Sept. 6, 1960 H. C. POLLITZ 2,951,426

SURFACING MACHINE WITH HEATED DEFLECTOR PLATE

Filed Sept. 3, 1957 4 Sheets-Sheet 1

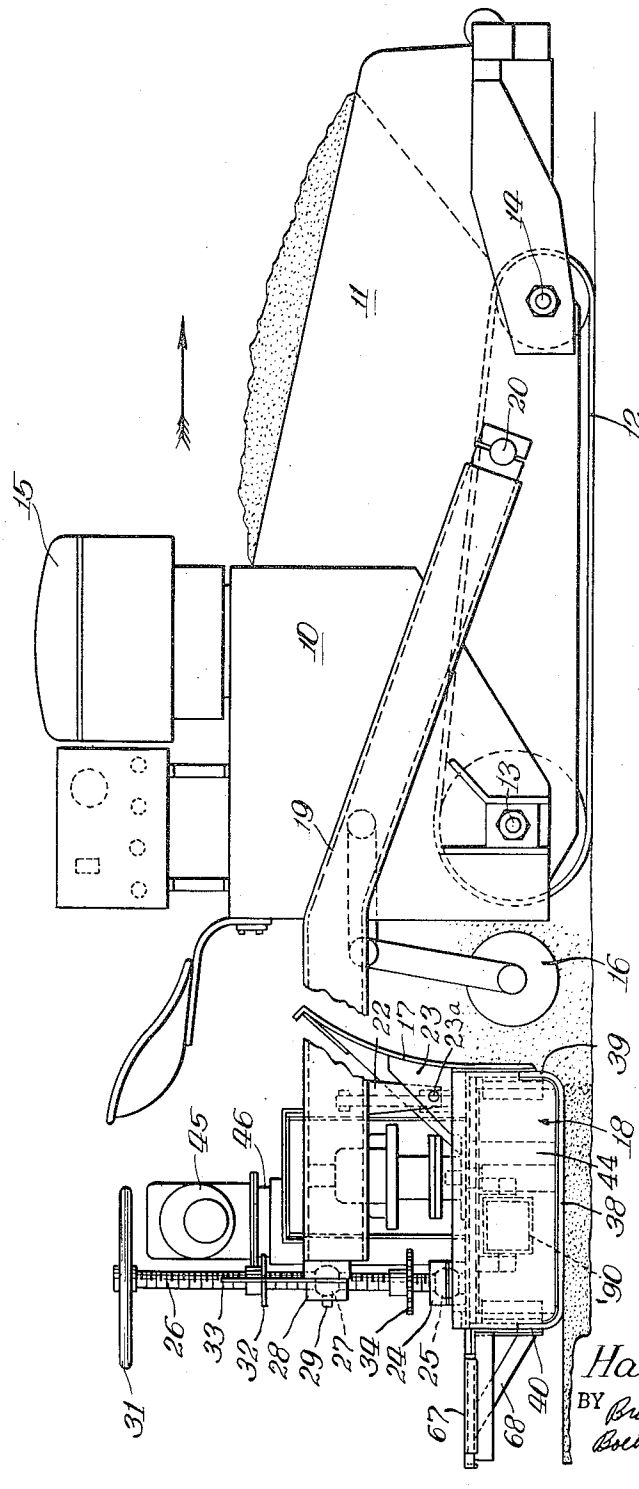


FIG. 1.

