Feb. 26, 1952 J. H. HOHNKE ET AL 2,587,321

MACHINE FOR FORMING AND FINISHING CONCRETE SURFACES

Filed May 26, 1947 5 Sheets-Sheet 1

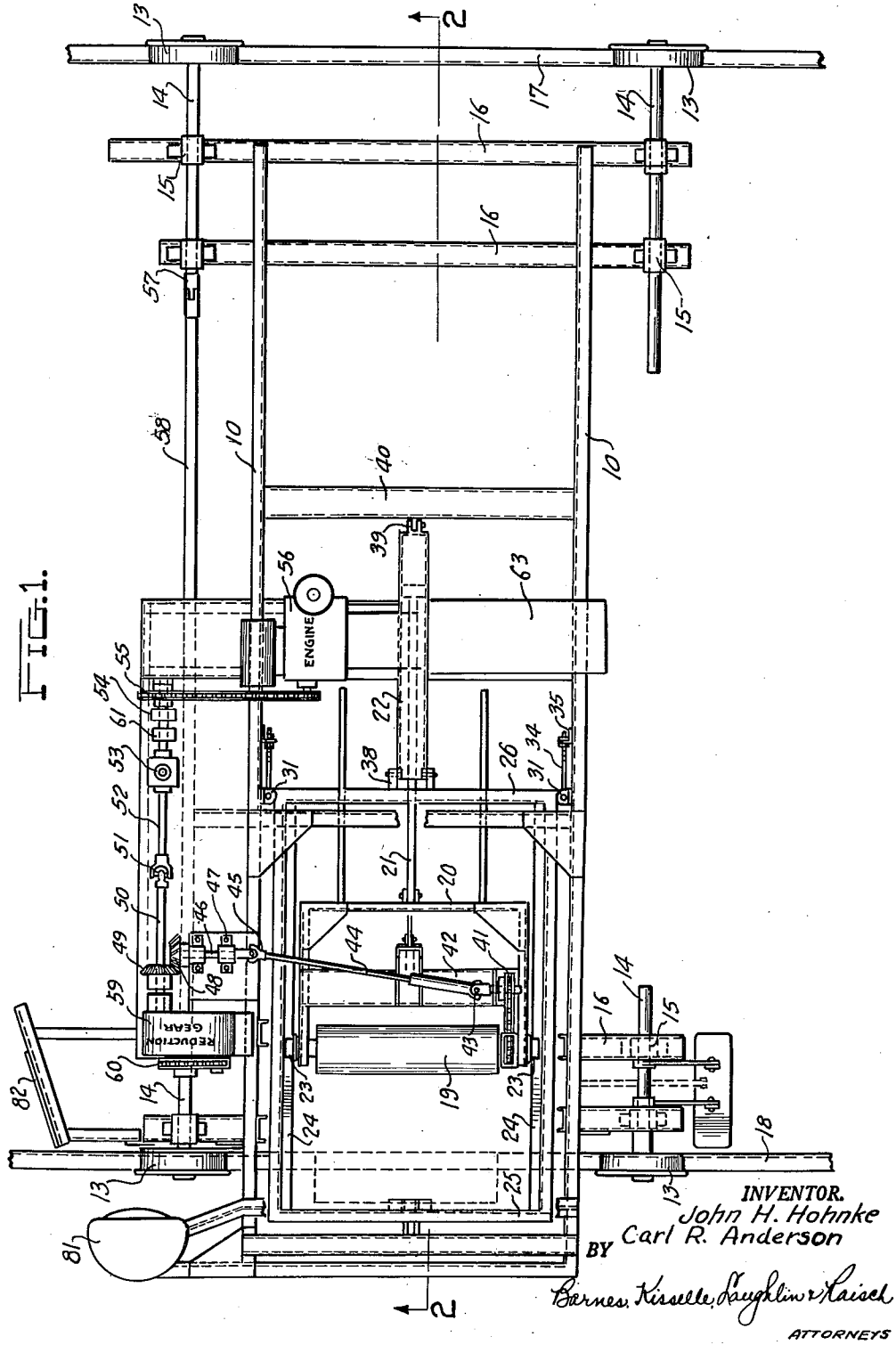

FIG. 1.

