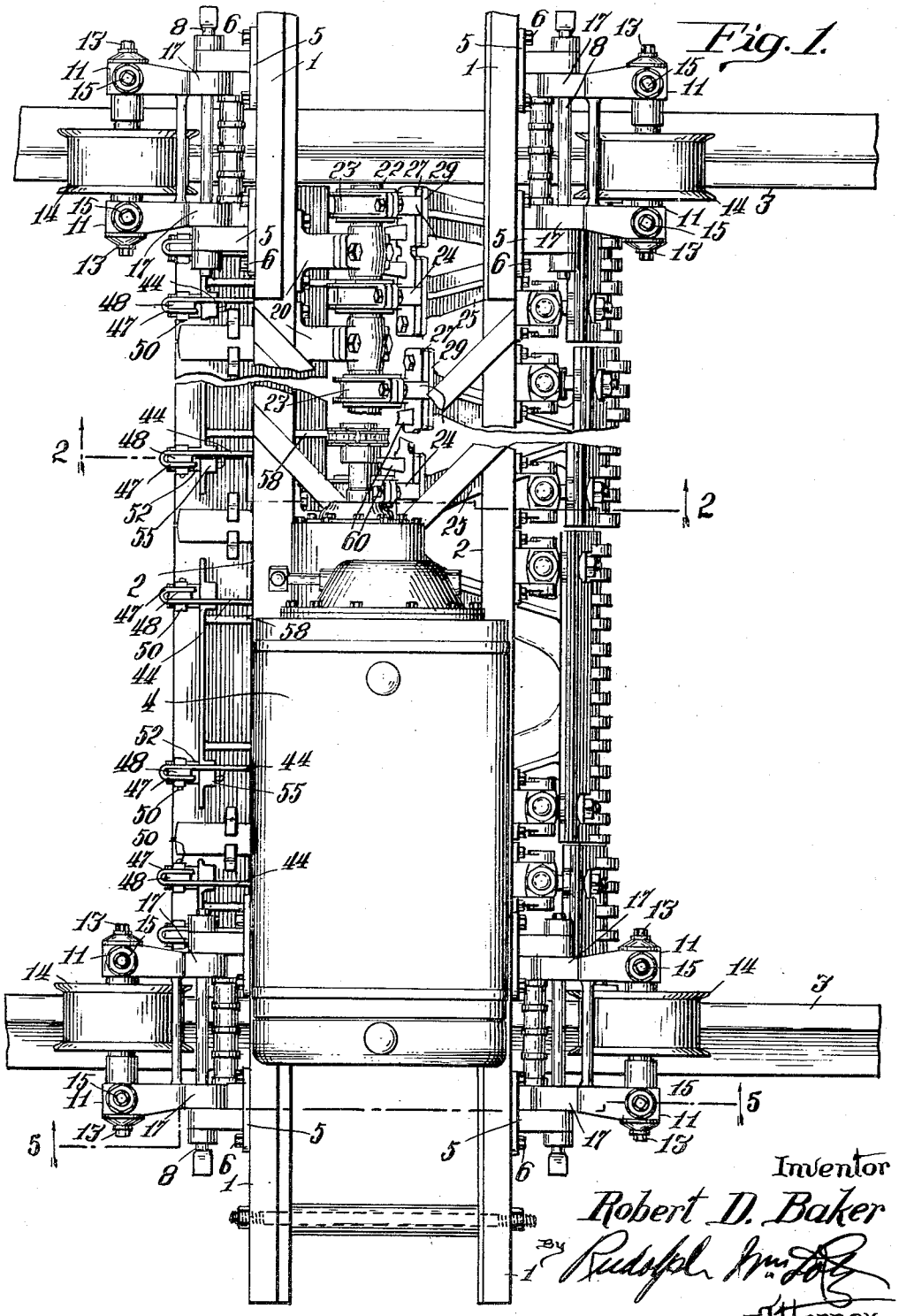
March 2, 1937. R. D. BAKER 2,072,150

FINE GRADING MACHINE

Filed May 6, 1935 4 Sheets-Sheet 1

Fig. 1.



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FINE GRADING MACHINE

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Fig. 2.