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SURFACING MACHINE WITH HEATED DEFLECTOR PLATE

Filed Sept. 3, 1957 4 Sheets-Sheet 2

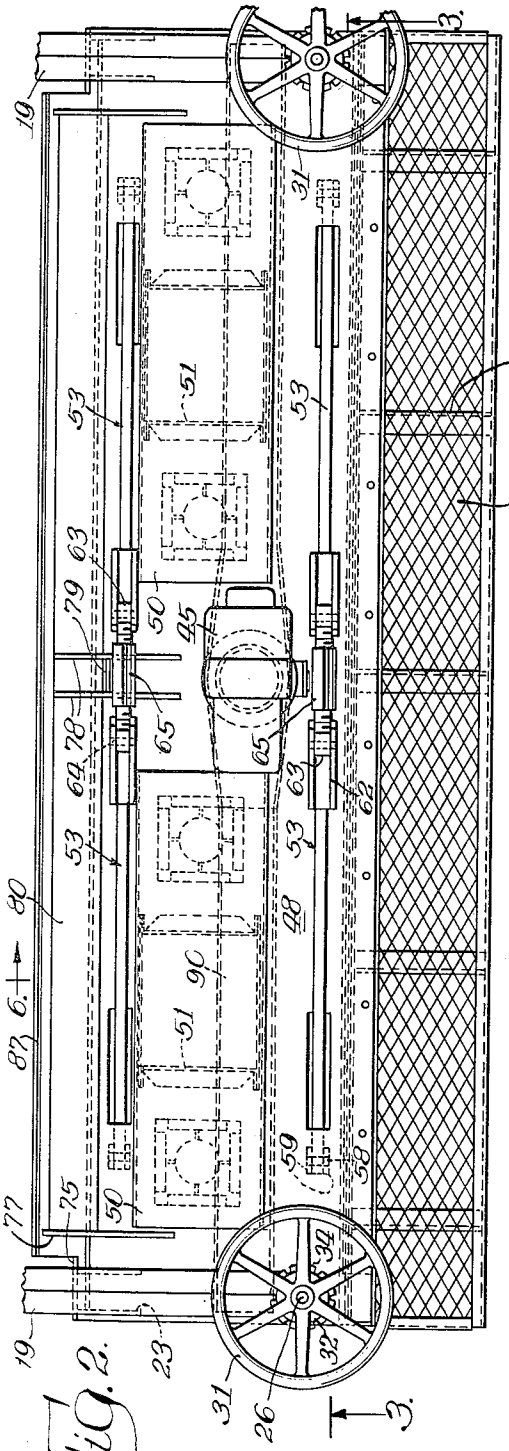


FIG. 2.

