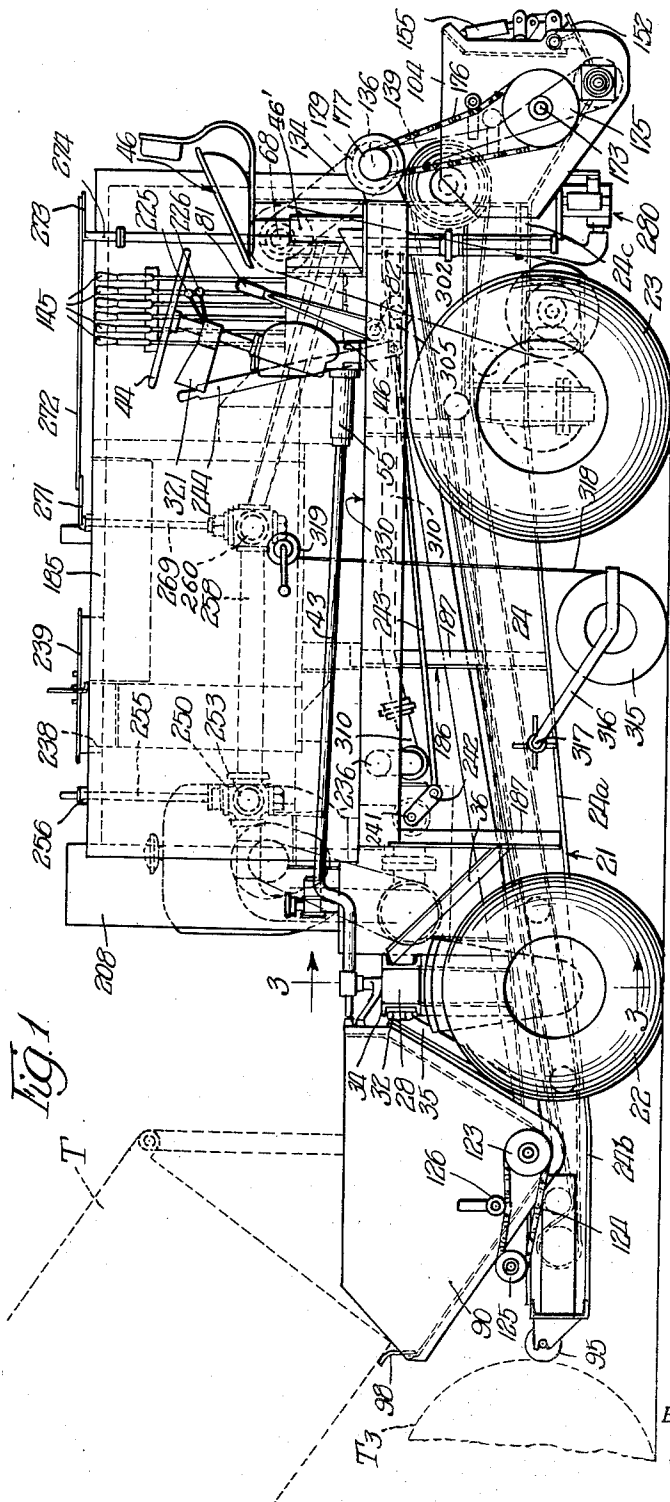
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3,016,809

PAVING MACHINE

Filed Nov. 29, 1956

7 Sheets-Sheet 1



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7 Sheets-Sheet 4

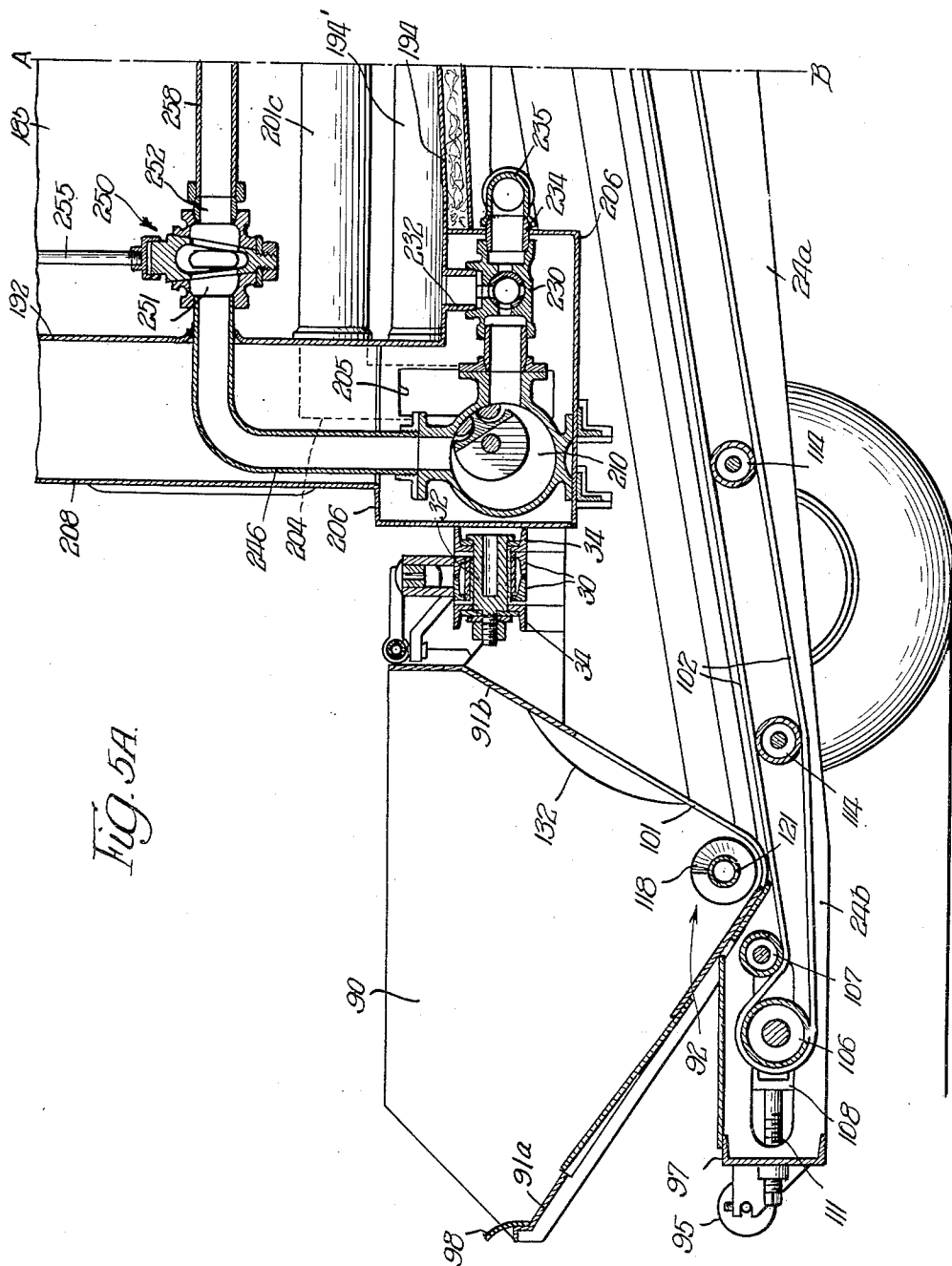


Fig. 5A.