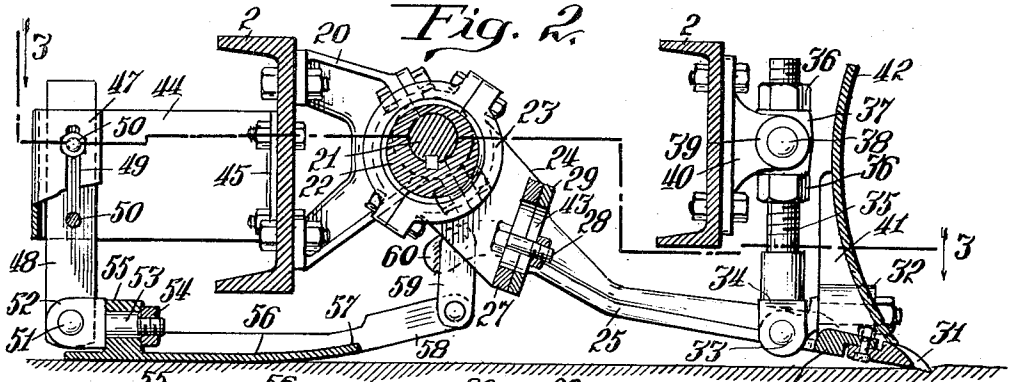
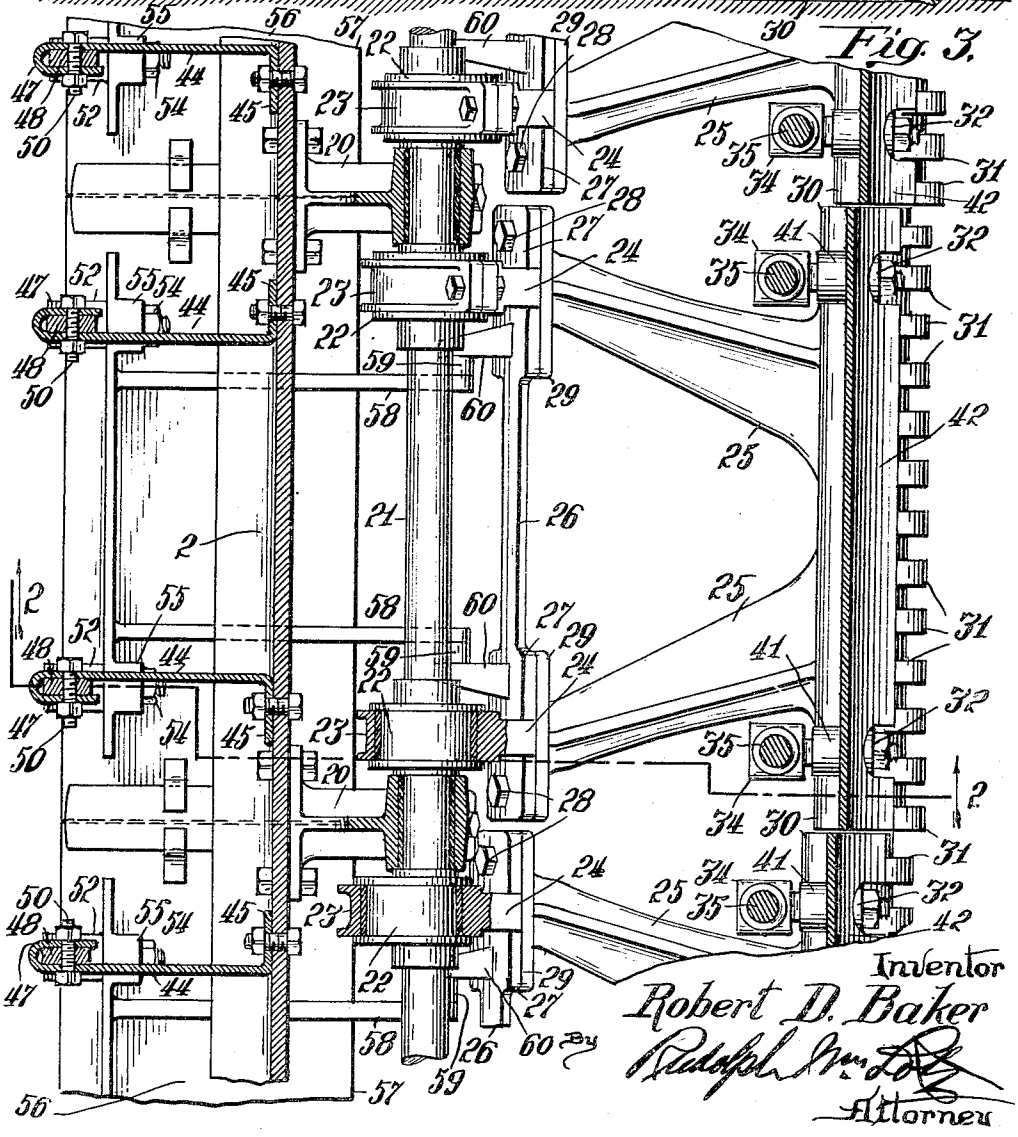


Fig. 3.