INVENTOR.
John H. Hohnke
Carl R. Anderson
BY
Barnes, Kisselle, Raisch & Choate
ATTORNEYS

Feb. 26, 1952 J. H. HOHNKE ET AL 2,587,321

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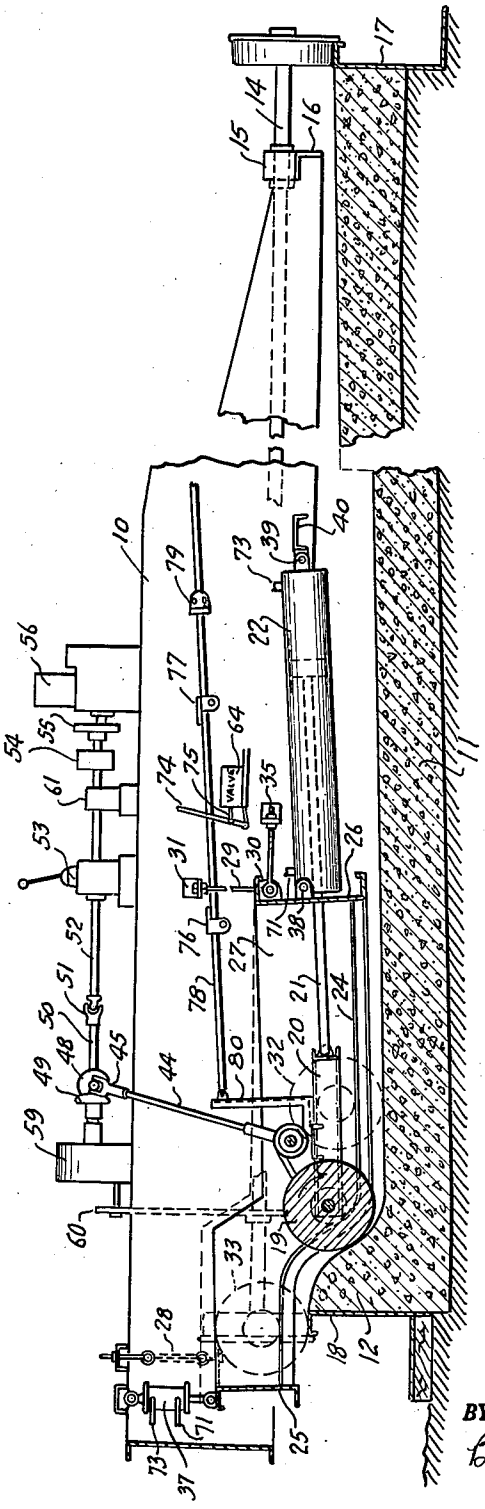
FIG. 2.



INVENTOR.
John H. Hohnke
Carl R. Anderson
BY
Barnes, Kisselle, Laughlin & Raisel
ATTORNEYS

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MACHINE FOR FORMING AND FINISHING CONCRETE SURFACES

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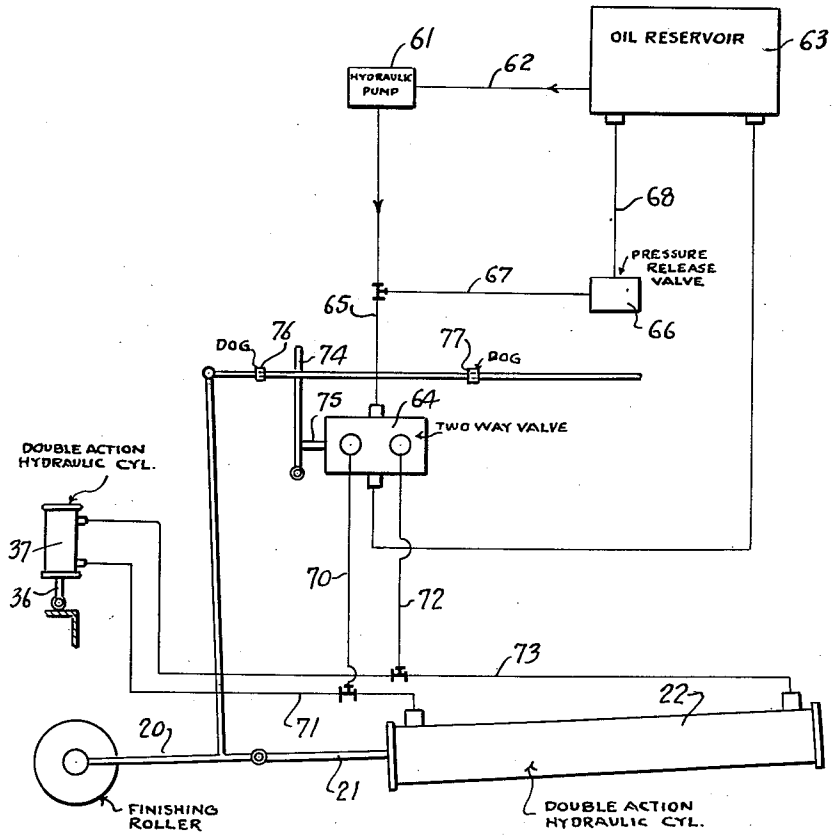
FIG. 3.