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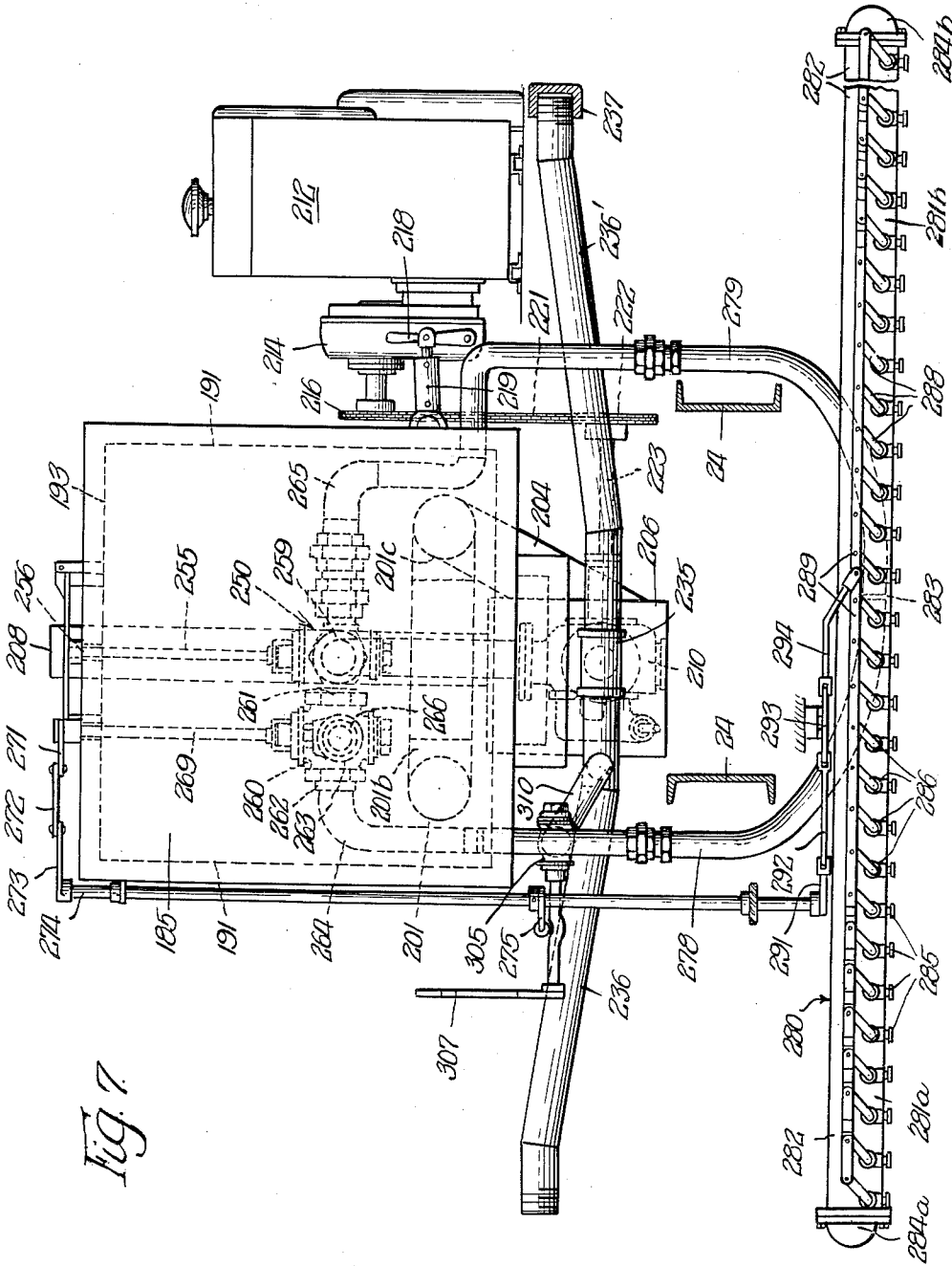


Fig. 7

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## PAVING MACHINE

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6 Claims. (Cl. 94-46)

The present invention relates to paving machines designed to be used in the paving or resurfacing of roads, runways, driveways, streets, parking areas and the like with a layer of bituminous material, such as liquid asphalt, and a layer or coating of aggregate, such as sized crushed stone.

The general object of the invention is to provide an improved machine which will substantially simultaneously perform these two operations of distributing the bituminous material and also distributing the aggregate in a single pass of the machine over the surface to be coated. The machine sprays heated liquid asphalt on the surface or area at a controlled rate. Immediately behind the freshly applied asphalt, the machine spreads the layer or coating of aggregate on to the asphalt, also at a controlled rate. The aggregate is deposited in the asphalt while it is still hot, and hence thorough penetration and mixing occur between the two. The asphalt cools rapidly upon contact with the relatively cool road surface, and hence it is imperative to apply the aggregate as soon as possible so as to insure that the asphalt will adhere to the aggregate particles. Also, the substantially simultaneous discharge of the asphalt and aggregate upon the road surface permits the use of a heavier, thicker and stickier grade of asphalt than is presently practical due to the temperature factor. This heavier grade of asphalt gives a better, longer wearing road surface.

Another object of the invention is to provide an improved paving machine in which the aggregate is received by the machine in a front receiving hopper located forwardly of the front wheels of the machine, and in which the aggregate is discharged from the machine from a rear discharge hopper located rearwardly of the rear wheels of the machine. Thus, the aggregate supply trucks can dump into the aggregate receiving hopper while traveling ahead of the paving machine, so that the supply of aggregate to the machine does not interrupt the paving operation. Also, by having the aggregate discharged at a point spaced rearwardly from the rear wheels of the machine, there are no vehicle wheels traveling in the freshly laid pavement or seal coating to leave wheel imprints therein. Still another advantage of having the rear wheels, which are preferably the traction wheels, spaced forwardly of the asphalt spray bars and of the aggregate spreader hopper, resides in the fact that such location keeps the traction wheels of the machine on the hard, dry surface of the road, thus aiding in the tractive effort for normal propulsion and in negotiating steep grades. Also, the driving wheels so located will not have a tendency to slip on the fresh application of asphalt and therefore will not damage the new surface. Any attempt to overcome this situation of slipping wheels by applying an excess of aggregate results in a waste of aggregate, and also prevents the accurate proportioning of the aggregate and asphalt.

With regard to the supply of aggregate to the front receiving hopper, pusher rollers are provided at the front end of the paving machine which engage the rear wheels of the aggregate dump truck and enable the paving machine to push the dump truck ahead of it while maintaining continuous contact with the truck in the aggregate dumping operation. As soon as the dump truck is empty it pulls away from the paving machine and a loaded truck takes its place. This avoids the necessity

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of any solid hook-ups between the paving machine and the empty truck, and hence the paving operation can be continued without interruption while changing dump trucks.

Very much the same applies to the supply of liquid asphalt to the paving machine, and to the discharge of the heated asphalt therefrom. The paving machine is provided with left hand and right hand supply connections leading to the asphalt tank on the paving machine. This enables a tank truck to be driven up along either side of the paving machine, for coupling to either the left hand or right hand supply connection. The asphalt can also be fed into the asphalt tank of the paving machine through the top of the tank. The heated asphalt is discharged from the paving machine through a bank of spray nozzles which is disposed in rear of the rear wheels of the paving machine, and in front of the aggregate spreading hopper. Because the rear wheels are in advance of the spray nozzles, there are no vehicle wheels to travel over the freshly sprayed asphalt, with the resultant leaving of wheel imprints therein. Also by having the spray nozzles slightly in advance of the aggregate spreading hopper, the aggregate is discharged into the freshly laid bed of hot asphalt.