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FINE GRADING MACHINE

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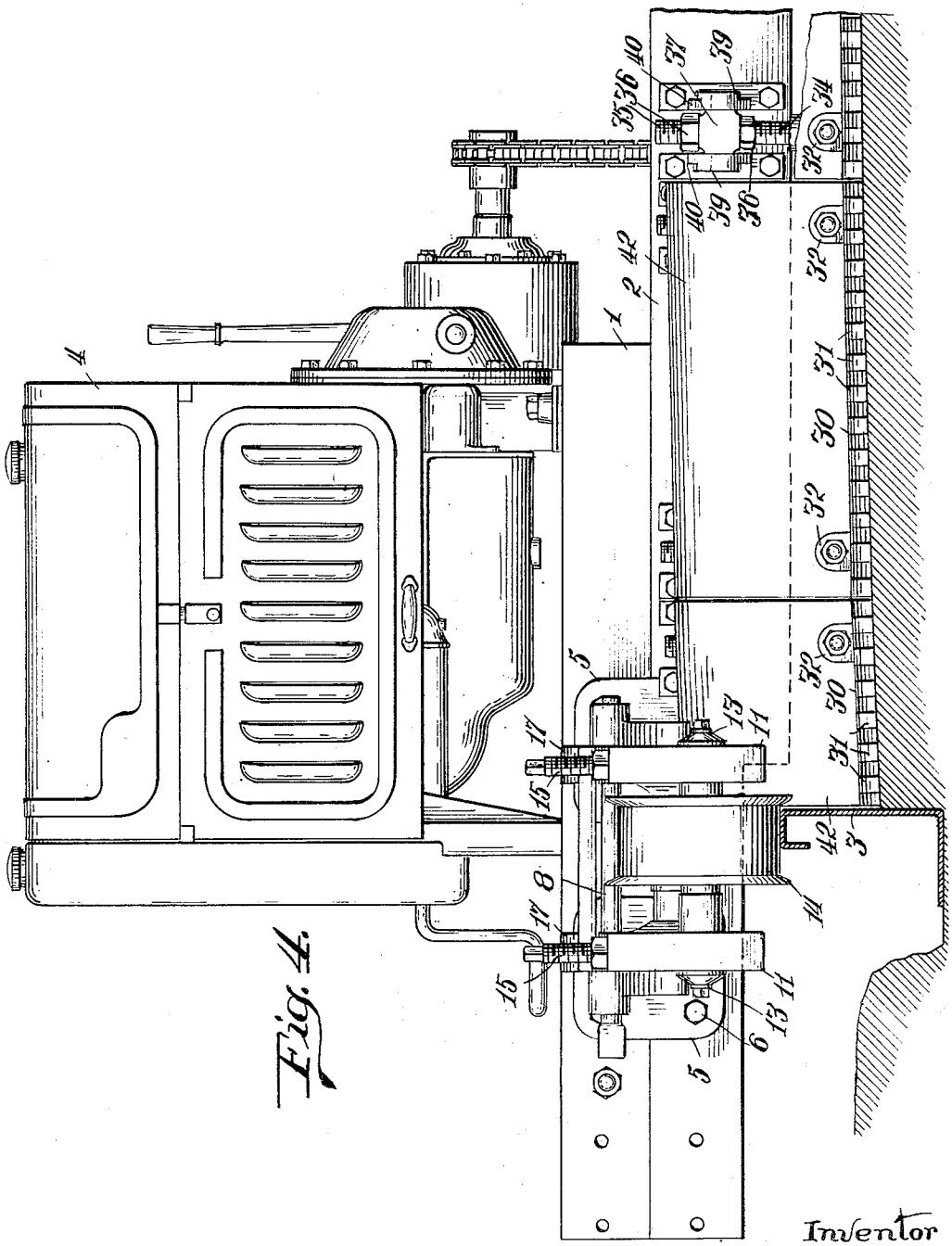


Fig. 4.

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FINE GRADING MACHINE

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Fig. 5.