INVENTOR.
John H. Hohnke
BY Carl R. Anderson
Barnes, Kisselle, Raisley & Raisel
ATTORNEYS

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MACHINE FOR FORMING AND FINISHING CONCRETE SURFACES

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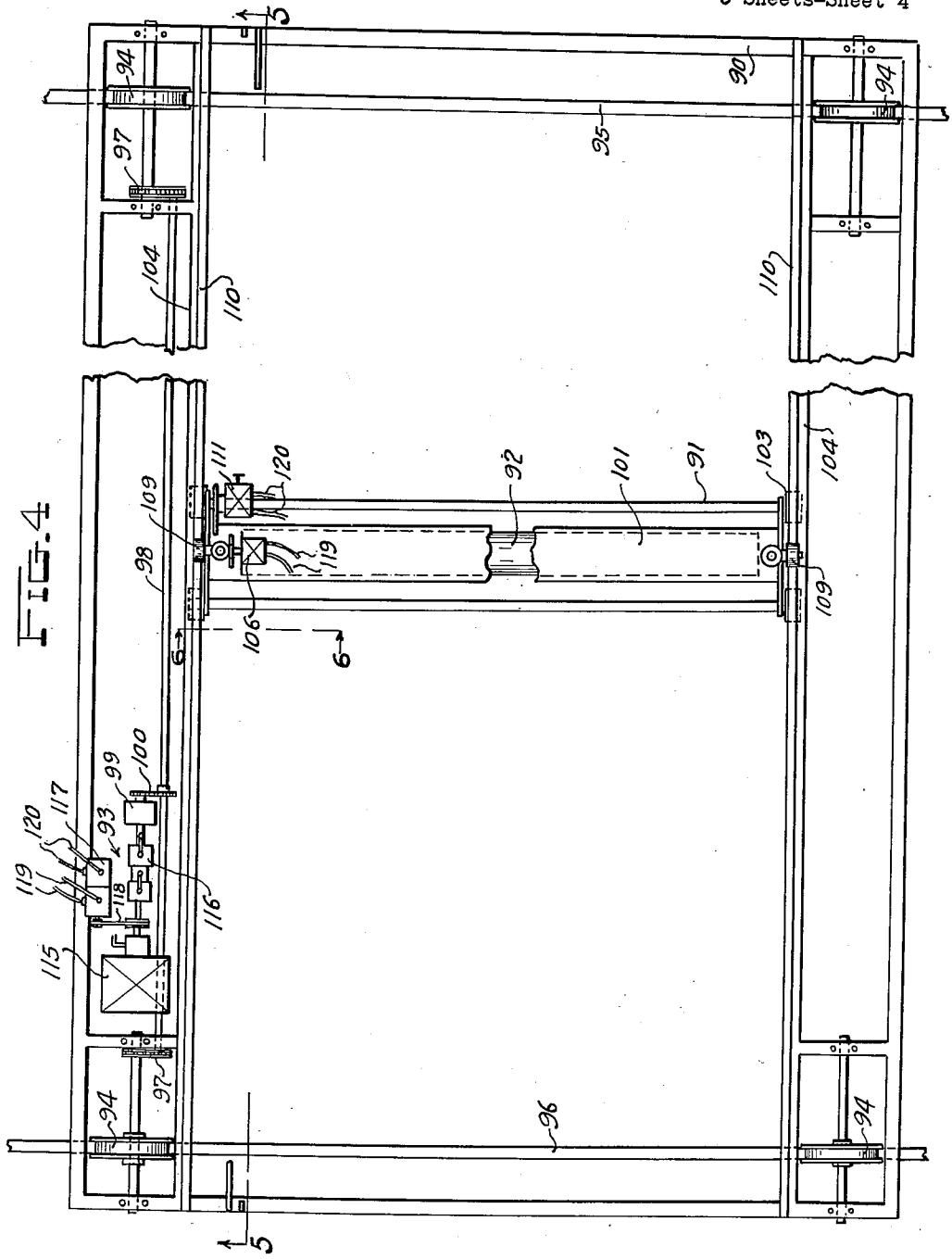

FIG. 4

INVENTOR.
John H. Hohnke
BY Carl R Anderson
Barnes, Kisselle, Laughlin & Raisch
ATTORNEYS

Feb. 26, 1952 J. H. HOHNKE ET AL 2,587,321

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FIG. 5.