Another object of the invention is to provide a relatively wide aggregate receiving hopper at the front end of the paving machine and a relatively wide aggregate spreading hopper at the rear end of the machine, with these two hoppers connected together by a substantially narrower conveyor belt located centrally of the machine. To carry the aggregate inwardly from the outer ends of the front receiving hopper to the centrally located conveyor belt, the receiving hopper is provided with two oppositely acting collector screws which collectively convey aggregate inwardly towards the belt. On the other hand, to carry the aggregate outwardly from the rear end of the conveyor belt to the outer ends of the rear spreading hopper, this latter hopper is provided with two oppositely acting distributing screws which convey aggregate outwardly away from the belt. Thus, the receiving hopper can be made substantially wider than the tail gate end of the dump trucks, so that in the operation of the paving machine pushing the dump truck through the pusher rollers, substantial misalignment or weaving between the vehicles will be accommodated. Also, the distributing hopper can be made as wide as the width of the spray bars, or wider than the tread width of the wheels of the paving machine. By making the connecting belt conveyor of narrower width, more space on the machine is made available for the asphalt tank, pump, heating equipment, etc.

Another object of the invention is to provide a paving machine of the above general description in which all of the operations of guiding the travel of the machine, and of controlling the rates of discharge of the aggregate and of the asphalt, etc. can be performed by one operator.

Other objects, features and advantages of the invention will appear from the following detail description of one preferred embodiment of the invention. In the accompanying drawings illustrating such embodiment:

FIGURE 1 is a side elevational view of my improved paving machine, an aggregate dump truck being illustrated in dotted lines at the front of the machine in the act of dumping a load of aggregate into the aggregate receiving hopper.

FIGURE 2 is a plan view of the machine.

FIGURE 3 is a transverse sectional view taken on the planes of the lines 3-3 of FIGURES 1 and 2, showing the transversely rockable front axle.

FIGURE 4 is a rear end elevational view of the machine with parts broken away.

FIGURES 5A and 5B are longitudinal sectional views through the front and rear portions of the machine, these two figures joining at the transverse vertical line A—B to show the entire machine.

FIGURE 6 is a longitudinal view showing the asphalt supply tank, the asphalt pump, and the four manually controlled valves which control the flow of the asphalt in the different operating phases of the machine, and

FIGURE 7 is a fragmentary rear view, partly in section and partly in elevation, affording a rearward view of such assembly of asphalt control valves contained within the asphalt supply tank, and also showing the asphalt spray bars, together with their spray nozzles and the valved control of such spray nozzles.

Referring first to FIGURES 1, 2 and 3, the machine comprises a main frame 21 which is supported at its front end on steering wheels 22 and at its rear end on driving wheels 23. The main frame comprises longitudinally extending side sills 24 which have intermediate portions 24a sloping downwardly from the rear wheels to the front wheels (FIGURE 1), and which have horizontally extending forward portions 24b and horizontally extending rearward portions 24c.

The front wheels 22 are journaled on a raised or arched axle mounting which has transversely rockable support on the main frame 21. This arched axle mounting comprises spindles 25 which project outwardly from wheel forks 26 that have steering mounting on king pins 27 which are vertically journaled in supporting housings 28 that are secured to the ends of an overhead or raised front axle 30. The front axle is of box type beam construction and has transversely rockable mounting at its center on a horizontally extending rocker pin 32, thereby affording a three-point mounting of the frame 21. The rocker pin 32 passes through the axle 30 and through two spaced channel irons 34 which are disposed in front and in rear of front axle 30 and have their ends extending downwardly for anchorage to the frame side sills 24, as shown in FIGURE 3. These axle guide channels 34 are braced by front and rear braces 35 and 36 extending diagonally down to the side sills of the main frame 21. As shown in FIGURE 3, this raised axle mounting 25—32 affords an arched or open clearance space extending from the underside of the overhead axle 30 down to the ground between the two steering wheels 22, through which clearance space extend the forward portions of the frame sills 24b and the forward portion of the conveyor belt 102, as will be later described. Referring to FIGURE 2, steering arms 38 projecting from the king pins 27 of the steering wheels are cross connected by the transverse tie rod 40. Extending outwardly from the king pin 27 of the left hand steering wheel is a steering arm 42 which connects with a steering rod 43 extending back along the left hand side of the machine to steering mechanism actuated by steering wheel 44 located at the operator's position 46. The operator's position 46 is located at the left hand rear corner of the machine where he can watch the alignment of the left hand edge of the machine, and can also watch the discharge of liquid asphalt and aggregate which occurs at the rear of the machine. The left hand location of the operator also enables him to see and to visually communicate with or signal to the driver of the aggregate dump truck T, who is also on the left hand side of his truck. If desired, the manual steering of the front wheels 22 may be supplemented by hydraulically operated power steering, and to this end a plate 49 projects rearwardly from the transverse tie link 40 and has pivotal connection with a piston rod 51 extending outwardly of a hydraulic cylinder 53 which is pivotally connected at its inner end to the top of the axle 30. This hydraulic cylinder 53 receives hydraulic pressure from a hydraulic steering valve 55 which responds to

the motion of the steering wheel 44 in conventional manner.

The rear driving wheels 23 are preferably arranged in pairs, and are mounted at the outer ends of a rear axle housing 57 (FIGURE 5B). These rear wheels are driven by a main internal combustion engine 60 which is mounted on the right hand side of the frame in a forwardly extending direction (FIGURE 2). This main power plant 60 comprises a master clutch 62 and a selective speed transmission 64, both contained in appropriate housings. From the selective speed transmission housing a drive is transmitted into a bevel gear box 65 in which bevel gears transmit the drive to a transversely extending transmission shaft 68. The inner end of shaft 68 couples to a traveling clutch 69 which is preferably of the over-center hydraulically operating type. This clutch 69 is suitably arranged to be controlled by a hydraulic cylinder 70. As shown in FIGURE 4, from the output side of this clutch 69 a propelling drive is transmitted through sprocket wheel 71 and chain 72 to a sprocket wheel 73 mounted on a lower drive shaft 74 (FIGURE 5B). The lower drive shaft 74 enters a bevel gear housing 75 where it transmits its drive through bevel gears 76, 77 to a longitudinally extending pinion shaft 78 which enters the differential housing 79 from the rear and which drives the rear wheels through a conventional differential gearing.

The master clutch 62 is controlled by a master clutch control lever 81 located at the operators position 46 and arranged to rock a transversely extending shaft 82. The right hand end of this shaft 82 is connected through linkage 83 with the clutch control shaft 84. The selective speed transmission mechanism 64 is controlled from the operators position 46 through any mechanical, hydraulic or electrical control mechanism well-known in the automotive field. The front steering wheels 22 and the rear driving wheels 23 have the standard or conventional tread width of trucks and like vehicles, being preferably in the neighborhood of 72 inches, or substantially under the 8 foot legal limit. This conventional tread width, or a tread width under the 8 foot limit, enables the present machine to be easily loaded on a standard heavy machinery trailer. The width of these trailers is 8 feet or less, to conform to state road requirements. In most instances it will be necessary to load the present machine on such a trailer to move it over any appreciable distance, where the time element of moving it under its own power would not be economically feasible. Although, it may not be practicable to keep the over-all width of the machine down to 8 feet, it is absolutely necessary to keep the wheel spacing or track width down to 8 feet or less so as to avoid a dismantling and erection job each time that the machine is moved from place to place. The operator can readily obtain a state permit for moving an over-width unit on the highways. By having the steering wheels 22 in front and the traction wheels 23 in rear the vehicle can be steered in the normal manner, the same as any car or truck. There is thus no wasted motion while following a given line, and there is no confusion of the operator. The short wheel base between the front and rear wheels enables the machine to follow short radius curves.