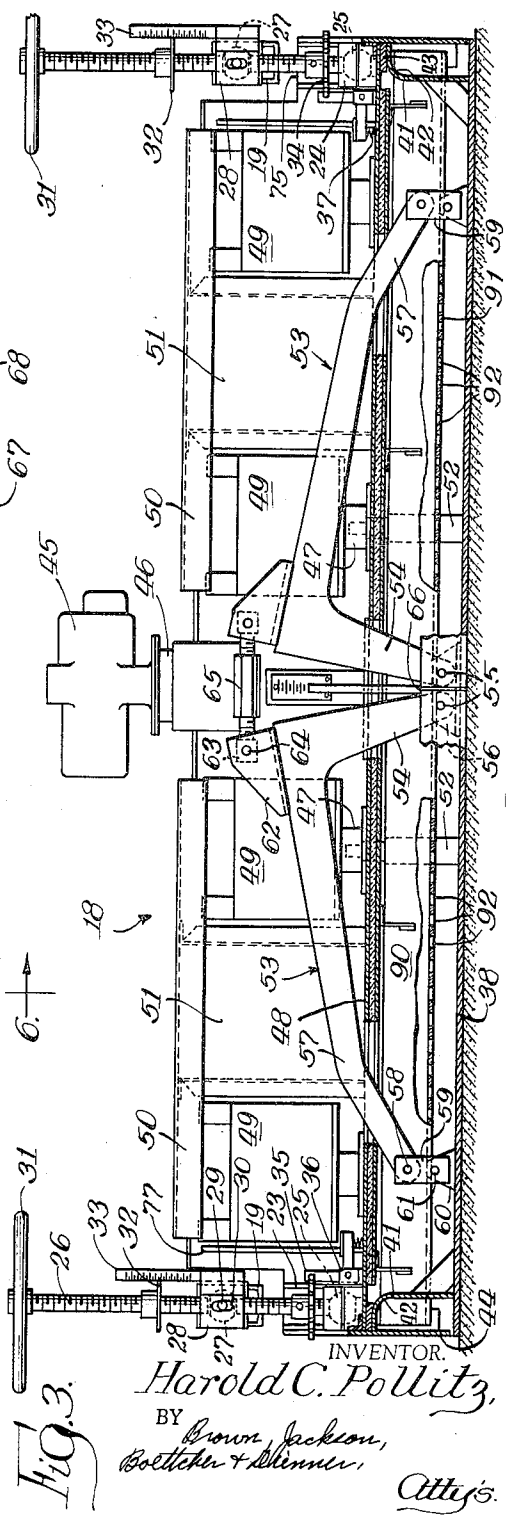


FIG. 3.

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SURFACING MACHINE WITH HEATED DEFLECTOR PLATE

Filed Sept. 3, 1957 4 Sheets-Sheet 3

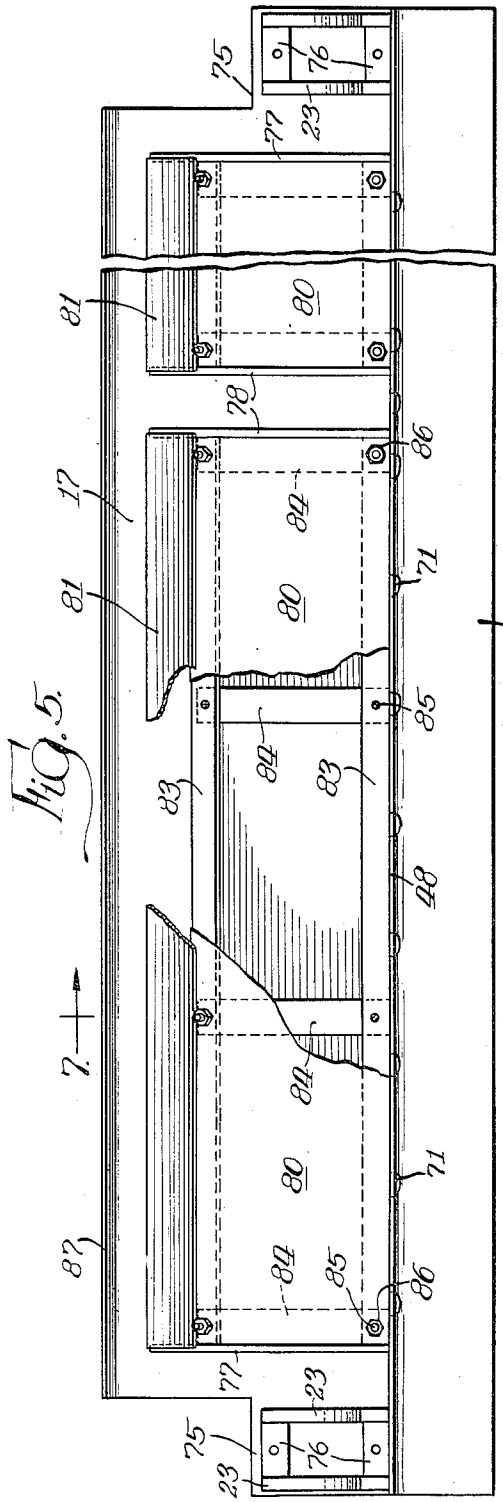


FIG. 5.