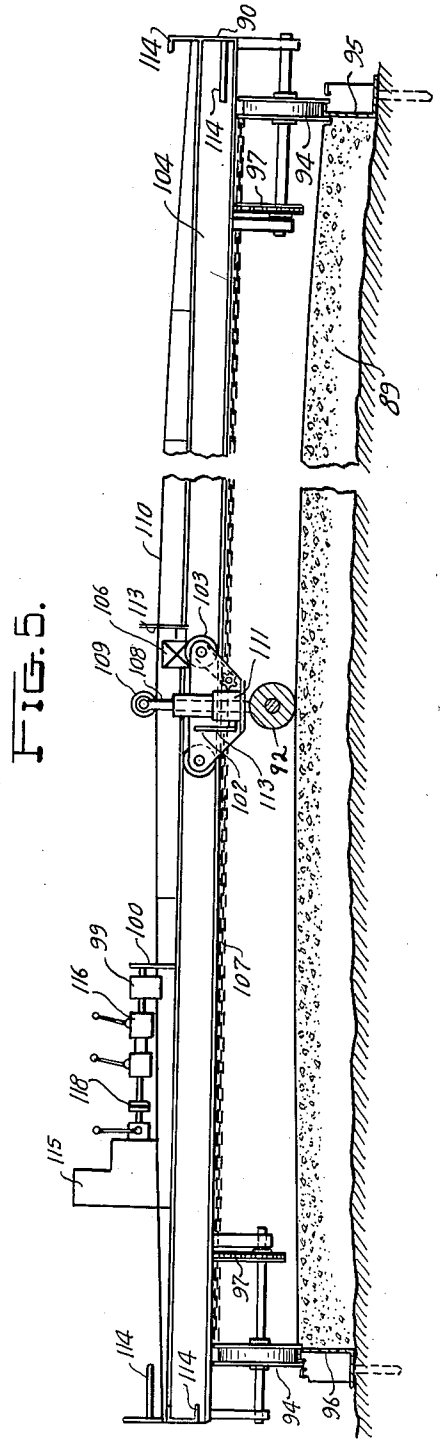
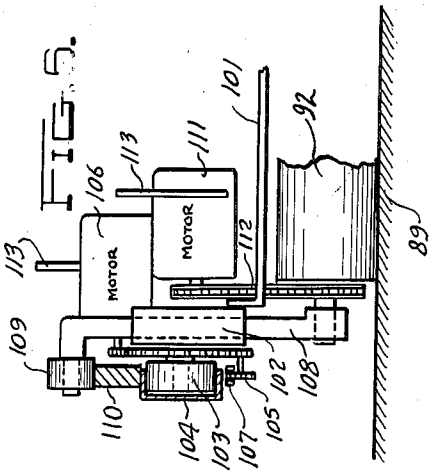


FIG. 6.



INVENTOR.
John H. Hohnke
Carl R. Anderson
BY
Barnes, Kisselle, Laughlin & Raisch
ATTORNEYS

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2,587,321

UNITED STATES PATENT OFFICE

2,587,321

MACHINE FOR FORMING AND FINISHING CONCRETE SURFACES

John H. Hohnke and Carl R. Anderson,
Detroit, Mich.

Application May 26, 1947, Serial No. 750,576

9 Claims. (Cl. 94—45)

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This invention relates to a machine for forming and finishing concrete surfaces and is particularly concerned with a machine for forming and finishing road surfaces and curbs.

It is an object of this invention to provide a machine which forms and finishes a surface, such as a concrete road or curb, to any predetermined contour and to very close limits. The invention also contemplates the production of a machine which forms and finishes a curb integral with the road pavement, that is, substantially at the same time the road surface is formed, and without the use of special forms to obtain the curb profile.

The invention also contemplates a machine which is adapted to finish a stretch of road pavement or curb as a continuous operation. More specifically, the machine may be operated so as to travel at a uniform speed longitudinally of the paved surface while the surface finishing operations are automatically controlled.

Several embodiments of machines constructed in accordance with our invention are shown in the following drawings in which:

Fig. 1 is a top plan view of a curb finishing machine embodying our invention.

Fig. 2 is a vertical sectional view of the machine shown in Fig. 1 taken substantially along line 2—2 in Fig. 1.

Fig. 3 is a diagrammatic view of the hydraulic system utilized in the machine shown in Figs. 1 and 2 which permits the automatic and continuous operation of the machine.