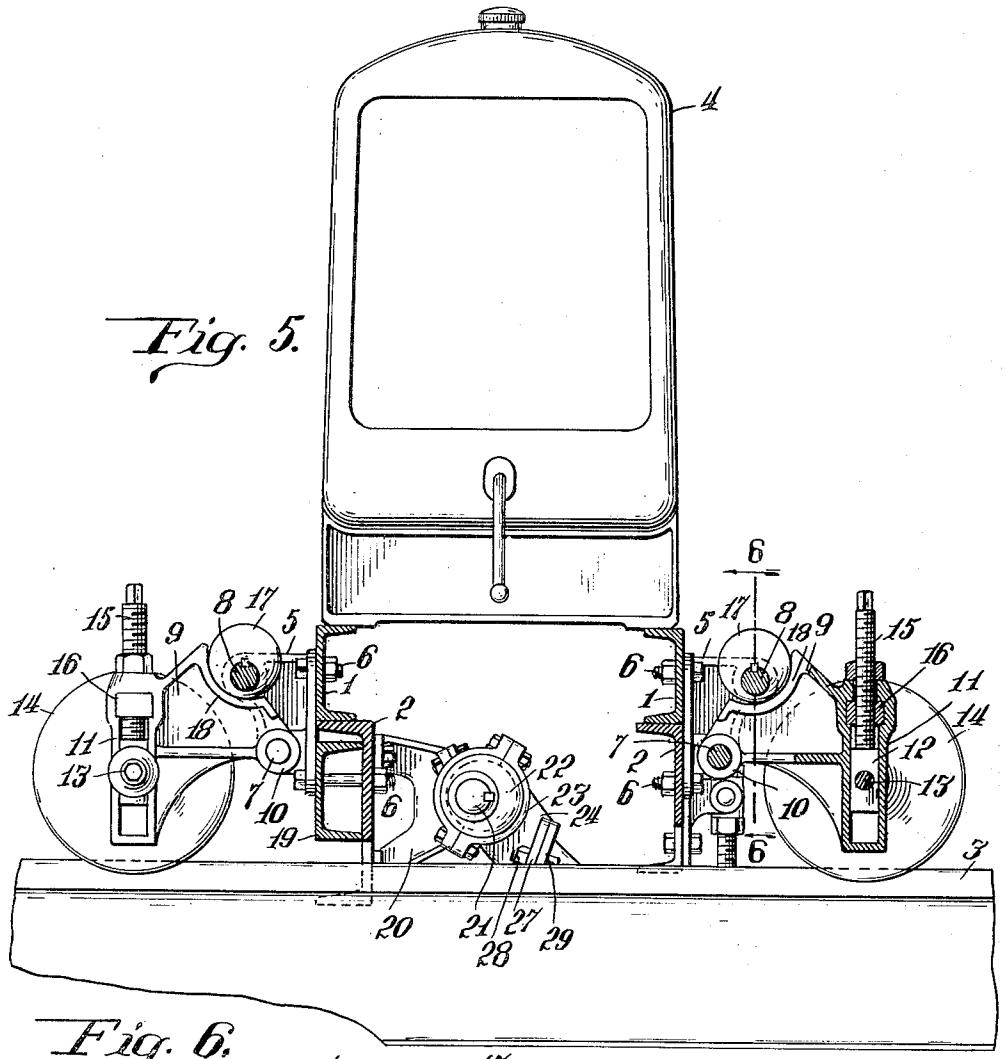
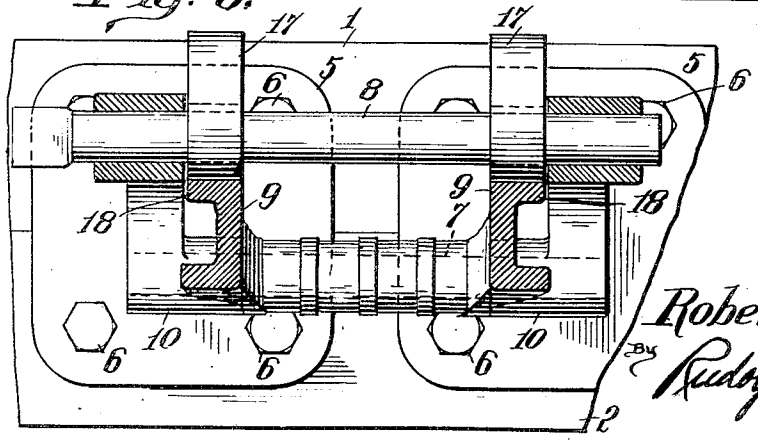


Fig. 6.



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Patented Mar. 2, 1937 2,072,150

UNITED STATES PATENT OFFICE

2,072,150

FINE GRADING MACHINE

Robert D. Baker, Birmingham, Mich.

Application May 6, 1935, Serial No. 20,004

11 Claims. (Cl. 37—108)

In the art of highway paving, the usual order of procedure is first to rough grade the highway, then to prepare the grade for the laying of the side forms bordering the ultimate finished and fine graded pavement strip, laying said side forms, and then fine grading the pavement strip in advance of the paver (concrete mixer) which travels upon the fine grade and receives the aggregates for the mixture from trucks which generally also travel upon the fine-grade, or from a railway which is disposed upon one of the shoulders bordering the pavement strip.