Mounted at the front end of the machine on the horizontally extending forward portions 24b of the frame sills is an aggregate receiving hopper 90. The hopper is of trough shape comprising sloping front and rear walls 91a and 91b terminating in a V-shaped bottom 92 extending transversely the entire width of the machine and closed at its ends by end plates 93. The hopper 90 is adapted to have aggregate dumped into it from the rear end of a tilting body type of dump truck T traveling in front of the hopper, as indicated in dotted lines in FIGURE 1. The front edge of the hopper is sufficiently low so that it is cleared by the rear end of the dump body and by the tail gate in the aggregate dump-

ing operation, the hopper 90 also being of a width substantially wider than the truck T so that no side spillage will occur. The paving machine is adapted to remain in traveling association with the dump truck T so that the paving machine can continue its normal pavement laying travel while the dump truck is dumping aggregate into the hopper 90. To this end, a pair of laterally spaced pusher rollers 95 are rotatably mounted on a cross beam 97 (FIGURE 5A) which is secured to the forward ends of the sill members 24b below the front edge of the hopper 90. These pusher rollers 95 are disposed at the appropriate height to engage the rear tires T3 of the truck T substantially at axle level so that the paving machine propels the truck in order to maintain continuous contact between the two vehicles in the aggregate dumping operation. Extending upwardly and forwardly from the front edge of the receiving hopper 90 is a strip of flexible flashing material 98 which is adapted to contact the end or bottom of the dump truck body so as to aid in preventing aggregate from spilling from the hopper 90 during hopper loading operations.

The hopper 90 is adapted to discharge its aggregate through a rectangular discharge opening 101 which is located in the center of the trough-shaped bottom 92, as shown in FIGURE 2. This discharge opening 101 serves to discharge the aggregate on to the upper surface of a centrally disposed conveyor belt 102 which carries the aggregate back to a trough-shaped discharge hopper 104 located at the rear end of the machine. The conveyor belt 102 is slightly narrower in width than the transverse space between the frame sills 24 so that the belt can travel between these sills and also between the inner sides of the front steering wheels 22 and of the rear driving wheels 23. The discharge opening 101 is made slightly narrower in width than the belt 102.

Referring to FIGURE 5A, the bottom run of the conveyor belt 102 passes forwardly around the underside of an end roller 106, and from this end roller the top run of the belt passes rearwardly down under a guide roller 107 and thence back under the discharge opening 101 where it receives the aggregate from the receiving hopper to be conveyed back to the discharge hopper 104. The end roller 106 is made adjustable longitudinally in the machine so as to enable the tension of the conveyor belt 102 to be adjusted. To provide for such adjustment, the shaft ends of the end roller 106 are journaled in slidable bearing blocks 108 which are capable of being shifted longitudinally of the machine by the manipulation of adjusting screws 111 in a manner well known. The rear end of the conveyor belt loop passes around a rear driving drum or roller 112 which is disposed in the forward portion of the discharge hopper 104. Intermediate rollers 114 and 115 support and guide the upper and lower runs of the belt loop. The aggregate is prevented from spilling from the side edges of the belt by longitudinally extending confining plates or boards 116 provided with strips of flexible flashing 117 along their lower edges for contacting the edge portions of the top run of the conveyor belt. These strips of flexible flashing 117 provide the contact seal between the conveyor belt and the confining plates 116. Because of the very gentle uphill slope of the conveyor belt 102 in its travel back to the rear driving roller 112 this conveyor belt does not have to use cross slats, and by reason of the absence of cross slats the flexible flashing strips 117 can provide a much more effective contact seal with the conveyor belt.

Because the receiving hopper 90 is much wider than the discharge opening 101 and conveyor belt 102, it is desirable to provide means for working the aggregate inwardly from the outer ends of the hopper toward the discharge opening 101. Such function is accomplished by right and left hand collecting screws 118, 119 (FIGURE 2) which are mounted on a transverse shaft 121 extending along the bottom of the hopper. The left

hand end of the shaft 121 extends beyond the hopper wall and mounts a sprocket wheel 123 over which travels a sprocket chain 124. This chain loops around a driving sprocket wheel 125, and engaging the top run of the chain is an adjustable chain tightening idler 126. The driving sprocket wheel 125 is mounted on a drive shaft 127 which has bearing mounting below the underside of the hopper 90. The shaft 127 is adapted to be driven by the end roller 106 of the conveyor belt 102 through a splined shaft 128 having universal joints 129 at its ends, whereby to accommodate the longitudinal adjustment of the belt tightening roller 106. Thus, whenever the conveyor belt 102 is in operation to convey aggregate rearwardly the collecting screws 118 and 119 are operating simultaneously therewith to move the aggregate inwardly from the outer ends of the hopper toward the hopper discharge opening 101. Formed in the sloping rear wall 91b of the hopper are forwardly projecting pockets or bulges 132 which afford clearance for the front steering wheels 22 when these wheels are being negotiated over uneven ground, it being noted in this regard that the trough-shaped formation of this front hopper 90 gives the front wheels 22 steering leeway under the sloping rear wall 91b, while still enabling the hopper to continue well back over the wheels.

Referring now to the drive for the conveyor belt 102, the right hand end of the transmission shaft 68 carries a sprocket wheel 133 that transmits a drive through a sprocket chain 134 to the sprocket wheel 135 mounted on a transversely extending power distribution shaft 136 extending transversely of the rear end of the machine frame. Mounted on an intermediate portion of the shaft 136 is a sprocket wheel 138 which transmits a drive through a downwardly extending sprocket chain 139 to a sprocket wheel 141 mounted concentrically of the rear belt driving drum or roller 112. Axially aligned with and connected between the sprocket wheel 141 and the mounting shaft 142 of belt driving drum 112 is a belt controlling clutch 144 which is preferably of the hydraulically operated over-center snap type. By the operation of this clutch 144 the travel of the conveyor belt 102 can be started and stopped to control the transfer of aggregate from the receiving hopper 90 to the spreading hopper 104.

Situated along side of the operator's seat 46 is a bank of control handles 145 which operate a bank of hydraulically controlled valves 146. One of the control handles 145 governs the hydraulic cylinder that actuates the traveling clutch 69, and another governs the hydraulic cylinder that actuates the conveyor belt control clutch 144.

Referring now to the aggregate discharge or spreader hopper 104, this is comparable in width to the receiving hopper 90, extending across the entire width of the machine, which is shown as having a width of approximately 10 or 11 feet, although this may be increased or reduced as desired, or to meet different operating conditions. As previously described, the spreader hopper 104 discharges the aggregate at a point substantially in rear of the rear vehicle wheels 23, so that these wheels do not travel over the newly laid pavement or seal coating deposited by the machine. Thus, there are no wheel prints left in the newly laid pavement or seal coating. As shown in FIGURE 5B, the hopper 104 has a trough shaped lower portion 150 having a transversely extending discharge slot 151 in its bottom. The rear edge of the spreader slot 151 is defined by an adjustable spreader gate 152 which is pivotally supported by mounting arms 153 extending downwardly at spaced intervals from a transversely extending rock shaft 154 pivotally supported on the back wall of the hopper 104. A hydraulic cylinder 155 also mounted on this back wall of the hopper is link connected to rock shaft 154, so that the operator by manipulation of one of the control handles 145 can control the amount of aggregate being discharged down-

wardly from the hopper 104. Rotating in the spreader slot 151 is a rotating spreader roller 160 which functions to feed the aggregate downwardly between its back surface and the forward edge of the spreader gate 152. The surface of this spreader roller is scored with intersecting right hand and left hand diagonal grooves 161, 162, as fragmentarily shown in FIGURE 4, whereby the grooves and intervening diamonds tend to pull the aggregate from the hopper 104. The right hand end of the spreader roller 160 has a mounting shaft extending beyond the end wall of the spreader hopper to mount a sprocket wheel 165 thereon. This sprocket wheel is driven by sprocket chain 166 which is trained over sprocket pinion 167 mounted in alignment with the right hand end of the power distributing shaft 136. A hydraulically controlled clutch 168 is interposed between the distributing shaft 136 and the sprocket pinion 167, and this clutch is controllable by one of the valve handles 145 so that the operator can start and stop the rotation of the spreader roller 160 at will.