Fig. 4 is a top plan view of a road finishing machine utilizing the principle of our invention.

Fig. 5 is a vertical sectional view taken substantially along line 5—5 in Fig. 4.

Fig. 6 is a partial elevational view taken along line 6—6 in Fig. 4.

Referring to the drawings, and particularly to Figs. 1 and 2, there is shown a curb finishing machine of our invention which comprises a rectangular carriage 10 which is adapted to span across a road slab 11 and curb 12 and on which the curb finishing mechanism and power unit is supported. The carriage is supported for traveling movement longitudinally of the road bed by a pair of flanged wheels 13 at each side of the carriage adjacent the ends thereof. Guide wheels 13 are mounted on stub axles 14 which are journalled in bearings 15 carried by transverse supports 16 on the carriage 10. Wheels 13 at the inner end of carriage 10 are arranged to ride on a rail 17 which extends longitudinally of the road bed along the central portion thereof and wheels 13 adjacent the curb end of the carriage are arranged to ride on rail 18 which also serves as the rear retaining wall of the curb 12.

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The curb forming and finishing mechanism comprises a finishing roller 19 mounted between the ends of a guided yoke 20 which is pivoted to the end of a double acting ram 21 of a hydraulic cylinder 22. Roller 19 has guide rollers 23 journalled at its opposite ends. Guide rollers 23 are arranged to travel on a pair of parallel tracks 24 which are shaped to the curb profile and offset from curb 12 a distance equal to the radius of roller 19 so that as roller 19 reciprocates back and forth on tracks 24 it generates the curb profile, the surface of the roller being tangent to the curb surface.

Tracks 24 are traversed at their forward end by a transverse member 25 and at their rear ends by a member 26 to form a cradle 27. The front end of cradle 27 is suspended from carriage 10 by means of vertically adjustable chain links 28 at each side of the cradle. The cradle 27 is supoprted at its rear end by means of tie rods 29 having one end pivotally attached to the cradle as at 30 and the other end adjustably supported by a bracket 31 fixed to carriage 10. Cradle 27 is suspended from carriage 10 in a vertically adjustable manner so that roller 19 may be aligned with the crown of the road at the rear end of its stroke and to the height of the curb desired at the forward end of its stroke. These positions are indicated by broken lines 32 and 33, respectively, in Fig. 2. A second set of tie rods 34 pivoted to the cradle at one end, as at 30, and adjustably retained at the other end by brackets 35 on carriage 10 permit transverse adjustment of cradle 27 to obtain the curb thickness desired. At its forward end cradle 27 is also pivotally attached to the lower end of a vertical piston rod 36 which is raised and lowered within a hydraulic cylinder 37 suspended from a transverse frame member 38 on carriage 10. By means of a fluid system hereinafter described, rod 36 is actuated to lift the forward end of the cradle 27 when roller 19 reaches the forward limit of its stroke and lower the cradle so that roller 19 is tangent to the road surface when the roller reaches the rear end of its stroke. The roller is lifted in this manner so that it will not distort the finished curb surface on its return stroke.

So that the adjustment and lifting of cradle 27 will not produce a binding action on ram 21, the hydraulic cylinder 22 is pivotally supported at its forward end between a pair of ears 38 on the rear transverse cradle member 26 and is

hinged at its rear end as at 39 to a transverse frame member 40 on carriage 10.

In addition to its reciprocating movement we have found it desirable in order to obtain a good finish on the curb to have roller 19 rotate as well. For this purpose there is provided a chain and sprocket drive 41 at one end of roller 19 which is mounted on a rigid member 42 extending transversely of yoke 20 and connected by a universal joint 43 to one end of a splined compensating drive shaft 44. The other end of shaft 44 is coupled, as by universal joint 45, with a stub shaft 46 which is journalled in bearings 47 mounted on the carriage frame 10. A bevel gear 48 at the end of shaft 46 is driven by a bevel gear 49 fixed on an operating shaft 50 which is coupled by a universal joint 51 with the drive shaft 52 of a transmission 53. The transmission 53 is driven through a clutch 54 by a chain and sprocket drive 55 connected with a motor 56 which is also mounted on carriage 10. Viewed from the left end, roller 19 is driven clockwise in operation so that it tends to produce a cutting action and carry the concrete ahead of the roller to fill voids which might otherwise occur.

Motor 56 also supplies the power for driving the carriage 10 along longitudinal tracks 17 and 18. The stub axles 14 on one side of carriage 10 are provided with universal joints 57 at their inner ends which are coupled with the opposite ends of a connecting shaft 58 to establish a driving relationship between one set of wheels 13. A gear reduction mechanism 59 mounted on carriage 10 is driven by shaft 50 and drives a chain and sprocket drive 60 which is connected to one of the axles 14 of the driven pair of wheels 13 to propel the carriage 10 along tracks 17 and 18.