Trucks are used more commonly than the railways and they serve, of course, to appreciably cut up the pre-formed fine-grade so that a very considerable amount of hand labor must be performed behind the mixer and ahead of the paving material to reconstruct the fine-grade ready to receive the paving material.

One of the main objects of the present invention is to provide a machine which is capable of being disposed behind, and which is pulled by the concrete mixer, which effects the fine grading of the pavement strip between the mixer and the area of deposit of the plastic concrete delivered from the mixer, it being obvious, of course, that the paver or mixer employed must be of the boom and bucket type or must be equipped with other means for causing the material to be carried over the fine grading machine for deposit behind the latter. The disposition of the fine-grading machine between the mixer and the area of deposit of the plastic concrete is most advantageous from a labor saving standpoint in obviating duplication of labor as hereinabove pointed out and further is advantageous in that the fine-grade produced thereby cannot be destroyed by heavy rains between the time of its completion and the time of deposit of the plastic concrete upon the same.

A further object of the invention is to provide a simple, light and readily manipulable machine for producing an accurate, smooth, compact and uniform fine grade behind the mixer, thus leaving the rough grade in advance of the mixer in condition for passage of trucks over the same without requiring duplication of labor in the provision of the ultimate fine-grade upon which the paving material is to be deposited.

It will be obvious, of course, that a machine constructed in accordance with the present invention need not be equipped with its own propelling mechanism and that, therefore, such a machine can be constructed and operated at far lower cost than if equipped with its own propelling mechanism.

A further object of the invention is to provide a fine grading machine which includes means for compacting tamping and smoothing the fine grade so as to produce a hard and smooth surface upon which the paving material will be deposited.

A suitable embodiment of the invention is illustrated in the accompanying drawings, wherein:—

Fig. 1 is a plan view partly broken away, of a machine constructed in accordance with the present invention.

Fig. 2 is a vertical, longitudinal section of the same taken on the line 2—2 of Figs. 1 and 3.

Fig. 3 is a plan section of the machine taken on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary front elevation of the machine showing in vertical section, one of the side forms on which it travels.

Fig. 5 is a vertical, longitudinal, sectional view of the machine taken on the line 5—5 of Fig. 1.

Fig. 6 is a fragmentary, vertical, transverse, sectional view taken on the line 6—6 of Fig. 5.

The machine of the present invention includes a suitable frame or carriage which comprises, in the main, a pair of parallel channel bars (1) which are disposed over and rest upon channel bars (2) as shown in Fig. 5. Said channel bars (2) extend the full width of the machine so as to completely span the pavement strip disposed between the side forms (3) upon which the machine travels and project beyond said side forms.

Additional cross frame members connect the pairs of channel bars (1) and (2) with each other so as to provide a relatively rigid frame which supports the engine (4) and the mechanisms actuated thereby, which are described hereinafter.

The machine frame which includes the aforesaid channel bars is supported upon trucks at front and rear of the said frame and as shown particularly in Figs. 1, 5, and 6, each of said trucks comprises a pair of brackets (5) rigidly secured to the channel bars (1) and (2) by means of bolts (6) which carries the opposite end portion of a shaft (7) and also the opposite end portions of a shaft (8).

A casting (9), comprising side plates equipped with bearings (10) for the shafts (7) is pivotally secured to the shaft (7) between the brackets (5) and (6) and at its outer end carries the guide (11) for the vertically adjustable bearings (12) for the trunnions (13) of the traction wheel (14), said bearings (12) being adjusted by means of

the screws (15) threaded through the nuts (16) which are disposed non-rotatably in the upper end portions of the said guides (11). Mounted upon the shaft (8) are eccentrics (17) which bear upon the arcuate flanges (18) of the casting (9) and permit adjustment of the positions of the casting (9) relatively to the machine frame to vary the elevation of the latter with respect to the crowns of side forms for well known reasons, such adjustment being effected with respect to each of the four trucks of the frame.

The said shafts (8) are journalled in bearings in the respective brackets (6) but are fitted so snugly in the same as to permit the said eccentrics to be adjusted to any desired position by means of a wrench applied to a square end of each of said shafts (8) without requiring any locking or other means for preventing rotation of said eccentrics by counter-pressure thereon, it being obvious, of course, that additional means for locking the eccentrics against rotation may be provided if necessary or desirable.