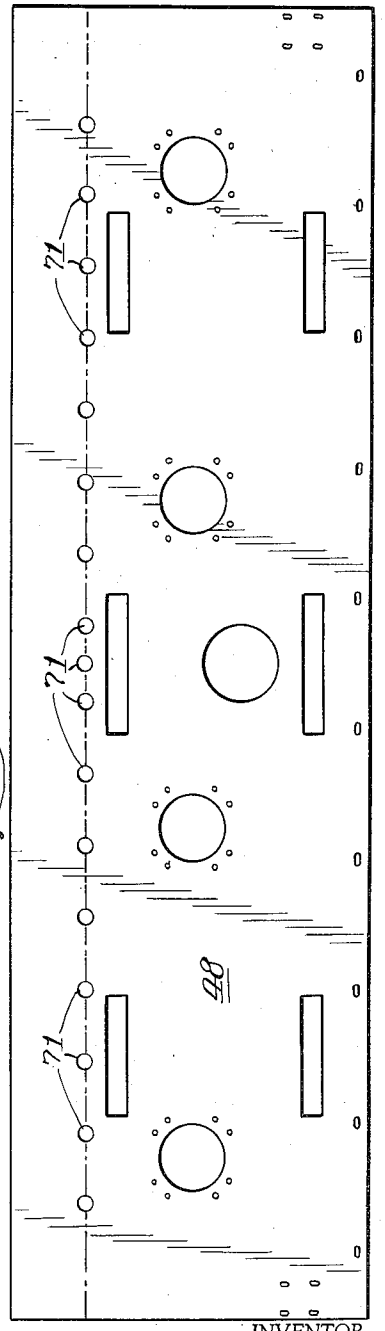


FIG. 4.

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Sept. 6, 1960 H. C. POLLITZ 2,951,426

SURFACING MACHINE WITH HEATED DEFLECTOR PLATE

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Fig. 7.

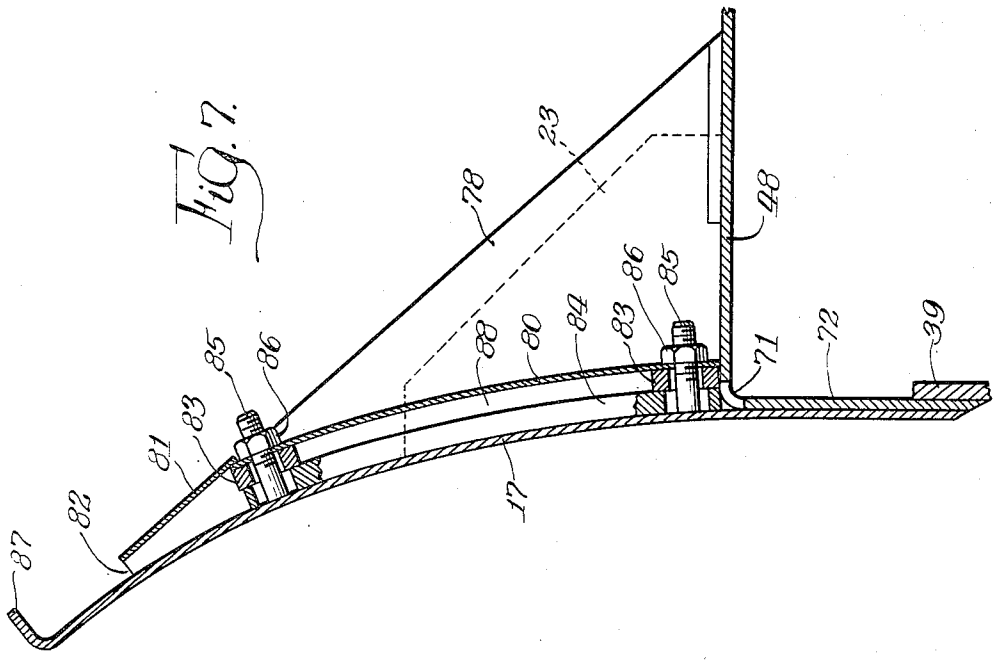
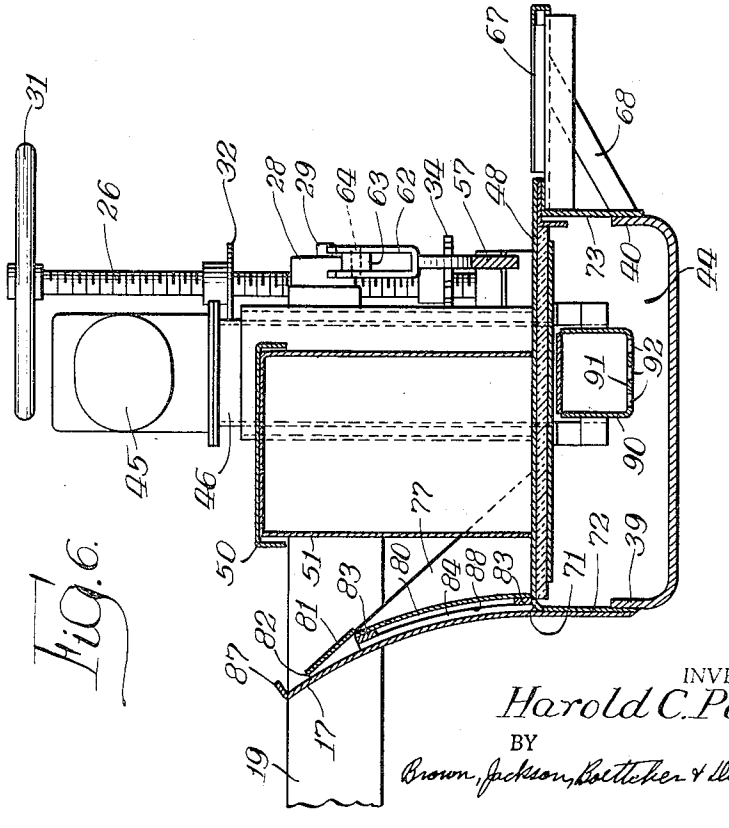