Since the conveyor belt 102 discharges the aggregate substantially in the center of the spreader hopper 104, there arises the problem of getting the aggregate spread or distributed outwardly to the ends of the spreader hopper, which is the reverse of the problem encountered in the receiving hopper 90. This outward spreading or distribution of the aggregate to the ends of the hopper 104 is accomplished by left and right hand spreader screws 171, 172 mounted above the spreader roll 160 on the transversely extending shaft 173. These two spreader screws spread the aggregate outwardly in opposite directions from the central zone of discharge of the conveyor belt 102, and serve to keep a level distribution of the aggregate in the spreader hopper 104, with all the points of the spreader roller 160 substantially uniformly covered. The spreader screws 171, 172 are preferably divided into sleeved sections joining at the joint lines 171', 172' (FIGURE 2), so that the number of sections mounted on the shaft 173 may be varied to permit the width of the finished paving strip to be varied within limits. The spreader screw mounting shaft 173 has its left hand end extending beyond the end wall of the hopper 104 for mounting a sprocket wheel 175. A sprocket chain 176 extends from this sprocket wheel upwardly over a sprocket pinion 177 which is mounted in alignment with the left hand end of the power distribution shaft 136. The transmission of power from the shaft 136 to the sprocket pinion 177 is controlled by a hydraulically responsive over center type of clutch 179, the hydraulic cylinder of which is arranged to respond to one of the control handles 145 at the operator's position. Thus, the operator can start and stop the drive to the spreader screws 171, 172 at will.

The above described aggregate spreading mechanism is designed to handle stone up to 1" size or larger, and it will obviously handle other types of aggregate and crushed stone. Different sizes of aggregate are accommodated by different degrees of opening of the spreader gate 152.

#### *Asphalt spreading mechanism*

The liquid asphalt is contained in a relatively long and narrow heated supply tank 185 which extends longitudinally of the main frame 21. As shown in FIGURE 2, this supply tank is disposed approximately centrally of the width of the main frame, substantially above the conveyor belt 102, and is located as low as possible, in close proximity to the conveyor belt 102 and to the top periphery of the inner left hand drive wheel 23. This tank, when full of asphalt, is extremely heavy, and hence the disposal of the tank approximately centrally of the main frame 21 and at as low a level as possible, is important from the standpoint of maintaining the lateral stability of the machine against tipping when traveling over laterally sloping ground. The tank is supported on a secondary frame structure 186 comprising vertically extending angle bars

187 extending upwardly from the frame sills 24 and joined at their upper ends by horizontally extending angle bars 188 (FIGURE 5B). The tank 185 comprises rectangular side, end, and top walls 191, 192 and 193, respectively, and has a downwardly and forwardly sloping bottom sump wall 194 (FIGURE 5A). The tank is substantially enclosed within a spaced sheet metal outer shell 195, and confined between this shell and the walls of the tank is heat insulating material 196 of any suitable type. Entering the front end of the tank adjacent to its left hand side, is a horizontally extending fire tube 201 into which an atomizing type of fuel burner 202 (FIGURE 6) is adapted to project a heating flame for heating the asphalt in the tank. A liner 203 of heat resistant steel extends from the open end of the fire tube 201 back a distance substantially equal to the length of the flame from the burner 202 to prevent the hot spot of the burner flame from having direct contact with the fire tube. As viewed in plan, the fire tube is of U-shaped configuration within the asphalt tank, comprising a cross portion 201b (FIGURE 5B) at the rear end of the tank, and a forwardly extending leg 201c leading from the cross portion 201b back to the front end of the tank. This forwardly extending leg or passage 201c opens into a downwardly inclined duct 204 which opens through a port 205 into the side of a heating chamber 206 that heats the asphalt pump (FIGURES 5A and 7). This asphalt pump heating chamber 206 is positioned so that it lies below and extends forwardly from the front end of the tank 185. Leading upwardly from the center of the pump heating chamber 206 is an exhaust stack 208 which exhausts the products of combustion to the atmosphere above the top of the tank 185. Thus, the flame from the burner 202 heats the asphalt in the interior of the tank 185, and also heats the interior of the asphalt pump heating chamber 206.

The asphalt pump, designated 210, is situated in the front end of the heating chamber 206, this pump being of the rotary positive displacement type. As will be hereinafter described, this pump 210 serves primarily to pump the heated asphalt from the heated supply tank 185 to the asphalt spray bars 280 at the rear of the machine. Secondly, the pump 210 can also be employed to pump asphalt from an asphalt supply truck to the present paving machine, and can also be employed in the performance of spray bar heating and spray bar cleaning operations. In the preferred two engine embodiment of my improved paving machine, I provide a second engine for operating this asphalt pump 210 because of the greater flexibility of control of pumping speeds; but my invention also contemplates a single engine embodiment wherein the pump 210 is driven by a power take-off leading from engine 60. In the two engine embodiment, a relatively small air-cooled engine 212 is mounted transversely on the right hand side of the frame in front of the main engine 60. In the illustrated embodiment, the drive from this second engine is shown as being transmitted through a gear reduction and clutch housing 214 to a sprocket wheel 216. A control lever 218 for operating the clutch in housing 214 is arranged to respond to hydraulic cylinder 219 which is governed by the manipulation of one of the control handles 145 located at the operator's position. Extending downwardly from sprocket wheel 216 is a driven chain 221 which passes over sprocket wheel 222 mounted on the projecting end of pump shaft 223, which drives the rotor of pump 210. As an alternative arrangement, the drive from the engine 212 to the sprocket wheel 216 may occur through a selective type gear box (of which the housing 214 may be representative). Since the rate of asphalt application depends upon the number of revolutions of the pump 210, the use of a selective speed gear box will give a broader range of rates of application of the asphalt with regard to the variable speeds of the engine 212. For best results, the asphalt pump 210 should have a wide range of speed variation, as for example for pumping from approximately 20 gallons per minute up to approximately 150

gallons per minute. The speeds of main engine 60 and of secondary engine 212 are governed by throttle control levers 225 and 226 mounted on the steering column below the steering wheel 44.

As shown in FIGURE 5A, the pump 210 has its inlet port communicating with 3-way suction valve 230 which is located directly below the front end of the asphalt tank 185. This 3-way valve 230 is also contained within the pump heating chamber 206 so that it is also heated by the products of combustion from the burner 202. The valve 230 has an upper intake port communicating upwardly through a nipple connection 232 opening into the lower end of the inclined sump 194' in the bottom 194 of the asphalt tank. The valve 230 also has a rearward port communicating through nipple connection 234 with a supply pipe T 235. The side ports of this pipe T 235 connect with left and right hand supply pipes 236, 236' (FIGURE 7) which slope upwardly and extend outwardly to the left and right hand sides of the machine frame. The ends of these supply pipes are provided with threads or with any other suitable coupling connections for establishing connection with an asphalt supply truck situated on either the left hand side or right hand side of the paving machine. The tank truck may be connected with either supply pipe 236 or 236' through a flexible hose so that the paving machine may be maintained in continuous operation while the asphalt tank 185 is being refilled. The outer ends of both supply pipes 236, 236' are adapted to be normally closed with leak-proof caps, 237. The downward dip in the center of the asphalt supply connection 236, 236' prevents loss of asphalt out of the end of this supply connection when the tank truck is disconnected therefrom. The asphalt tank 185 can also be loaded through the top through an upper manhole opening 238 which is normally closed by lid 239. This manhole opening 238 also provides access to the interior of the asphalt tank for cleaning purposes.

