Oct. 1, 1935. E. B. CADWELL ET AL 2,015,707

METHOD OF AND APPARATUS FOR PREPARING PAVING COMPOSITIONS

Filed Feb. 23, 1932 3 Sheets-Sheet 1

Fig: 1

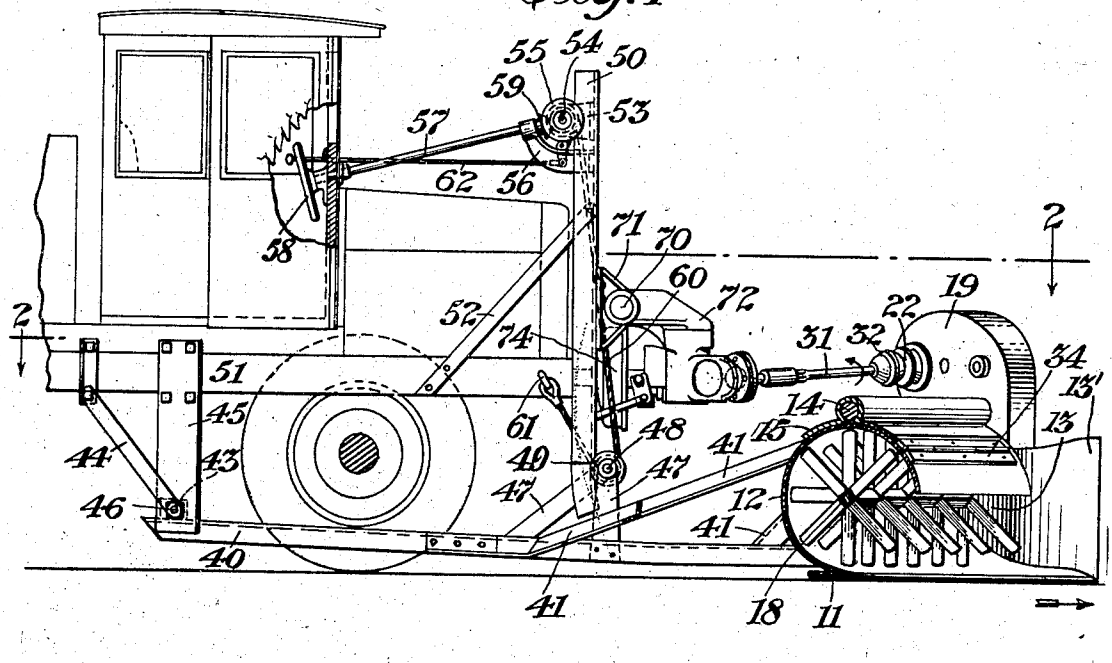
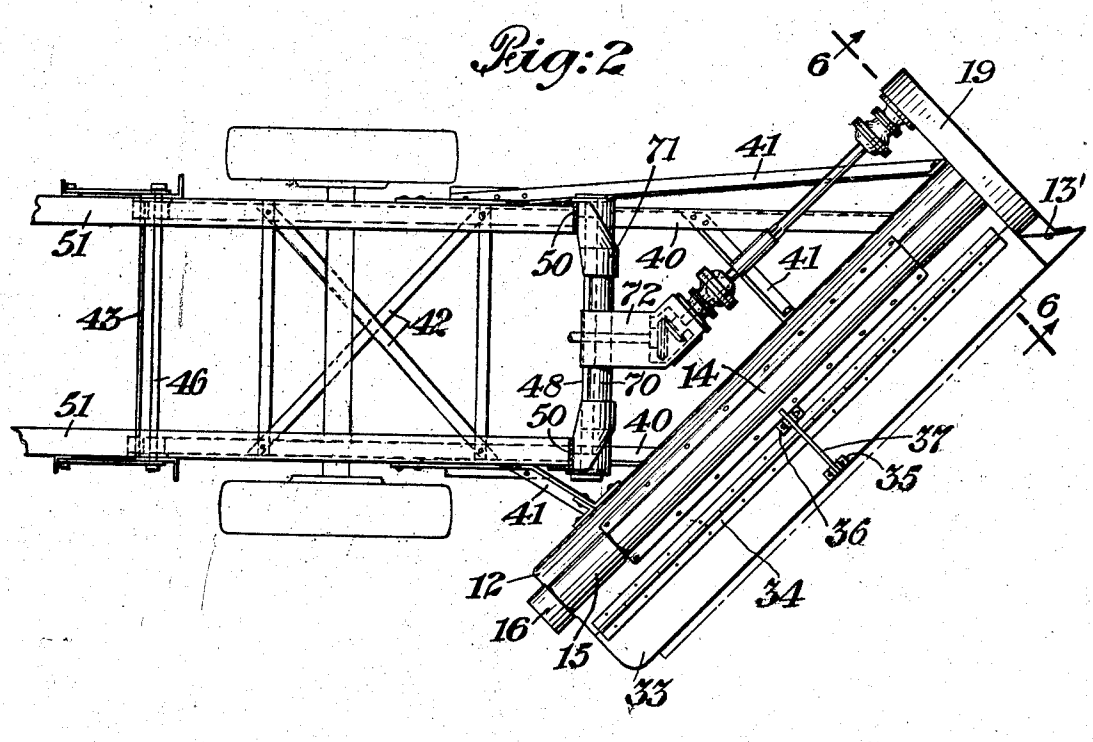


Fig: 2



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Fig. 3.