Fig. 6.



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United States Patent Office 2,951,426
Patented Sept. 6, 1960

2,951,426

SURFACING MACHINE WITH HEATED DEFLECTOR PLATE

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Filed Sept. 3, 1957, Ser. No. 681,600

8 Claims. (Cl. 94—46)

This invention relates to road surfacing machines using screed assemblies and, also, to screed assemblies to use with such machines.

Many road ways are surfaced with "black-top," a mix of aggregate and fines with a bituminous binder. The surfacing material is commonly applied by means of a surfacing machine comprising a tractor unit and a trailing screed assembly. The tractor unit is provided with a hopper into which the hot mix is dumped by trucks and is delivered by a conveyor and a spreader to the screed assembly. The screed assembly has a front deflector plate, sometimes termed a mold board, which directs the hot mix rearwardly and downwardly to compacting and finishing means which may include tamping bars, for compacting the mix, and a screed plate for surface finishing the compacted bed of material. The bituminous binder is, when cooled, highly adhesive. It is often necessary to stop the travel of the surfacing machine, for various reasons and for varying periods of time. During such stoppages the mix cools off and would adhere tenaciously to the parts of the screed assembly with which it is in contact. In order to guard against adhering of the mix to the screed plate during stoppages, means is provided for heating the screed plate, such means commonly utilizing a blower type oil heater as the source of heat. When travel of the machine is stopped, the operator turns on the heater thereby maintaining the screed plate at a sufficiently high temperature to guard against adhesion thereto of the mix. During travel of the machine in normal operation, the mix does not cool sufficiently to adhere to the screed plate, and the heater is then turned off. While heating of the screed plate during stoppages avoids the difficulty of the mix adhering to that plate, it does not solve the problem of the mix adhering to the deflector plate, which is exposed to the atmosphere and cools more rapidly than the screed plate and can not be heated by conduction from the latter sufficiently to prevent adhering of the cooled mix. Accordingly, it frequently happens, that when the machine is stopped the mix at the front of the deflector plate, which is also exposed to atmosphere and cools more rapidly than the mix under the screed plate, adheres to the deflector plate. When the machine again starts to travel, the mix adhering to the deflector plate prevents smooth flow thereover of the mix delivered thereto by the conveyor and the spreader. That interferes with proper spreading and distribution of the material and renders it difficult to obtain a surfacing bed of proper thickness and smooth finish, while also objectionably delaying the surfacing operation.