It will be noted that the channel bars (2) project below the crowns of the side forms (3) and therefore the lower flanges and portions of the webs thereof are cut away. The channel bar (2) at the rear of the machine is reinforced by means of an opposed smaller channel bar (19). Mounted upon the channel bars (2) are brackets (20) equipped with bearings for the shaft (21) which is suitably geared to the engine shaft for rotation at a relatively high speed, as, for example, 350 to 400 R. P. M.

Referring now to Figs. 2 and 3, it will be noted that the shaft (21) is equipped at intervals with eccentrics (22). In the instance illustrated in Fig. 3, it will be noted that said eccentrics are arranged in pairs, a pair (22) thereof being journalled in bearings (23) of a substantially V-shaped casting (24), the middle portion (26) of which spans the space between said eccentrics. The said casting (24) includes a pair of plates (27) at the ends of the middle portion and arms thereof through which bolts (28) pass. Opposed to and connected with said plates (27) are the plates (29) of the yoke casting (25) which includes the arms indicated by reference character (25) and also includes a bar (30) integral with both said arms (25) and which carries the cutting tooth member or bar (31). The said plates (29) are provided with vertical slots in which the shanks of the bolts (28) engage.

The bar (30) is equipped with bearings (32) for the shanks of bearings for shafts (33) which engage in the forked ends of the yoke (34) at the lower ends of threaded shanks (35). Said threaded shanks (35) pass through and are secured by means of nuts (36) to the blocks (37) equipped with trunnions (38) journalled in bearings (39) of brackets (40). The said brackets (40) are secured to the channel bar (2) at the front of the machine frame. The forward end portions of the castings (25) are thus suspended adjustably from the said bearings (39) and by means of such suspension and the reciprocatory motion imparted to the castings (25) by the eccentrics (22) there is imparted to the said cutting blades a combined reciprocatory and rocking movement.

Integral with the bearings (32) for the threaded end portion of the shanks of the bearings for the shafts (33), are upwardly extending projections or arms (41) which may be integral with or otherwise suitably secured to the arcuate plates (42) which extend from a point just above the cutting teeth of the bar (31) to substantially the level of the top of the channel bar (2) and against which earth removed from the pavement strip by the cutting teeth accumulates conveniently for removal by manual laber or otherwise, said plate serving to prevent an appreciable amount of loose earth from finding its way past the cutting blades and their carriers.

Each pair of eccentrics (22) is offset arcuately from all of the remaining pairs thereof so that in the rotation of the shaft (21) only one at a time of the castings (25) is subjected to the same resistance to its cutting stroke as the remainder of the said castings.

In practice, each of the toothed bars (31) will be, for example, two feet in length, but in the event that the machine is adjusted to cut the fine-grade for an eighteen ft. instead of a standard twenty ft. width of pavement strip, the end plates and cutting bars will be one foot in width each in place of two feet each and, similarly, in the event that the machine is adjusted to cut the grade for a twenty-two ft. instead of a twenty ft. pavement strip.

The slots (43) of the plates (29) through which the shanks of the bolts (28) pass, permit the castings (25) to be adjusted vertically or substantially vertically with respect to the plates (27) of the castings (24). Such adjustment made in cooperation with vertical adjustment of the suspension devices for the forward ends of said castings (25) effects an obvious though slight change in the motion of the cutting teeth for reasons pointed out hereinafter.

Secured to the inner face of the channel bar (2) at the rear of the frame, are pairs of brackets (44) composed, preferably, of heavy sheet steel plates equipped with flanges (45) bolted to the said channel bar (2) and which, at their outer ends, are provided with U-shaped formations or flanges (47) affording guides for the vertically adjustable bars (48), said U-shaped formations being provided with longitudinal slots (49) through which the shanks of bolts (50) pass, said bolts being mounted in openings in the bars (48) and the latter being thus adjustable vertically relatively to the brackets (44).

Mounted in the lower ends of bars (48) are shafts (51) which engage in the bearings (52) secured by means of their shanks (53) and nuts (54) to the projections (55) of tamper plates (56). The said tamper plates (56) are flat, but have upwardly curved forward end portions (57) and are equipped with forwardly extending projections (58) pivotally secured at their ends to links (59). The latter are pivotally secured at their upper ends to the projections (60) of the castings (24) so that, in travel of the machine, said plates (56) and (57) are rocked and will serve to tamp and compact the fine-grade produced by the cutting teeth aforesaid, which may be arranged to cut the grade to a level slightly higher than the ultimate predetermined fine-grade and cause said plates (56) and (57) to reduce this level to the predetermined profile and level.