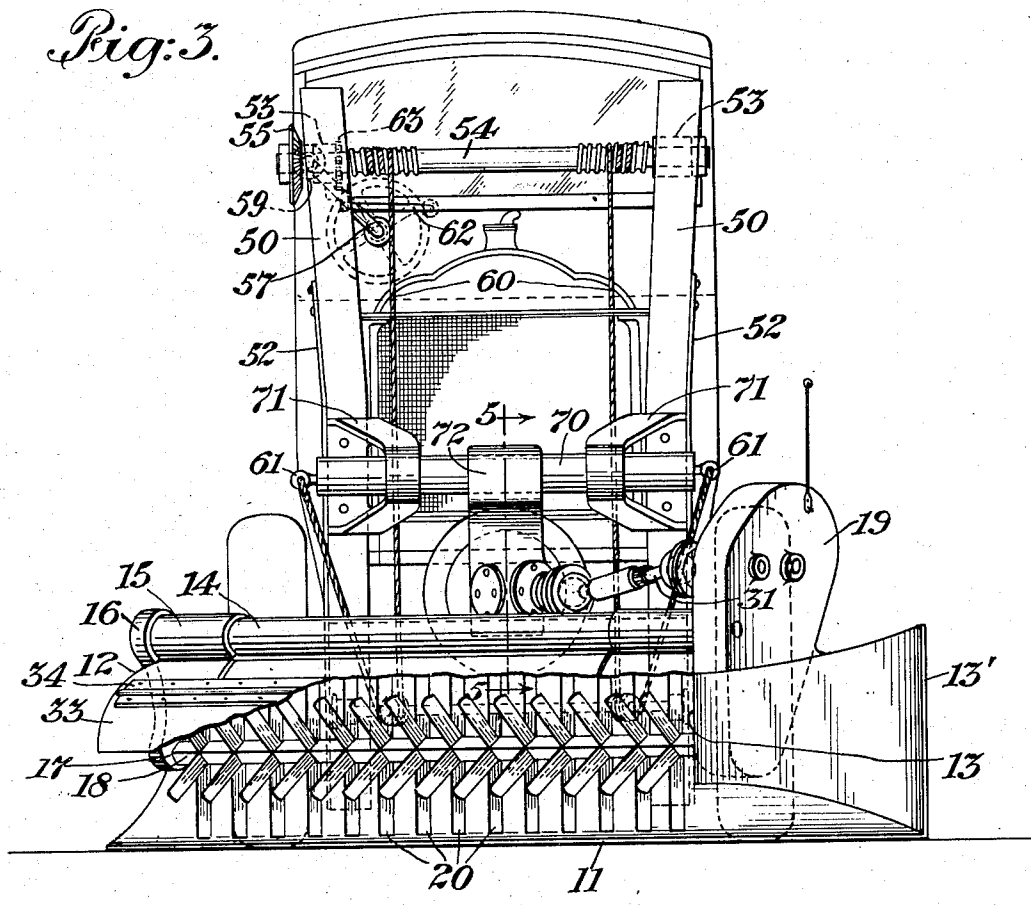
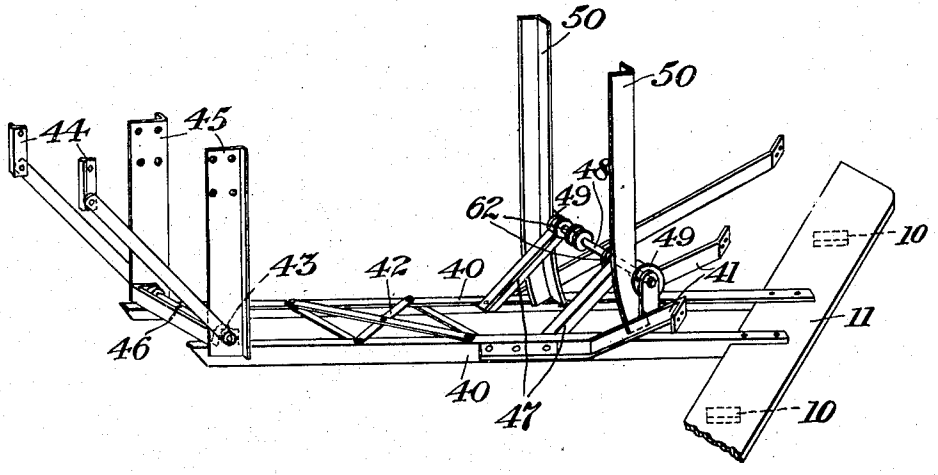


Fig. 4.