My invention is directed to a surfacing machine which avoids the above noted objections to the presently used machines referred to above. To that end I provide a screed assembly having means for heating the deflector plate effective for preventing adhering thereto of the mix during stoppage of the machine, as well as means for heating the screed plate. The heating means may be,

and preferably is, common to both plates and conveniently is a pressure or blower type of oil burner. More specifically, the screed assembly includes a substantially closed housing with the screed plate forming the bottom thereof, the deflector plate being positioned at the front of the assembly and means being provided whereby hot gases or products of combustion from within the housing are caused to flow over the deflector plate effective for heating it sufficiently to preclude adhering thereto of the cooled mix. Further objects and advantages of my invention will appear from the detailed description.

In the drawings:

Figure 1 is a side view of a surfacing machine including a screed assembly embodying my invention;

Figure 2 is a top plan view of the screed assembly;

Figure 3 is a sectional view taken substantially on line 3—3 of Figure 2, certain parts being broken away and shown in section;

Figure 4 is a plan view of the housing top plate in its flat condition prior to bending to provide the front flange thereof;

Figure 5 is a rear view of the deflector plate and the housing top plate, with certain parts broken away;

Figure 6 is a sectional view taken substantially on line 6—6 of Figure 2; and

Figure 7 is a sectional view, on an enlarged scale, taken substantially on line 7—7 of Figure 5, the housing top plate being broken away in major portion.

My present invention is, in certain of its aspects, in the nature of an improvement over the screed assemblies disclosed in my copending application for Screed Compensating and Adjusting Means, Serial No. 646,917, filed March 18, 1957, and in my patent for Vibrating Finishing Machine, No. 2,757,588, issued August 7, 1956.

The machine of Figure 1 includes a tractor 10 and a hopper 11 carried thereby, both mounted on a track laying carriage 12 extending between axles 13 and 14, and a suitable power source, such as an internal combustion engine 15; the unit as a whole being self-propelled along a road being surfaced. The hopper 11 receives the road surfacing mix, which may be bitumen and an aggregate, or any suitable mix. The mix is delivered by a rearwardly travelling conveyor (not shown) to a two part screw conveyor or distributor 16 which spreads the mix upon the roadway in front of a mold board 17. The mold board 17 is disposed in front of, and directs the mix downward and rearward to, a screed assembly 18 supported by arms 19 pivoted at their forward ends, at 20, to the tractor unit and extending rearwardly therebeyond. The machine so far described is similar to that of my above identified patent.

The screed assembly is supported at its front from arms 19 by brackets 22 secured to and depending from arms 19 and pivoted at their lower ends, at 23a between pairs of brackets 23 secured to assembly 18. At its rear the screed assembly 18 is provided with split socket blocks 24 secured to each end thereof. The blocks 24 receive balls 25 at the lower ends of adjusting screws 26 threaded through balls 27 mounted in split socket blocks 28 secured to the rearward ends of arms 19. Each ball 27 is provided with a rearwardly extending stud 29 projecting through a slot 30 in block 28 effective for restraining ball 27 against turning movement while permitting tilting thereof both lengthwise and transversely of the screed assembly 18. A hand wheel 31 is fixed on the upper end of each screw 26, which also has secured thereon a disc 32 disposed below hand wheel 31 and cooperating with a suitably graduated plate 33, mounted on block 28, to indicate the extent of vertical adjustment of the corresponding end of the screed assembly 18. Each of the adjusting screws 26 is further pro-

vided with a ratchet wheel 34 secured thereon a short distance above block 24. A locking pawl 35 is pivoted in a bracket 36 secured to the screed assembly 18, adjacent each ratchet wheel 34 and normally is held in engagement therewith by suitable means, such as a compression spring 37. As will be understood from the above, the screed assembly 18 may be adjusted, by means of the screws 26, so as to adjust the thickness of the bed or mat of material.