The machine frame will be equipped, of course, with suitable draft rigging to which cables or other means coupling the same with the carriage of the concrete mixer will be connected, and, preferably, the machine frame will also be equipped with the well-known axles between its lateral extremes for the attachment thereto of wheels extending transversely of the vertical plane of the traction wheels (14) for transporting the machine and also for turning the same through an arc of 90 degrees when desired to

permit the passage of trucks along a pavement strip on which the machine is operating or along which it is being moved to operating location.

The machine is very simple and occupies as little space as is possible lengthwise of the pavement strip on which it is operating so that the boom of a boom and bucket mixer to which the present machine is connected may easily extend an appreciable distance beyond the machine for the deposit of plastic material upon the fine-grade produced by the machine.

In the operation of fine-grading machines, many types of earth are encountered and many of which are difficult to cut. It has been demonstrated in practice that in some instances a downward cutting stroke of the cutting teeth at relatively sharp angle is most effective while, in other instances, a more nearly horizontal cutting stroke is most efficient. Obviously, by varying the relative positions of the opposed plates (27) and (29) and adjusting the suspension devices for the cutting tooth ends of the castings (25) and also varying the elevation of the machine frame relatively to the side forms, the cutting stroke of the cutting teeth will be varied in direction quite appreciably.

The rear ends of the tamper plates will be adjusted to be disposed in relative positions to coincide with the predetermined profile of the fine grade to be produced and by reason of their rapid rocking movement and the resistance of weight of the machine frame to any upward movement of said plates as in riding over exceptional hard surface areas, said plates will produce an extremely smooth and compact fine-grade.

In instances where the earth is soft, the cutting edges of the cutting plates may be disposed to reduce the grade to a level of a half inch or more above the ultimate fine grade and the tamper plates relied upon to compact the soft earth to the desired level and profile. But where the earth is hard and compact, the cutting blades may reduce the grade to a small fraction of an inch above the predetermined level and contour, the machine being adapted to meet all soil conditions following proper and efficient rough grading and elimination of large pebbles, rocks and the like.

Generally the fine-grading machine is not required to cut away more than an inch or two of excess soil and as this accumulates in front of the plate (42) it is so easily and quickly removed by hand labor as to eliminate the necessity for mechanical removal thereof.

The machine may, of course, be employed also to cut the grade in advance of the mixer and, in such event, will be drawn behind a tractor and, preferably, equipped with a loose earth removing mechanism disposed in front of the plate (42), such a mechanism being illustrated and described in Letters Patent No. 1,990,362 granted to me on February 5, 1935.

The span of operation of the machine may be increased or diminished quite easily by removing the bolts securing the various brackets to the channel bars and re-mounting the same in other locations, the frame members being provided with sets of bolt-holes at intervals for determining the proper locations of said brackets and parts connected therewith to accommodate the same to the width of the pavement strip to be operated upon, it being obvious that the shaft (21) may be extended in length by coupling extensions to one or both ends of the same and equipping the lengthened shaft with the additional requisite eccentrics.

I claim as my invention:

1. A fine-grading machine comprising a carriage for travel on side forms bordering a pavement strip, power actuated mechanism at the front of said carriage for cutting away surplus earth disposed upon the strip to a level and contour substantially parallel with but disposed slightly above the predetermined ultimate level and contour of said strip, and power actuated earth tamping and smoothing mechanism disposed behind the first-named mechanism for reducing the level and contour of the strip to the ultimate predetermined level and contour, and a single actuating shaft common to both mechanisms.

2. A machine of the type specified comprising a carriage for travel on side forms bordering a pavement strip, an engine mounted on said frame, a shaft geared to the engine shaft, eccentrics on said shaft, a plurality of earth cutting members spanning the pavement strip and connected with said eccentrics for reciprocation thereby for cutting surplus earth within said strip to a predetermined level and contour substantially parallel with but higher than the predetermined ultimate fine-grade level and contour and tamping plates disposed behind said cutting blades and operatively associated with said eccentrics for actuation thereby in unison with said cutting blades for tamping and compacting the earth in said strip to the ultimate level and contour of the predetermined fine-grade upon which paving material is to be disposed.

3. In a machine of the type specified, the combination with earth cutting means spanning the pavement strip and arranged to cut away the surplus earth disposed above the level and contour defined by the cutting edges of said cutting means, of a series of earth compacting and smoothing plates disposed rearwardly of said cutting means and pivotally secured at their rear ends to the machine frame, a source of power for actuating said cutting means, and an operative connection between said source of power and the front end portions of said plates for rocking the latter and causing an up and down rocking movement thereof, the rear end portions of said plates being disposed to conform to the level and contour of the ultimate predetermined level and contour of the fine-grade and cooperating with said cutting means to produce the latter.