The hydraulic system, shown diagrammatically in Fig. 3, which operates cylinders 37 and 22, comprises a hydraulic pump 61 which is driven by motor 56 through the sprocket and chain drive 55. The inlet side of pump 61 is connected by a conduit 62 with an oil reservoir 63 and the outlet side of pump 61 is connected with a two-way valve 64 by means of a conduit 65. Conduit 65 also connects with a pressure relief valve 66 by means of conduit 67 and valve 66 is connected by a return conduit 68 with oil reservoir 63. Valve 64 also has a return conduit 69 extending to oil reservoir 63. The forward end of valve 65 is connected by a conduit 70 with a conduit 71 extending between the lower end of cylinder 37 and the forward end of cylinder 22. The rear end of valve 64 is connected by a conduit 72 with a conduit 73 extending between the upper end of cylinder 37 and the rear end of cylinder 22.

The transverse movement of roller 19 is synchronized with the lifting of cradle 26 by a pivotal handle 74 which is connected by link 75 with the spool (not shown) of valve 64. Handle 74 is arranged to shift the spool to either end of valve 64 by means of a pair of dogs 76 and 77 which are arranged on a valve actuating rod 78 so as to be longitudinally adjustable. Rod 78 is loosely supported at one end for sliding movement within a bracket 79 on carrier frame 10 and is pivoted at its other end to an upright leg 80 mounted on yoke 20. Dogs 76 and 77 are arranged so that when the roller 19 advances to the position indicated by broken lines 33, dog 77 abuts against and shifts handle 74 to its forward position so as to admit fluid through conduits 70 and 71 to the lower end of cylinder 37 and to the forward end of cylinder 22. It will be readily understood that the fluid flow produced thereby causes ram 21 to be retracted in cylinder 22 and simultaneously raises rod 36 within cylinder 37 to lift the cradle 27. When roller 19 reaches the rearward position indicated by broken lines 32, dog 76 is arranged to shift handle 74 rearwardly or to the right so that fluid will be admitted to the rear end of cylinder 22 and to the upper end of cylinder 37. This fluid flow simultaneously lowers cradle 27 and moves ram 21 in an outward direction.

It will be appreciated that during reciprocation of roller 19, carriage 10 is propelled at a uniform speed along tracks 17 and 18. We have found that a very smooth finish is produced when the longitudinal speed of the carriage is controlled so that for each complete cycle of roll 19, the carriage 10 travels forwardly a distance equal to one half of the length of the roller. In this manner roller 19 laps approximately half of its length per cycle.

For convenient operation, an operator's seat 81 may be mounted on carriage 10 as shown and control rods (not shown) may be extended from the transmission 53, clutch 54, and other control mechanisms towards the operator's seat so that the operator is enabled to control the entire operation of the machine from the operator's seat.

In operation, the rod slab 11 is finished by a transverse finishing machine leaving the curb portion 12 to be formed and finished by the curb finishing machine described which may be arranged to follow a short distance behind the transverse finisher. Concrete is poured along the inner side of rail 18 and is roughly shaped to a contour slightly larger than the curb profile by a curb profile shield 82 which is mounted on carriage 10 so as to remove the excess concrete as the carriage travels forwardly. At the same time, roller 19 moves outwardly and upwardly on tracks 24 while rotating in a clockwise direction as shown. This produces a cutting action at the surface of the concrete which together with the transverse movement of the roller generates a true curb profile and carries the excess concrete ahead of the roll and over the upper edge of rail 18 when the roller reaches its outward limit of movement. At this point handle 74 of the two-way valve 64 is shifted rearwardly by dog 77 causing cylinder 37 to raise cradle 27 and simultaneously reversing the stroke of ram 21. In the same manner when dog 76 strikes handle 74 on the return stroke of the ram, cylinder 37 drops cradle 27 into finishing position and ram 21 reverses and moves roller 19 outwardly along tracks 24. This operation is continuous and automatic and insures proper lapping of the curb surface since during each complete cycle of reciprocation, roller 19 advances longitudinally approximately one-half of its axial length and the surface of the curb will thereby receive at least a double finishing effect.