The screed plate 38 is formed of comparatively thin resilient plate metal, is flat and of substantially rectangular shape in plan, and may be, by way of example, approximately ten feet long and two feet wide. It is provided with upwardly extending front and rear flanges 39 and 40 and is suspended from screed assembly 18, as shown more clearly in Figure 3, by means of resilient hangers 41 of substantially inverted L shape, the arms of which are connected by an arcuate element 42 curved on a substantial radius. The lower ends of hangers 41 are welded to plate 38 adjacent the ends thereof. The ends of the upper arms of hangers 41, remote from elements 42, are secured, conveniently by welding, to two end frame members 43 of the assembly 18. The screed plate 38 is thus supported so as to be vibrated readily and adjusted in a vertical plane. End plates 44 are mounted on the screed assembly 18, free from plate 38 so as not to interfere with freedom of vibration or adjustment thereof. The plate 38 may be heated from its upper side by suitable known means, such as an oil burner 45 from which the hot products of combustion are directed downward by a stack 46 and are uniformly distributed, by means to be prescribed presently, over the upper face of screed plate 38, as is known.

The screed plate 38 is vibrated in a suitable manner, preferably by a plurality of electro-magnetic vibrators 47 mounted on a plate 48 of the assembly and enclosed in housings 49 suspended from channel members 50 supported above plate 48 by boxings 51. Each of the vibrators 47 has a tubular rod or armature 52 attached thereto at its upper end and secured at its lower end, conveniently by welding, to the upper face of screed plate 38. The vibrators 47 are spaced uniformly along the screed assembly 18 lengthwise thereof and are suitably energized, preferably in the manner disclosed in my above identified patent, for vibrating the screed plate 38 in the manner and for the purposes stated in that patent. Within the broader aspects of my invention, the screed plate 38 may be vibrated in any suitable manner.

The screed plate 38 is provided adjacent the front and the back thereof with a pair of substantially L shaped temperature compensating and adjusting levers 53. The shorter arm 54 of each lever 53 is pivoted at 55 to a bracket 56 suitably secured, conveniently by welding, to the upper face of screed plate 38 adjacent the midlength thereof. The longer arm 57 of each lever 53 is pivoted at 58 between the upper ends of two links 59 disposed at opposite sides thereof and at opposite sides of a bracket 60 suitably secured, conveniently by welding, to the upper face of screed plate 38 a short distance from the end thereof, to which bracket 60 the lower ends of the links 59 are pivoted at 61. A substantially U-shaped bracket 62 is secured, conveniently by welding, to the upper face of arm 57 of each of the levers 53, adjacent the inner end thereof. A suitably bored and threaded block 63 is disposed between the sides of bracket 62 and is pivoted by studs 64, at its opposite sides, in bracket 62 for turning movement about a horizontal axis extending transversely of screed plate 38. The blocks 63 of each pair of levers 53 receive the threaded end portions of a turnbuckle 65.

The levers 53 of each pair are tied together at their inner ends by the turnbuckles 65 and associated parts and may be adjusted thereby to assure that the screed plate 38 is flat and level lengthwise as well as transversely. The linkage connections between the outer ends of the

levers 53 and the screed plate 38 accommodate expansion and contraction of the latter, due to temperature variations, and, in conjunction with levers 53, effectively restrain the end portions of plate 38 against vertical movement relative to the midportion thereof. That prevents any objectionable lengthwise warping or buckling of screed plate 38. When the bed of surfacing material being laid is of substantial width, approximately twice the length of screed plate 38, for example, crowning may be effected by disposing the screed plate 38 at an appropriate inclination lengthwise, by means of the adjusting screws 26. If the bed of surfacing material being laid is of a width within the length of the screed plate 38 the latter may be bowed lengthwise to give the desired crown. That is accomplished by turning the turnbuckle 65 in such direction as to force the inner ends of the levers 53 of each pair thereof away from each other, it being noted that each of the flanges 39 and 40 is provided at its midlength with a vertical slot 66 extending for the full height thereof and thus comprises two sections. Forcing the inner ends of levers 53 apart causes them to swing in opposite directions about pivots 55. That swings the outer ends of levers 53 downward depressing the ends of screed plate 38 and imparting thereto a lengthwise bow, determined by the extent of adjustment of the turnbuckles 65, for imparting the desired crown to the bed of surfacing material being laid. When the screed plate 38 is thus bowed, the levers 53 remain effective for preventing objectionable warping or buckling thereof as before. The rear turnbuckle 65 and the hand wheels 31 of the adjusting screws 26, and the locking pawls 35 are readily accessible from an operator's platform 67 mounted at the back of the screed assembly 18 on brackets 68, and a suitably disposed platform (not shown) may be provided giving ready access to the front turnbuckle 65.