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Fig: 5.

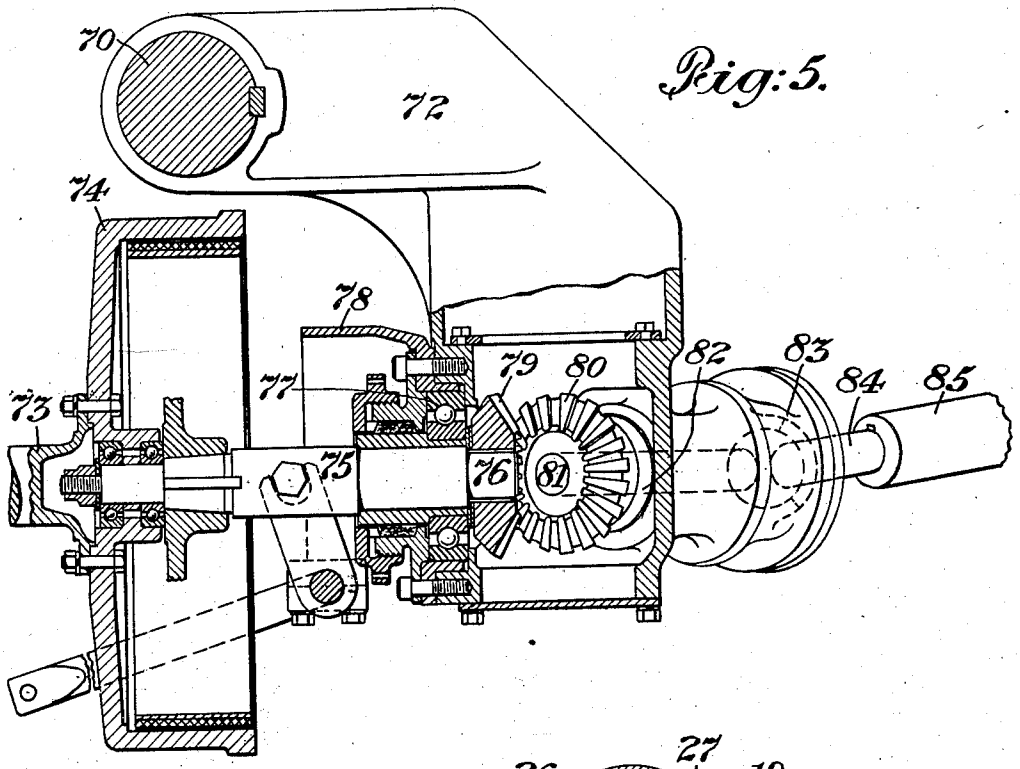


Fig: 6.

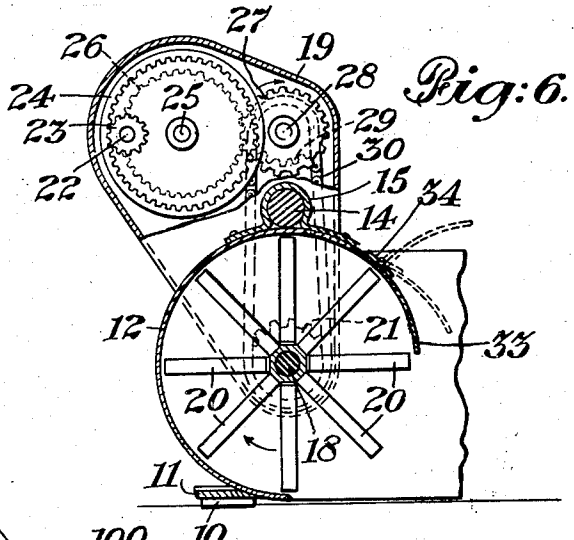
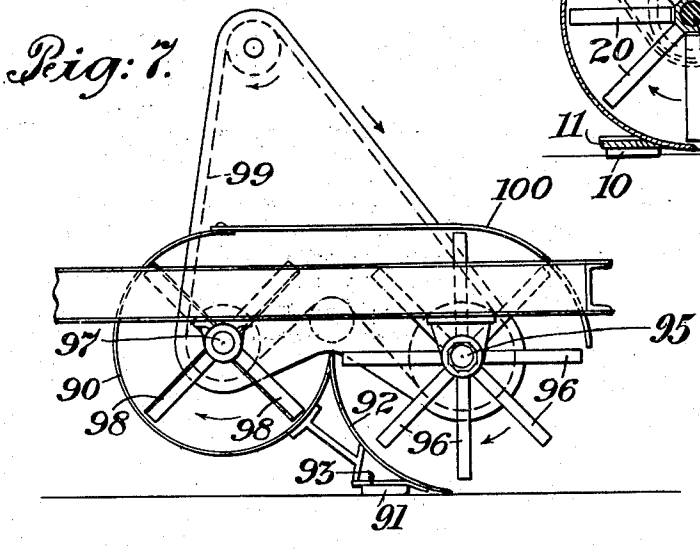