The suction or intake valve 230 has a rotatable valve element provided with a T-shaped relation of ports which enables the inlet of the pump 210 to be connected selectively with either or both of the asphalt tank 185 and supply pipes 236, 236'; and which also enables the supply pipes 236, 236' to be connected with the tank 185 for filling the latter. An operating shaft 241 extends to the left from this rotatable valve element and mounts an operating arm 242 at its outer end. Extending from the end of this operating arm is a rod 243 which extends back for connection to the lower end of a control lever 244 located at the operator's position, by the manipulation of which control lever the operator can position the intake valve 230 in any of its above described positions.

Extending upwardly from the outlet port of the pump 210, and disposed within the exhaust stack 208, is an asphalt pipe 246 which extends rearwardly and enters the asphalt tank 185 through its front wall 192. Connected to the rear end of pipe 246, within the tank 185, is a 3-way intermediate valve 250. This valve has an inlet port 251 communicating with the pipe 246; a through discharge port 252 in alignment with inlet port 251; and a right angle outlet port 253 which opens into the interior of the tank 185 (FIGURES 2 and 6). Extending upwardly from the rotatable element of this valve 250 is an operating shaft 255 which extends out through the top of the tank 185, and which carries an operating lever 256 on its upper end, by the manipulation of which the valve 250 can be set to direct the pumped flow of asphalt either through straight line port 252, or through angle port 253 into the interior of the tank 185.

The straight line through port 252 has connection through a flexible metallic hose 258 with a T connection 259 (FIGURE 2) located substantially midway of the length of the tank. As shown in FIGURES 2 and 7, the left hand branch of this T connection 259 opens into one of the through ports of a 3-way valve 260 which is also disposed within the tank 185. This valve 260 com-

prises a through port 261 which is connected to the left hand side of the T connection 259; another through port 262 which is connected to nozzle supply pipe 264; and an angle port 263 which communicates with check valve 266 opening into the tank. This check valve 266 permits free flow of heated asphalt to occur from the 3-way valve 260 in a rearward direction through port 263 and thence through check valve 266 into the tank, when the valve 260 is set in position with its ports 262 and 263 in communication, for the purpose of circulating heated asphalt through the spray bars to heat the spray bars, which feature, however, constitutes no part of the present invention.

Extending upwardly from the rotatable element of valve 260 is an operating shaft 269 which carries an operating arm 271 on its upper end above the top of the tank. The arm 271 is connected through link 272 with another crank arm 273 mounted on vertical control shaft 274 which extends downwardly alongside the tank near the operator's position. The control shaft 274 is arranged to be power operated through crank arm 275 (FIGURES 6 and 7) and linkage connected to a hydraulic cylinder 276 which is made responsive to the operation of one of the valve handles 145 at the operator's position. The lower end of this vertical control shaft 274 is operatively connected to control the spray nozzle valves, as will be presently described.

Referring again to the T connection 259, the right hand branch thereof is connected to spray nozzle supply pipe 265. As shown in FIGURES 6 and 7, the two spray nozzle supply pipes 264 and 265 extend diagonally rearwardly and downwardly within the asphalt tank, and thence pass outwardly thereof through the bottom and side walls respectively. The lower ends of pipes 264 and 265 connect through flexible hoses 278 and 279 with a two section type of asphalt spray bar 280.

At closely spaced points across the entire length of the two-section spray bar 280 are downwardly directed asphalt spray nozzles 285 each provided with a control valve 286 having an individual operating lever 288. These operating levers 288 have multiple connection with transversely extending operating linkage designated 289 in its entirety. This linkage 289 is adapted to be shifted to and fro for opening and closing the spray nozzle valves under the actuation of hydraulically operated control shaft 274. As shown in FIGURE 7, the lower end of this vertical control shaft 274 carries a crank arm 291 which is connected through link 292 with lever 293 pivoted at an intermediate point on the frame. The other end of lever 293 connects through link 294 with the shiftable valve operating linkage 289, thereby placing the spray nozzle valves 286 under the control of the operator through the vertical control shaft 274.

It will be noted from FIGURE 1, that the spray bar 280 is positioned directly in advance of the aggregate spreading hopper 104, so that the spray nozzles 285 spray the hot liquid asphalt upon the road surface just before the aggregate is discharged downwardly upon this surface. Hence, thorough penetration and mixing occurs between the two. Also, these spray nozzles are disposed in rear of the rear vehicle wheels 23 so that no vehicle wheels travel over the freshly discharged asphalt, with the resultant leaving of wheel imprints in the freshly laid pavement or seal coating.

Referring to FIGURES 6 and 7, it will be seen that a short horizontal pipe section 302 opens into the front side of left hand spray nozzle supply pipe 264 and extends forwardly therefrom for opening into the inlet port of a two-way suction valve 305. This valve 305 has a rotatable valve core which is operated by a hand lever 307. Leading from the outlet port of this valve 305 is a pipe 310 which opens into the rear side of the left hand supply pipe 236 preferably near the supply pipe T 235. The valve 305 is normally closed to shut off flow from the left hand spray nozzle supply pipe 264 to the left hand

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inlet supply pipe 236. However, in the operation of cleaning the asphalt spray bar 280, this valve 305 is opened to permit a cleaning flow of asphalt or solvent from the spray bar 280 through pipe 264, valve 305, pipe 310, inlet supply pipe 236, 3-way valve 230 and pump 210 into the asphalt supply tank 185. However, this feature of the cleaning flow through valve 305 and pipe 310 constitutes no part of the present invention.

Attention is directed to the fact that the majority of the asphalt flow control valves are contained in the heated asphalt supply tank 185 and in the pump heating chamber 206. That is to say, the three-way valve 250, the three-way valve 260, and the check valve 266, are all contained in the heated asphalt supply tank 185; and the three-way valve 230 is contained in the pump heating chamber 206. Attention is also directed to the fact that a very substantial proportion of the asphalt piping, represented for example by the pipes 258, 264, 265, etc., is enclosed within the heated asphalt supply tank 185. The purpose of this is to keep the valves and piping from cooling off rapidly, and to facilitate reheating them when they have cooled off. Also, by having most of the large valves inside of the heated supply tank 185 they will be free from dust and resulting wear; and, moreover, leaks occurring at these valves will be of no consequence because the asphalt will merely leak back into the supply tank 185.

Referring now to the various indicating and recording devices of the machine, it will be seen from FIGURE 1 that a recording tachometer wheel 315 is mounted to bear against the roadway between the front and rear wheels 22 and 23. This tachometer wheel is journaled in an arm or U-shaped frame 316 which is pivoted to the main frame 21 at 317, whereby the tachometer wheel can be lowered and raised into and out of contact with the road surface, through a lifting cable 318 which winds upon a manually operated winch 319. This tachometer wheel is operatively connected through a flexible shaft with a tachometer which is located on an instrument panel 321 located in front of the operator's position 46, which tachometer records the speed of the machine in feet per minute.

Also mounted on the instrument panel 321 are an asphalt pump tachometer; a heat gauge for registering the heat of the asphalt in the tank 185; an r.p.m. indicator; an oil pressure gauge for indicating the oil pressure in the hydraulic control system; an ammeter, etc. The hydraulic pump for the hydraulic control system can be driven from either engine 60 or 212.

A tank level gauge 327 affords an indication to the operator in the operator's position 46 as to the amount of asphalt within the supply or storage tank 185.

The operator's seat 46 can swivel around the vertical standard 46' to enable the operator to swing his position around to observe more accurately the line of travel of the machine, the discharge of the aggregate and asphalt, etc. An upper deck surface 330 extends forwardly from the front of the operator's position along the left side of the tank 185 to afford convenient access to the burner 202, valve control lever 256, etc.

The machine is equipped with a hand spray attachment so that areas unavoidably missed may be covered by hand.

It will be understood that my machine may spread any desired type of aggregate, and may spray all types of asphalt, tar, emulsions, road oils and cut-back. It is believed that the mode of operation of the machine will be apparent from the preceding description.