In Figs. 4 to 6 there is shown another embodiment of a surface finishing machine of our invention. The machine illustrated in these drawings is particularly adapted for finishing or "ironing out" surface irregularities of the pavement which remain after the surface has been finished by ordinary means, such as by a finisher employing a transverse screed which reciprocates transversely over the paved surface. The machine comprises a rectangular frame 90 which is adapted to span a concrete road slab 89 and on which is mounted a transverse traveling carriage 91 which carries a finishing roller 92. The

machine is also provided with power unit 93 mounted on frame 90.

Frame 90 is supported at opposite ends adjacent its sides by two pairs of flanged wheels 94 which are arranged to be guided on parallel rails 95 and 96. Rails 95 and 96 serve as end forms for the concrete and extend longitudinally along the pavement. At one side of frame 90, wheels 94 are connected through chain and sprocket drives 97 with a drive shaft 98 which is driven by power unit 93 through a speed reducing mechanism 99 and a chain and sprocket drive 100.

The transverse carriage 91 comprises an operator's platform 101 which is supported at its opposite ends by carriage hangers 102 on which a pair of rollers 103 are journalled. Rollers 103 are arranged to ride in a pair of channeled tracks 104 extending along each side of frame 90. The carriage 91 is propelled back and forth across frame 90 on tracks 104 by a sprocket 105 which is driven by a fluid motor 106 and which engages with the links of stationary chains 107 mounted on frame 90 under each of the channel tracks 104.

The finishing roller 92 is journalled between the lower ends of vertical suspension bar 108 which are slidably retained in carriage hangers 102. Bars 108 are provided at their upper ends with guide rollers 109 which ride on crown tracks 110 on frame 90. Tracks 110 are adapted to be adjustable within limits to any contour of road crown desired. By suspending finishing roller 92 from carriage 91 in this manner it will be observed that its path of travel follows the contour of crown tracks 110 and the roller therefore produces a crown surface on the pavement having exactly the same contour as the crown tracks 110. Roller 92 is also rotated by a fluid motor 111 which drives the roller by means of a chain and sprocket drive 112.

Motors 106 and 111 are of the standard reversing fluid type and are provided with two-way pilot valves which are actuated by control levers 113 on each motor. The motors are arranged to be automatically reversed as the carriage 92 reaches either end of frame 90 by camming members 114 at each end of frame 90 which engage levers 113 and shift them to the reverse position.

The power unit 93 comprises a motor 115, preferably of the internal combustion type, with a reversing type transmission 116 for driving the traveling wheels 94 at variable speeds through the reduction gear train 99. Motor 115 also drives a double hydraulic pump 117 through a chain and sprocket drive 118. Pump 117 is connected by a pair of fluid hoses 119 with fluid motor 106 for propelling the carriage 91 and by a pair of hoses 120 with fluid motor 111 which rotates finishing roller 92.

In the operation of the machine illustrated in Figs. 4 to 6, frame 90 is propelled at a uniform speed longitudinally of the pavement on tracks 95 and 96. At the same time finishing roller 92 rotates and is carried by carriage 91 back and forth across frame 90 from one edge of the pavement to the other. By reason of the floating suspension of the finishing roller 92 on the carriage 91, the roller traverses the pavement in a contoured path and thereby finishes the pavement surface to a crown profile parallel to the contour of the adjustable crown tracks 110 on frame 90. The relation of the rotation of finishing roller 92 with respect to its transverse movement is such that the tangential direction of the roller surface at the pavement contact line is the same as the direction of its transverse travel. As previously explained the rotation of the finishing roller 92 in this manner produces a cutting action which removes high spots at the pavement surface and carries the excess concrete ahead of the roller. When carriage 91 reaches either end of frame 90, the direction of travel and the rotation of roller 92 is automatically reversed by camming members 114 on frame 90 which shift control levers 113 on fluid motors 106 and 111 to effect a reversal of the inlet and outlet ports on each motor.

To obtain very close tolerances on any stretch of pavement we have found it desirable to control the longitudinal speed of frame 90 so that the finishing roller 92 advances a distance of approximately one-half of its length while it travels from one side of the frame to the other. By controlling the speed of travel in this manner any portion of the pavement surface receives at least a double finishing effect. A truer crown line and smoother surface may also be obtained by mounting the guide rollers 109 on eccentric lift cams so that roller 92 may be lifted so as to hurdle the small accumulations of mortar at each end of its stroke and carry that surplus back on its return stroke to fill any voids which may occur in the pavement surface.