Fig: 7.



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UNITED STATES PATENT OFFICE

2,015,707

METHOD OF AND APPARATUS FOR PREPARING PAVING COMPOSITIONS

Edwin B. Cadwell, Chicago, Ill., and Arthur B. Webb, Milwaukee, Wis.; said Webb assignor to said Cadwell

Application February 23, 1932, Serial No. 594,406

19 Claims. (Cl. 94—44)

Our invention relates to methods and means for preparing road paving compositions on the surface of the roadway to secure proper mixture and even coating of aggregate particles with a binder material.

The object of our invention is to provide a method which will be more efficient and more economical of time, labor and materials than processes heretofore used, and to provide an apparatus which will facilitate the employment of our improved method.

Our method is an improvement upon a process now in common use in which the loose aggregate for the paving composition, together with a suitable quantity of binder material, is piled in the roadway, preferably in a long pile extending longitudinally of the road, the pile measuring about six to eight feet wide and six to ten inches deep. Such piles are commonly created by first arranging the aggregate materials and then distributing the binder over them in liquid form. The aggregate may consist of variously sized stone, crushed rock, sand or other suitable material, and the binder employed may be any of the usual binders, such as tar, asphalt or bitumen.

The materials thus arranged are then worked together to secure an even coating of the binder over the surfaces of the aggregate particles, so that when the mixture is finally spread in place to provide a pavement, the particles will not disintegrate but will be firmly bound together.

This mixing and coating treatment has heretofore been accomplished by scraping or rolling the material over the surface of the roadway in a mass with a horizontal bladed implement inclined transversely of the road and moved continuously in a longitudinal direction, its forward end engaging the pile. In this manner, material is scraped from the pile and moved transversely of the road in advance of the blade and comes to rest again in a windrow-like pile parallel to the pile originally formed.

During the period of their movement, a portion of such aggregate particles as may have become lumped together and united by the binder are broken up and the binder is caused to spread more evenly. However, to secure a uniform and even coating of binder over all the aggregate surfaces by this method, the operation just described must be repeated many times before the mixture is in proper condition for final laying as a pavement.

The number of operations may be greatly reduced and a more uniform mixture obtained in much less time by our improvement of the above method, which consists in scraping or rolling the material over the road surface as heretofore while at the same time violently, rapidly and repeatedly beating and rending the mass in the course of its movement.

This additional treatment of the material obtains a more complete disintegration of the lumps and a more even and thorough coating of binder over the particles of aggregate. We have found that this is more particularly true if the beating and rending is performed in a rapid whirling and slashing manner, thus imparting a rotary or spiral movement to the constituents of the mass, causing them to be violently rubbed together under pressure and hurled one against the other and against the surface of the roadway.

In addition to the economies in time and labor effected by our improvement, there is a decided saving in material where cut-back asphalt or bitumen is employed as a binder for the reason that the volatile liquids used to cut the binder are quite expensive and as more time is taken to process the mixtures, more of this liquid must be used to keep the binder fluid until the aggregate is thoroughly coated and the pavement finally laid.

To implement our improved process, we have provided the novel machine illustrated in the accompanying drawings of which the following is a detailed specification:

Fig. 1 is a side elevational view in section of our machine connected to the forward end of a conventional motor truck, the truck being shown with the near front wheel removed to reveal the disposition of the connecting elements.

Fig. 2 is a plan view taken on lines 2—2 of Fig. 1.

Fig. 3 shows a front elevation of the machine with the apron broken away to reveal the disposition of the mixing blades.

Fig. 4 is a perspective drawing of the frame assembly, by means of which the machine is attached to the truck frame.

Fig. 5 is a sectional view of the bevel-geared power-take-off assembly, taken on lines 5—5 of Fig. 3.

Fig. 6 is a sectional view taken on lines 6—6 of Fig. 2 and shows the reducing gear transmission and sprocket chain drive.

Fig. 7 is an end view showing a modification of our machine.