While I have illustrated and described what I regard to be the preferred embodiment of my invention, nevertheless it will be understood that such is merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

I claim:

1. In a self-propelled paving machine for simultane-

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ously and continuously laying asphalt and aggregate, the combination of a main frame comprising laterally spaced side sills, front steering wheels and rear driving wheels supporting said frame, a front trough-shaped receiving hopper extending transversely of said main frame in front of said front steering wheels and adapted to receive aggregate from a rear dumping supply truck traveling forwardly in front of said receiving hopper, a rear trough-shaped spreading hopper extending transversely of said main frame in rear of said rear driving wheels and adapted to spread aggregate upon the road surface in rear of said rear driving wheels, longitudinally traveling belt conveyor means disposed substantially centrally of the machine between said side sills of the main frame and between the pairs of front and rear wheels for conveying the aggregate rearwardly from said receiving hopper to said spreading hopper, a discharge opening in the bottom of said trough-shaped front hopper for discharging aggregate upon said belt conveyor means, a front roller for the front end of said belt conveyor means located under said front hopper and a rear roller for the rear end of said belt conveyor means located above said rear hopper, means for driving one of said rollers, an asphalt supply tank supported to extend longitudinally of said main frame substantially midway of the sides thereof and overlying said belt conveyor means in immediate vertical proximity thereto, means for heating the asphalt in said tank, spray nozzles disposed transversely of said frame between said rear driving wheels and said rear spreading hopper operative to receive the heated asphalt from said tank and to spray it upon the road surface in rear of said rear wheels and immediately in front of the line of spreading of the aggregate from said rear spreading hopper, the rear wall of said trough-shaped receiving hopper overlying the front portions of said front steering wheels and said asphalt supply tank having its front end disposed substantially in the transverse vertical plane of the rear portions of said front wheels in such close proximity to said receiving hopper as to preclude the interposition of a longitudinally extending internal combustion engine therebetween, a longitudinally extending laterally disposed internal combustion engine mounted on said frame between one side of said tank and the adjacent side of said frame, an operator's seat mounted on said frame between the other side of said tank and the other side of said frame, a rear axle housing extending axially between said rear driving wheels, a differential housing embodied in said rear axle housing and enclosing a differential mechanism operative to drive said rear wheels differentially, a longitudinally extending pinion shaft entering said differential housing from the rear side thereof, a crosswise drive shaft extending transversely of said frame in rear of said rear axle housing, beveled gearing connecting said crosswise drive shaft with said longitudinally extending pinion shaft, selective speed transmission mechanism for transmitting a selective speed drive from said engine to said crosswise drive shaft, means operable from said operator's seat for controlling said selective speed transmission mechanism, an arched rockable axle mounting for said front steering wheels comprising a front overhead axle extending transversely above said front steering wheels, a longitudinal pivot at the center of said overhead axle and carried by said main frame to establish a transversely rockable mounting of said axle on said frame, vertical kingpins journaled for steering rotation in the ends of said axle, fork arms extending downwardly from said kingpins carrying spindles on which said steering wheels are rotatably mounted, said arched axle mounting defining an open vertical clearance space extending downwardly from the underside of said overhead axle to the ground between said steering wheels through which the front portion of said main frame and the front portion of said conveyor belt extend at a very low level, whereby said front receiving hopper is of trough-shaped formation and is disposed at a rela-

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tively low level for accommodating dumping trucks of low dumping height, while still having the front end of said conveyor belt pass beneath said discharge opening in the bottom of said receiving hopper for gravitational discharge of aggregate from said hopper to said conveyor belt means, and control means operative from the operator's position for controlling the rate of discharge of the asphalt and of the aggregate upon the road surface.

2. In a self-propelled paving machine for simultaneously and continuously laying asphalt and aggregate, the combination of a main frame comprising laterally spaced side sills, front steering wheels and rear driving wheels supporting said front, a front aggregate receiving hopper extending transversely of said main frame in front of said front steering wheels and adapted to receive aggregate from a rear dumping supply truck traveling forwardly in front of said receiving hopper, a rear aggregate spreading hopper extending transversely of said frame in rear of said rear driving wheels and adapted to spread aggregate upon the road surface in rear of said rear driving wheels, a longitudinally traveling belt conveyor disposed substantially centrally of the machine between the side sills of said frame and between the pairs of front and rear wheels for conveying the aggregate rearwardly from said receiving hopper to said spreading hopper, a discharge opening in the bottom of said front hopper for discharging aggregate upon said belt conveyor, an asphalt supply tank supported to extend longitudinally of said main frame substantially midway of the sides thereof and overlying said conveyor belt in immediate vertical proximity thereto, said asphalt supply tank extending above said wheels and horizontally throughout substantially the entire span between said front and rear wheels with its front end in such close proximity to said front receiving hopper as to preclude the interposition of an internal combustion engine therebetween, means for heating the asphalt in said tank, spray nozzles disposed transversely of said frame between said rear driving wheels and said rear spreading hopper operative to receive the heated asphalt from said tank and to spray it upon the road surface in rear of said rear wheels and immediately in front of the line of spreading of the aggregate from said rear spreading hopper, a longitudinally extending laterally disposed internal combustion engine mounted on said frame between one side of said tank and the adjacent side of said frame, an operator's seat mounted on said frame between the other side of said tank and the other side of said frame, power transmission mechanism for transmitting a drive from said engine to said rear driving wheels, means operable from said operator's seat for controlling said power transmission mechanism, an arched rockable axle mounting for said front steering wheels comprising a front overhead axle extending transversely above said front steering wheels, a longitudinal pivot at the center of said overhead axle and carried by said main frame to establish a transversely rockable mounting of said overhead axle on said frame, vertical kingpins journaled for steering rotation in the ends of said axle, fork arms extending downwardly from said kingpins having spindles on which said steering wheels are rotatably mounted, said arched axle mounting defining an open vertical clearance space extending downwardly from the underside of said overhead axle to the ground between said steering wheels through which the front portion of said main frame and the front portion of said conveyor belt extend at a very low level whereby said front receiving hopper is disposed at a relatively low level for accommodating dumping trucks of low dumping height, while still having the front end of said conveyor belt pass beneath the discharge opening in the bottom of said receiving hopper for gravitational discharge of aggregate from said hopper to said belt, and control means operative from the operator's position for controlling the rate of discharge of the asphalt and of the aggregate upon the road surface.

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3. In a self-propelled paving machine for simultaneously and continuously laying asphalt and aggregate, the combination of a main frame comprising laterally spaced side sills, front steering wheels and rear driving wheels supporting said frame, a front trough-shaped receiving hopper extending transversely of said main frame in front of said front steering wheels and adapted to receive aggregate from a rear dumping supply truck traveling forwardly in front of said receiving hopper, a rear trough-shaped spreading hopper extending transversely of said main frame in rear of said rear driving wheels and adapted to spread aggregate upon the road surface in rear of said rear driving wheels, a longitudinally traveling conveyor belt disposed substantially centrally of the machine between the side sills of said frame and between the pairs of front and rear wheels for conveying the aggregate rearwardly from said receiving hopper to said spreading hopper, a discharge opening in the bottom of said receiving hopper for discharging aggregate upon said conveyor belt, rotating collecting screws in said front receiving hopper for working the aggregate inwardly from the outer ends of said receiving hopper toward said discharge opening, rotating spreader screws in said spreading hopper for working the aggregate outwardly from the point of discharge of said belt conveyor toward the outer ends of said spreading hopper, an asphalt supply tank supported to extend longitudinally of said main frame substantially midway of the sides thereof and overlying said conveyor belt in immediate vertical proximity thereto, spray nozzles disposed transversely of said frame between said rear driving wheels and said rear spreading hopper operative to receive the heated asphalt from said tank and to spray it upon the road surface in rear of said rear wheels and immediately in front of the line of spreading of the aggregate from said rear spreading hopper, an arched rockable axle mounting for said front steering wheels comprising a front overhead axle extending transversely above said front steering wheels, a longitudinal pivot at the center of said overhead axle and carried by said main frame to establish a transversely rockable mounting of said axle on said frame, vertical kingpins journaled for steering rotation in the ends of said axle, fork arms extending downwardly from said kingpins carrying spindles on which said steering wheels are rotatably mounted, said arched axle mounting defining an open vertical clearance space extending downwardly from the underside of said overhead axle to the ground between said steering wheels, through which clearance space the front portion of said main frame and the front portion of said conveyor belt extend at a very low level whereby said front receiving hopper is disposed at a relatively low level for accommodating dumping trucks of low dumping height while still having the front end of said conveyor belt pass beneath said discharge opening in the bottom of said receiving hopper for gravitational discharge of aggregate from said hopper to said belt, and a power plant mounted in a laterally offset position on said main frame operatively connected for supplying propelling power to said rear drive wheels, and for driving said conveyor belt and said collecting and spreading screws.