4. A machine of the type defined comprising a vehicle frame, pairs of brackets secured to each of the front and rear portions of said frame, shafts secured at their ends to said respective brackets of each pair, members pivotally mounted on said shafts and equipped with traction wheels for the support of said carriage on side forms bordering a pavement strip, means carried by said brackets and engaged with said members for adjusting the same arcuately relatively to said brackets thereby to adjust the elevation of the frame relatively to the side forms and pavement strip, cutting mechanism spanning the pavement strip and presenting a cutting edge defining a contour parallel with the level and contour of the ultimate predetermined fine-grade plane and determinable by adjustment of said members relatively to said frame, earth tamping mechanism disposed rearwardly of said cutting means and cooperating with the latter to produce a paving strip surface coincident with the predetermined level and contour of the ultimate fine-grade and

determinable by adjustment of said members relatively to said plane, an engine on said frame, and gearing between the latter and said mechanism for actuating the latter.

5. A machine of the kind specified including a carriage, an engine mounted thereon, a shaft spanning the entire width of the machine and geared to said engine, a plurality of eccentrics rigid with said shaft, a plurality of members connected with said eccentrics for reciprocation by the same, a plurality of earth cutting members corresponding in number and location with said first-named members, cooperating opposed coupling means connecting said earth cutting members with said first-mentioned members and including means for adjusting the position of the cutting members vertically relatively to said first-named members, a plurality of suspension links connecting said earth cutting members with the machine frame at points spaced from their connection with said first-named members, and means for adjusting said suspension members to vary the position of the cutting edges of said cutting members relatively to the first-named members thereby varying the direction of cutting strokes of said cutting members.

6. In a machine of the kind specified, the combination with power actuated earth cutting mechanism disposed at the front of the machine, of a series of earth tamping and smoothing members disposed rearwardly of the cutting members and pivotally secured at one end to machine frame members, whereby to maintain portions of said plates in a predetermined position relatively to each other to define the lateral profile of the ultimate fine-grade of a paving strip spanned by said plates, and power mechanism for effecting oscillation of said plates on a horizontal axis for causing the main portions of said plates to contact with surplus earth deposits forwardly of the pivotal axis aforesaid for compaction thereof to the profile of the predetermined ultimate fine-grade level and contour.

7. A machine of the kind specified including a carriage for travel on side forms of a pavement strip, a series of power actuated earth cutting devices disposed at the front of the machine and spanning the pavement strip, and a plate disposed above the cutting edge portions of said devices with its lower edge disposed in close proximity to said cutting edge portions for accumulation of loose earth in front of said plate and prevention of appreciable loose earth finding its way past said cutting devices.

8. A machine of the kind specified including a carriage for travel on side forms of a pavement strip, a series of power actuated earth cutting devices disposed at the front of the machine and spanning the pavement strip and an arcuate plate extending over the entire width of the pavement strip and disposed above said cutting devices with its lower edge disposed in close proximity to the cutting edge portions of said devices and presenting its concave face forward.

9. In a machine of the kind specified, the combination with power actuated earth cutting devices disposed at the front of the machine, and a plate disposed in cooperating relation to said devices for preventing earth loosened from the pavement strip by said devices from becoming disposed behind the latter, of power actuated earth compacting and smoothing devices disposed behind said cutting devices for cooperating therewith to provide a smooth, hard and accurate fine-grade over the entire width of the pavement strip coincident with the predetermined level and profile of said fine-grade.

10. A machine of the kind specified equipped with earth cutting means at the front thereof extending over the entire width of a pavement strip, and including means for preventing cut away loose earth from becoming disposed behind said cutting means, and power actuated mechanism disposed behind said cutting means and spanning the pavement strip for compacting, lowering and smoothing the earth surface produced by said cutting means to the predetermined profile and level of the pavement strip preparatory to deposit of paving material upon the same.

11. A machine of the kind specified equipped with earth cutting means at the front thereof extending over the entire width of a pavement strip, and including means for preventing cut-away loose earth from becoming disposed behind said cutting means, and power actuated earth compacting and smoothing mechanism disposed behind said cutting means and comprising a series of plates disposed side by side, a series of vertically adjustable members for said respective plates, pivotal connections between the rear edge portions of said plates and said members and pivotal connections between the front end portions of said members and a source of power for imparting up and down rocking movement to said plates, the said rear edge portions thereof being disposed to define the predetermined profile of the pavement strip at the predetermined level thereof, the rocking of said plates serving to reduce the level of the earth surface to said profile and thereby compacting and smoothing the resulting surface.

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