10—10 indicate the road engaging supports for our machine which are here shown as oblong shoes having their long dimensions extending parallel in the direction in which the machine is adapted to be moved, indicated by the arrow in Fig. 1. 11 indicates a base plate transversely

mounted on the supports 10 at an angle thereto. On this base plate is a horizontal semi-cylindrical drum 12, one edge of which is disposed at its bottom and fixed parallel to the forward edge of the base plate by welding or other suitable means. This drum 12 constitutes the body portion of our apparatus and is closed at its forward end by a wall 13. A forwardly and outwardly curved wall 13' is supported in advance of the end wall 13 to provide a scoop capable of delivering material into the drum 12 adjacent its closed end.

Fixed on top of the drum is a parallel bar 14 strapped in position by a sheet metal strip 15 riveted or welded to the drum and formed as illustrated. Depending from this bar at the rear end of the drum is a bracket 16 carrying a bearing 17 in which is rotatably supported one end of a shaft 18 extending centrally thru the drum 12. The opposite end of the rotatable shaft 18 extends thru an opening in the scoop wall 13 and is rotatably supported in the lower portion of a cast metal gear casing 19, supported on the adjacent end of bar 14.

The rotatable shaft 18 is provided with a plurality of radially disposed mixing blades 20—20 etc., which extend a distance somewhat shorter than the radius of the drum 12, to provide a rotary beater and the shaft has a sprocket gear 21 keyed to its forward end within the casing 19. In the upper portion of the casing is a train of reduction gears, shown in Fig. 6. 22 is a short driving shaft journalled in the casing wall and extending externally of the casing. Keyed on this shaft within the casing is a pinion gear 23 meshing with an internal gear 24 keyed to shaft 25 which is similarly journalled in the wall of the casing. Driven on this shaft 25 is also a spur toothed gear 26 in driving engagement with a smaller spur toothed gear 27 keyed to shaft 28 which carries a sprocket 29. A roller drive chain 30 couples the sprocket 29 to sprocket 21 to complete the drive from shaft 22 to the driven shaft 18, as will be readily understood. A propeller shaft 31 is coupled to the external end of shaft 22 by a conventional type of universal joint 32. An apron 33 is attached in swinging relation parallel along the upper edge of the drum 12 by means of hinges 34 and is adapted to be held in any one of several adjusted positions by means of bracket 35 fixed on the apron, bracket 36 fixed on the drum and bar 37, as will be readily understood.

The apparatus thus far described comprises a unit embodying all the dominant features of a machine which, together with our improved method, constitutes our present invention. The unit is operated by propelling it over the surface of the roadway in the direction indicated by the arrow in Fig. 1, its forward end in engagement with a pile of material to be mixed, and the shaft 31 is rotated at high speed to turn the train of gears and rapidly revolve shaft 18 carrying the blades 20—20 in a forward direction. We have found that best results are obtained in the usual work when the shaft 18 is rotated at a speed of approximately 175 R. P. M.

As the forward movement continues, the material engaged by the scoop 13' is moved transversely by the inclined drum thru the paths of the rapidly revolving blades 20 which resist transverse movement of the material thru the drum and create a high pressure in the mass to more rapidly and evenly coat the aggregate particles with the binder material. The material is ultimately again deposited on the road surface in a windrow-like pile at the rear end of the drum. During the period of its transverse movement, the material is violently beaten by the whirling blades 20—20, causing the aggregate particles to be whipped against the inner wall of the drum and against each other, and a part thereof to be hurled forcefully against the surface of the roadway in advance of the machine. The material thus thrown on the roadway, is reengaged by the rotating blades and the forward moving lower edge of the drum and again hurled against the road surface, and the treatment is repeated until it has passed completely across the machine and is deposited as heretofore described.

The blades 20—20 are shown to be straight but they may be pitched to deflect the material transversely in either direction, if desired, and thus permit the drum to be disposed at any angle to the road. We have found it more economical, however, to transversely move the material by obliquely disposing the drum as shown and that approximately thirty degrees of angular inclination is best suited.

In these repeated treatments of the material, the adjustable apron 33 serves importantly to regulate the distance which the material is thrown in advance of the apparatus. When the apron is positioned highly tilted (as shown in dotted lines in Fig. 6) the material is tangentially released from the drum at a point which allows it to be thrown a considerable distance by the blades, and since the direction of throw is oblique to the direction in which the apparatus is propelled, because of the inclination of the apparatus, the material is engaged only a few times in the course of its transverse movement.