4. In a self-propelled paving machine of the class described, the combination of a main frame comprising laterally spaced side sills, front steering wheels and rear driving wheels supporting said frame, a front trough-shaped receiving hopper extending transversely of said main frame in front of said front steering wheels and adapted to receive aggregate from a rear dumping supply truck traveling forwardly in front of said receiving hopper, a rear trough-shaped spreading hopper extending transversely of said main frame in rear of said rear driving wheels and adapted to spread aggregate upon the road surface in rear of said rear driving wheels, longitudinally traveling belt conveyor means disposed substantially centrally of the machine between said side sills of the main frame and between the pairs of front and rear wheels for

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conveying the aggregate rearwardly from said receiving hopper to said spreading hopper, a discharge opening in the bottom of said trough-shaped front hopper for discharging aggregate upon said belt conveyor means, a front roller for the front end of said belt conveyor means located under said front hopper and a rear roller for the rear end of said belt conveyor means located above said rear hopper, means for driving one of said rollers, a longitudinally extending laterally disposed internal combustion engine mounted on one side of said frame, an operator's seat mounted on the other side of said frame, a rear axle housing extending axially between said rear driving wheels, a differential housing embodied in said rear axle housing and enclosing a differential mechanism operative to drive said rear wheels differentially, a longitudinally extending pinion shaft entering said differential housing from the rear side thereof, a crosswise drive shaft extending transversely of said frame in rear of said rear axle housing, beveled gearing connecting said crosswise drive shaft with said longitudinally extending pinion shaft, selective speed transmission mechanism for transmitting a selective speed drive from said engine to said crosswise drive shaft, means operable from said operator's seat for controlling said selective speed transmission mechanism, an arched rockable axis mounting for said front steering wheels comprising a front overhead axle extending transversely above said front steering wheels, a longitudinal pivot at the center of said overhead axle and carried by said main frame to establish a transversely rockable mounting of said axle on said frame, vertical kingpins journaled for steering rotation in the ends of said axle, fork arms extending downwardly from said kingpins carrying spindles on which said steering wheels are rotatably mounted, said arched axle mounting defining an open vertical clearance space extending downwardly from the underside of said overhead axle to the ground between said steering wheels through which the front portion of said main frame and the front portion of said conveyor belt extend at a very low level, whereby said front receiving hopper is of trough-shaped formation and is disposed at a relatively low level for accommodating dumping trucks of low dumping height, while still having the front end of said conveyor belt pass beneath said discharge opening in the bottom of said receiving hopper for gravitational discharge of aggregate from said hopper to said conveyor belt means, and control means operative from the operator's position for controlling the rate of discharge of the aggregate upon the road surface.

5. In a self-propelled paving machine of the class described, the combination of a main frame comprising laterally spaced side sills, front steering wheels and rear driving wheels supporting said frame, a front aggregate receiving hopper extending transversely of said main frame in front of said front steering wheels and adapted to receive aggregate from a rear dumping supply truck traveling forwardly in front of said receiving hopper, a rear aggregate spreading hopper extending transversely of said frame in rear of said rear driving wheels and adapted to spread aggregate upon the road surface in rear of said rear driving wheels, a longitudinally traveling belt conveyor disposed substantially centrally of the machine between the side sills of said frame and between the pairs of front and rear wheels for conveying the aggregate rearwardly from said receiving hopper to said spreading hopper, a discharge opening in the bottom of said front hopper for discharging aggregate upon said belt conveyor, a longitudinally extending laterally disposed internal combustion engine mounted on one side of said frame, an operator's seat mounted on said frame, power transmission mechanism for transmitting a drive from said engine to said rear driving wheels, means operable from said operator's seat for controlling said power transmission mechanism, an arched rockable axle mount-

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ing for said front steering wheels comprising a front overhead axle extending transversely above said front steering wheels, a longitudinal pivot at the center of said overhead axle and carried by said main frame to establish a transversely rockable mounting of said overhead axle on said frame, vertical kingpins journaled for steering rotation in the ends of said axle, fork arms extending downwardly from said kingpins having spindles on which said steering wheels are rotatably mounted, said arched axle mounting defining an open vertical clearance space extending downwardly from the underside of said overhead axle to the ground between said steering wheels through which the front portion of said main frame and the front portion of said conveyor belt extend at a very low level whereby said front receiving hopper is disposed at a relatively low level for accommodating dumping trucks of low dumping height, while still having the front end of said conveyor belt pass beneath the discharge opening in the bottom of said receiving hopper for gravitational discharge of aggregate from said hopper to said belt, and control means operative from the operator's position for controlling the rate of discharge of the aggregate upon the road surface.

6. In a self-propelled paving machine of the class described, the combination of a main frame comprising laterally spaced side sills, front steering wheels and rear driving wheels supporting the frame, a front trough-shaped receiving hopper extending transversely of said main frame in front of said front steering wheels and adapted to receive aggregate from a rear dumping supply truck traveling forwardly in front of said receiving hopper, a rear trough-shaped spreading hopper extending transversely of said main frame in rear of said rear driving wheels and adapted to spread aggregate upon the road surface in rear of said rear driving wheels, a longitudinally traveling conveyor belt disposed substantially centrally of the machine between the side sills of said frame and between the pairs of front and rear wheels for conveying the aggregate rearwardly from said receiving hopper to said spreading hopper, a discharge opening in the bottom of said receiving hopper for discharging aggregate upon said conveyor belt, rotating collecting screws in said front receiving hopper for working the aggregate inwardly from the outer ends of said receiving hopper toward said discharge opening, rotating spreader screws in said spreading hopper for working the aggregate outwardly from the point of discharge of said belt conveyor toward the outer ends of said spreading hopper, an arched rockable axle mounting for said front steering wheels comprising a front overhead axle extending transversely above said front steering wheels, a longitudinal pivot at the center of said overhead axle and carried by said main frame to establish a transversely rockable mounting of said axle on said frame, vertical kingpins journaled for steering rotation in the ends of said axle, fork arms extending downwardly from said kingpins carrying spindles on which said steering wheels are rotatably mounted, said arched axle mounting defining an open vertical clearance space extending downwardly from the underside of said overhead axle to the ground between said steering wheels, through which clearance space the front portion of said main frame and the front portion of said conveyor belt extend at a very low level whereby said front receiving hopper is disposed at a relatively low level for accommodating dumping trucks of low dumping height while still having the front end of said conveyor belt pass beneath said discharge opening in the bottom of said receiving hopper for gravitational discharge of aggregate from said hopper to said belt, and a power plant on said main frame operatively connected for supplying propelling power to said rear drive wheels, and for driving said conveyor belt and said collecting and spreading screws.

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