We claim:

1. A machine for forming a roll type curb along the edge of a road surface from a plastic material such as concrete comprising a carriage movable in a direction longitudinally of the curb being formed, a frame supported on said carriage and movable thereon, track members on said frame extending transversely of said direction of movement of said carriage and having a contour corresponding to the contour into which the curb is being formed, said track members having a pair of vertically spaced horizontal portions and an intermediate portion connecting and substantially inclined to said horizontal portions, a roller supported by said track members, means for reciprocating said roller along said track members and over the surface of said material, and means for rotating the roller about its axis in a direction such that the tangential movement of its surface at the point of contact with said material is the same as the direction of its bodily movement and means acting between said frame and carriage for raising said frame on said carriage during a portion of the stroke of the roller so as to lift the roller out of contact with the curb surface.

2. A machine as set forth in claim 1 including means for adjusting said frame on said carriage in a direction vertically and transversely of said direction of movement of said carriage to vary the height and thickness of the curb being formed.

3. A machine for forming a roll type curb along the edge of a road surface from a plastic material such as concrete comprising a roller, a support movable in a direction longitudinally of the curb being formed, means on said support for reciprocating the roller over the surface of said material along a path transversely of said direction of movement of said support, means for rotating the roller about its axis in a direction such that the roller opposes said bodily movement, means for axially supporting said roller, and spaced parallel tracks on said support for positively guiding said supporting means along a path corresponding to the contour of the curb being formed, said tracks having a pair of vertically

spaced horizontal portions and an intermediate portion connecting and substantially inclined to said spaced portions.

4. A machine for forming a roll type curb along the edge of a road surface from a plastic material such as concrete comprising a cylindrical roller, a support movable in a direction longitudinally of the curb being formed, means on said support for reciprocating said roller over the surface of said material in a direction transversely of said direction of movement of said support, means for rotating the roller about its axis so that the roller opposes such reciprocating movement in at least one direction, a pair of spaced parallel tracks on said support extending transversely of said direction of movement of said support, said tracks having a portion thereof inclined substantially to the surface of the road and being shaped to guide said roller in a path corresponding to the contour into which the curb is being formed, and means for lifting the roller away from the curb surface and lowering the roller to the curb surface so that the roller may be raised out of contact with the inclined portion of the curb surface during that portion of its stroke when it is moving downwardly and in the direction of the center of the road.

5. A machine as set forth in claim 4 including means for synchronizing said lifting and lowering means with said reciprocation means so that the roller is raised out of contact with the curb surface near one end of its stroke and is lowered into contact with the curb surface near the other end of its stroke so that the roller acts upon the curb surface only during that portion of its stroke when its rotation tends to oppose its reciprocating movement.

6. A machine for forming a roll type curb along the edge of a road surface from a plastic material such as concrete comprising a carriage, a frame movably supported on said carriage, a pair of rigid track members on said frame extending transversely of the axis of the curb and having a contour corresponding to the contour into which the curb is being formed, said track members each having a pair of vertically spaced horizontal portions and an intermediate portion connecting and substantially inclined to said horizontal portions, a roller supported by said track members, means for reciprocating said roller along said track members and over the surface of said material, means for rotating the roller about its axis in a direction tending to resist its reciprocal movement, and means for shifting said frame on said carriage in a vertical and transverse direction relative to the curb so as to vary the height and thickness of the curb being formed.

7. The combination as set forth in claim 6 including means for raising said roller out of contact with the curb surface when the roller is reciprocated in a direction towards the center of the road.

8. A machine for forming a roll type curb along the edge of a road surface from a plastic material such as concrete comprising a carriage adapted to span the curb being formed in a transverse direction, a frame pivoted on said carriage on an axis parallel with the axis of the curb, a pair of track members on said frame extending transversely of the axis of the curb and having a contour corresponding to the contour of the curb being formed, said track members having at least a portion thereof inclined substantially to the horizontal, means for reciprocating said roller along said track members and over the surface of said material, means for rotating the roller about its axis in a direction such that the roller tends to resist said reciprocating movement in at least one direction, and means synchronized with said reciprocating means for pivoting said frame upwardly to raise the roller out of contact with the curb surface during that portion of its stroke when the roller is moving downwardly on said inclined portion of said track members.

9. A machine for forming a roll type curb along the edge of a road surface from a plastic material such as concrete comprising a roller, means for reciprocating the roller over the surface of said material along a path transversely of the curb and roller axes, means for rotating the roller about its axis in a direction such that the roller opposes said bodily movement, means for guiding the roller along a path at least a portion of which is inclined substantially to the surface of the road, said path corresponding to the contour into which the curb is being formed, and means for shifting said guiding means in a direction vertically and transversely of the curb so as to vary the height and thickness of the curb being formed.

JOHN H. HOHNKE.
CARL R. ANDERSON.

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