Conversely, when the apron is positioned as shown in full lines in Fig. 6, the material is hurled against the road surface immediately in advance of the apparatus and is resubjected to the treatment of the blades many times before it is finally deposited at rest by the rear end of the drum. Thus it will be seen that the adjustable apron functions to provide a high degree of flexibility, permitting economical treatment of different mixtures requiring various processing. When the material requires but little treatment, the apron is swung up and a deep cut is made by the scoop 13'. When more processing is required, the apron is lowered and a cut of proportionately reduced depth is taken by the scoop. In either case, the same pressure may be built up and maintained within the drum without varying the forward speed, the speed of the shaft 18, the angular inclination of the apparatus or the pitch of the blades 20. This pressure is desirable in securing a proper amount of rubbing friction between the aggregate particles to secure a thorough coating of them by the liquid binder.

The modification illustrated in Fig. 7 is particularly designed for use where the material to be mixed comprises very fine aggregate, such as clay or soft sand and is disposed and operated in an identical manner to the unit just described. In this modification the drum 90 is elevated somewhat from the road surface and is open forwardly of its top rather than at its bottom.

Welded to the forward edge of the drum 90 and extending parallel thereto is a curved blade 92, the lower edge of which is positioned in close proximity to the road surface where it is attached to and supported by base plate 93 having shoes on its underside.

A rotatable shaft 95 is provided with blades

96—96 etc., in all respects similar to the shaft 18, and is positioned in advance of the blade 96. A similar shaft 97 provided with blades 98—98 etc., is carried parallel in the drum 90. A roller drive chain 99 is employed to drive both shafts in the direction indicated and a plate 100, downwardly curved at its forward edge, covers the top and a portion of the front of the apparatus as shown.

In operation, the blades 96 whip the transversely moving material upward over the surface of the blade 92 into the drum 90 where it is engaged by the more rapidly whirling blades 98. The material is then carried around the inner surface of the drum 90 and tangentially catapulted by the blades 98 back along the underside of the cover plate 100 into the path of the rotating blades 96 and by them onto the surface of the roadway. Material thus thrown onto the road in the path of the apparatus is immediately reengaged by the forwardly moving rotating blades and the lower edge of the blade 92 and the treatment repeated until the mixture is finally piled on the road by the rearwardly inclined end of the apparatus.

Either apparatus may be forwardly propelled over the road by drawing or pushing it, or it may be attached to the rear or intermediate the length of the frame of any suitable carriage. We prefer, however, to movably attach the machine in front of a truck or tractor in accordance with the same principles employed to attach snow plows, described in copending application of Arthur B. Webb, filed October 31, 1931, and bearing Serial No. 572,333, and more particularly as follows:

Longitudinally extending push frame members 40 are attached at their forward ends to base plate 11 and upwardly inclined struts 41—41 etc. are attached to said members and to the drum 12. The push frame members are tied together intermediate their length by braces 42—42 etc., and are provided at their rear ends with journal brackets 43.

Push frame supports 44—44 and 45—45 are securely fastened to the truck frame 51 and are joined at their lower ends by a shaft 46 which extends thru the journal brackets 43 to pivotally support the ends of the push frame members. Upright A-frames 47 are oppositely disposed on each of the push frame members forward of the braces 42 and are tied together by a shaft 48 on which flanged rollers 49 are rotatably mounted. The faces and inner flange walls of these rollers engage the adjacent faces of each of the angular uprights 50 securely attached to the front end of the truck frame. These uprights are further secured and braced to the truck by braces 52.

By this arrangement, the thrust of the moving truck is exerted against the rollers 49 to propel the apparatus and since these rollers are located well in advance of and above the plane in which the push frame pivots, the direction of thrust is downward as well as forward, thus operating to hold the apparatus attached to the forward end of the push frame in close contact with the road surface and resisting tendency for it to ride upwardly over loose material in its path.

In order that the truck may be used to transport the mixing apparatus at speeds higher than would be practical with the apparatus riding on the road, we have provided a hoisting arrangement by means of which the mixer may be lifted clear of the road surface and carried by the truck.

Attached to the upper end of each of the uprights 50 are oppositely disposed rearwardly extending brackets 53 carrying bearings rotatably supporting a transverse shaft 54, to one end of which a bevel gear 55 is affixed. Also attached to the upright member adjacent gear 55 is a bracket arm 56 journalled to rotatably support a shaft 57 which extends within the truck cab. A hand wheel 58 is attached to the inner end of the shaft 57 and its outer end is provided with a bevel pinion 59 meshing with gear 55.

Wire ropes 60—60 each have an end suitably anchored to the truck frame 61—61 and are looped about pulleys 62—62 rotatably mounted on shaft 48 from whence they extend upwardly and are attached to the rotatable shaft 54.

It will now be seen that turning of the hand wheel 58 will cause rotation of the shaft 54, wind up the cables 60, and lift the forward end of the push frame together with the mixing unit attached thereto, the push frame being pivoted on the shaft 46. It will also be noted that the lower ends of the uprights 50 are inclined forwardly at an angle which permits the rollers 49 to move rearwardly in contact with the uprights when they are hoisted upward with the pivoting push frame.

To hold the apparatus in hoisted position, a ratchet gear 63, shown in dotted lines in Fig. 3, is provided on the rotatable shaft 54 and is engaged by a pawl pivoted on bracket 56. This pawl is manually actuated to lock and release the shaft by a rod 62 extending into the truck cab as shown.

While the principal object of the hoist is to permit the apparatus to be carried clear of the road surface by the truck to permit rapid transportation when the mixer is not at work, the hoist is also used to support the mixing apparatus in close working proximity to the road surface when the surface is so soft that the shoes 10 of the mixer cannot carry their load without digging in.

The blades of the mixing apparatus may be driven by coupling the shaft 31 to an engine mounted on the push frame or on the truck. We prefer, however, to utilize for this purpose the same engine which drives the truck.

Referring to Fig. 5, 73 is a coupling member secured in driven relation to the forward end of the truck engine. The exact method of securing this member to the engine is not here shown as the method varies, depending upon the design of the engine. The several methods are well known, however, to those engaged in highway work and are the same as those employed to connect rotary snow plows etc.

Bolted to the member 73 is a clutch 74 shiftable by means of sleeve 75 and operating to drive shaft 76 which extends within the housing formed in the lower end of the casting 72. The clutch indicated is one of several standard products suitable for use here. The shaft 76 is packed and supported in a race type bearing 77 housed by a bell shaped casting 78 bolted to the casting 72 and carries a bevel gear 79 at its inner end.

In mesh with gear 79 is a similar gear 80 mounted on one end of a shaft 81 which is supported in a race type bearing 82 journalled in the housing wall. The opposite end of shaft 81 extends externally of the housing and is coupled by a universal joint 83 to shaft 84. Fixed to the shaft 84 is one end of a sleeve 85 keyed to slidingly receive and drive the splined shaft 31 attached to the mixing unit, thus providing a flexible drive to

permit the mixing unit to be raised and lowered as heretofore described.

The foregoing description taken in connection with the accompanying drawings discloses the principles of an apparatus which will be readily understood by those skilled in the art to which the invention appertains and comprises what we now consider to be the best embodiment thereof. We desire to have it understood, however, that the machine shown is merely illustrative and that such changes may be made, when desired, as fall within the scope of the here appended claims.

We claim:

1. In methods of preparing materials for road paving compositions in which the materials are moved over the surface of a roadway by scraping, that improvement which consists in violently mixing and beating the material as it is moved.

2. The method of preparing materials for road paving compositions consisting in arranging the materials on the surface of a roadway in a pile extending longitudinally thereof, the moving material from the pile transversely over the road surface while simultaneously mixing and beating it.

3. The method of preparing materials for road paving compositions consisting in arranging the materials on the surface of a roadway in a pile extending longitudinally thereof, moving material from the pile transversely over the road surface and repeatedly picking up portions of the material and violently hurling them against the road surface in the course of their transverse movement.

4. In methods of preparing materials for road mixed paving compositions in which the materials, comprising aggregate and a binder therefor, are moved transversely over the road surface by scraping, that improvement which consists in partially confining the materials during their transverse movement and violently mixing and beating them while so confined to provide a more uniform mixture of the aggregate particles and a more perfect coating of binder material thereover.

5. In methods of preparing road mixed paving compositions, that improvement which consists in mixing the materials by feeding them thru a drum type rotary mixing apparatus propelled on the roadway at an oblique angle in engagement with the materials, whereby the materials are fed thru the mixing apparatus.

6. In methods of preparing materials for road paving compositions, that improvement which consists in propelling a mixing drum at an oblique angle in engagement with the materials, whereby the materials are fed transversely thru the drum, and slashing thru the materials in the course of their transverse movement thru the drum.

7. An apparatus for preparing road mixed paving compositions adapted to be moved forwardly in engagement with material for mixture lying in its path comprising a horizontal drum extending transversely to the direction of movement, a rotary beater comprising a plurality of mixing blades supported in said drum, power means for driving said beater, and a scoop at one end of the drum arranged to engage the material and deliver it into the drum, the other end of the drum being open whereby it is adapted to deliver the mixed material onto the roadway.

8. A portable apparatus for preparing road mixed paving compositions comprising a horizontal trough-shaped drum having one of its long edges disposed at its bottom, a rotary beater in said drum comprising a shaft and a plurality of mixing blades fixed on said shaft and partly shrouded by said drum, and power means for rotatably driving said beater, the upper portion of said drum extending downwardly to shroud said blades forward of said beater shaft.

9. A portable apparatus for preparing road mixed paving compositions comprising a horizontal trough-shaped drum having one of its long edges disposed at its bottom, a rotary beater in the drum comprising a shaft and a plurality of mixing blades fixed on said shaft and partly shrouded by said drum, an adjustable apron attached along the upper edge of the drum whereby said blades are shrouded forward of said beater shaft, and power means for driving said beater.

10. An apparatus for preparing road mixed paving compositions comprising a horizontal trough-shaped drum having one of its long edges disposed at its bottom, said drum being adapted for forward movement in engagement with paving materials lying in its path and inclined obliquely to its direction of movement for transversely scraping the engaged materials over the road surface, a rotary beater comprising a plurality of mixing blades rotatably supported in said drum, and power means for driving said blades whereby they are caused to violently mix and beat the materials in the course of their transverse movement, the rearward end of said drum being open whereby it is adapted to deliver the mixed materials onto the roadway.

11. Apparatus for preparing materials for road paving compositions comprising, in combination, means for moving the materials transversely over the surface of a roadway, and a rotary mixer for mixing the materials as they are moved, said mixer comprising a shaft, a plurality of flat blades attached thereto and arranged and adapted to be driven edgewise, and power means for driving said mixer.

12. Apparatus for preparing road-mixed paving compositions adapted to be moved along a roadway, comprising a transverse rotary mixing device and a horizontal trough-shaped drum partially surrounding said device having its rearward edge close to the road surface, the drum extending forwardly across the top of said mixing device and downwardly and having its forward edge below the horizontal plane tangent with the top of the drum.

13. A portable apparatus for preparing road-mixed paving compositions comprising a horizontal trough-shaped drum having one of its long edges disposed at its bottom, a rotary mixer in said drum comprising a shaft and a plurality of flat blades attached to said shaft and arranged and adapted to be driven edgewise, and power means for driving said mixer.

14. A portable apparatus for preparing road-mixed paving compositions comprising a horizontal trough-shaped drum having one of its long edges disposed at its bottom, a rotary mixer in said drum comprising a shaft and a plurality of flat blades attached to said shaft and arranged and adapted to be driven edgewise and partly shrouded by said drum, and power means for driving said mixer, the upper portion of said drum extending downwardly to shroud said blades forward of said mixer shaft.

15. Apparatus for preparing road-mixed paving compositions adapted to be moved along a roadway, comprising a transverse rotary mixing device and a horizontal trough-shaped drum partially surrounding said device and having its

rearward edge close to the road surface, said drum extending forwardly across the top of and downwardly in front of said mixing device.

16. An apparatus for preparing road mixed paving compositions adapted to be moved forwardly in engagement with material for mixture lying in its path comprising a horizontal trough-shaped drum extending transversely to the direction of movement, a rotary beater comprising a shaft having a plurality of mixing blades fixed thereon within said drum, a horizontal blade attached along the forward long edge of the drum and curved downwardly therefrom, a rotary beater comprising a shaft having a plurality of mixing blades thereon supported in advance of said blade, means shrouding the blades of said last named beater above and forward of its shaft, and power means for rotatably driving the shaft.

17. In combination, apparatus for preparing road mixed paving compositions adapted to be forwardly moved in engagement with material for mixture lying on the surface of a roadway comprising a horizontal trough-shaped drum having one of its long edges disposed at its bottom, an adjustable apron attached parallel along the upper edge of the drum, a beater comprising a plurality of mixing blades rotatably supported in the drum, and a scoop at one end of the drum arranged to engage the material and deliver it into the drum, the other end of said drum being open whereby it is adapted to deliver mixed material onto the roadway; a carriage having an engine mounted thereon, a frame connecting the apparatus to the carriage, and a driving connection coupling the engine to the mixing apparatus.

18. In combination, apparatus for preparing road mixed paving compositions adapted to be forwardly moved in engagement with material for mixture lying on the surface of a roadway comprising a horizontal drum obliquely inclined to the direction of movement, a beater comprising a plurality of mixing blades rotatably supported in said drum, and a scoop at the forward end of the drum arranged to engage the material and deliver it into the drum, the rearward end of the drum being open whereby it is adapted to deliver the mixed material onto the roadway; a carriage having an engine mounted thereon, a frame connecting the apparatus to the carriage and a driving connection coupling engine to the beater in driving relation.

19. In combination, apparatus for preparing road mixed paving compositions adapted to be forwardly moved on the surface of a roadway comprising a horizontal drum obliquely inclined to the direction of movement, a beater in said drum comprising a rotatable shaft and a plurality of mixing blades fixed on said shaft and partly shrouded by said drum, the upper portion of said drum extending downwardly to shroud said blades forward of said beater shaft; a carriage having an engine mounted thereon, a rigid frame connecting said drum in movable relation to said carriage, a flexible driving connection coupling the engine to said rotatable shaft, and a hoist for elevating the apparatus in relation to the carriage.

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