The road surfacing machine, including the screed assembly, so far described is similar to that disclosed in my above identified copending application.

The plate 48, as initially formed, is flat and oblong in plan and is provided, a short distance from its forward edge, with a row of openings 71, as shown more clearly in Figure 4. The forward portion of plate 48 is bent downward substantially perpendicular to the remainder thereof along a lengthwise line extending diametrically of the openings 71, providing a substantially vertical flange 72 extending downward from the front of plate 48. The lower end of flange 72 overlaps the front flange 39 of the screed plate 38, as shown more clearly in Figures 1, 6 and 7. A vertically disposed plate 73 extends downward from the operator's platform 67, at the back of the screed assembly 18 and, at its lower portion, overlaps the upper portion of the rear flange 40 of screed plate 38. The plate 48, screed plate 38, flange 72 of plate 48, flanges 38 and 40 of screed plate 38, the rear plate 73 and the end plates 44 thus cooperate to provide a substantially closed housing of rectangular cross section of which plate 48 is the top plate and screed plate 38 is the bottom plate.

The mold board 17 is provided with end extensions 75 of reduced height, as shown more clearly in Figures 3 and 5, which seat on and are secured to, conveniently by bolting, cross pieces 76 secured between the brackets of the respective pairs of brackets 23. The lower portion of mold board 17 extends downwardly along the outer faces of flange 72 of top plate 48 and front flange 39 of the screed plate 38. A triangular plate or gusset 77 is welded to top plate 48 adjacent and a short distance inwardly from each pair of brackets 23. A pair of gussets 78, connected by a cross piece 79, is also welded to top plate 48 at the midlength thereof. A lower cover or shield plate 80 is welded to the gussets 77 and 78 and the cross piece 79 and extends from top plate 48 upward in rear of the mold board 17 for approximately two-thirds of the height thereof. An upper shield plate 81 is welded to the gussets 77 and extends from the upper edge of

plate 80 a substantial distance, being spaced at its upper edge from mold board 17 to provide an outlet opening or slot 82, as shown more clearly in Figure 7. Reinforcing bars 83 are welded to the forward face of plate 80 at the upper and the lower portions thereof and extend the full length of such plate. The bars 83 are welded to the rearward faces of the end portions of suitably spaced vertically disposed reinforcing bars 84, also of substantial thickness. The bars 83 and 84 together provide a rigid supporting frame secured to the top plate 48 of the housing for reinforcing and supporting the mold board 17. In that connection, the bars 84 are curved lengthwise to conform to the curvature of the mold board 17, as are the forward edges of the gussets 77, the latter being disposed adjacent the ends of the body portion of mold board 17 inwardly from the reduced end portions 75 thereof. Bolting studs 85 are welded to the rearward face of mold board 17 and pass through openings in the reinforcing bars 84 and 83 and the plate 80, as shown more clearly in Figure 7. Nuts 86, threaded on the bolting studs 85 and seating on plate 80 secure the mold board 17 to the reinforcing frame comprising the bars 83 and 84 and, in conjunction with the brackets 23 and associated parts, removably secure the mold board 17 in position on the screed assembly at the front thereof. The upper edge portion of the body portion of mold board 17 preferably is bent rearward to provide a top flange 87 against the under face of which the hot gases escaping through the outlet slot 82 impinge. The mold board 17 is of suitable curvature from top to bottom for directing the mix downward to and beneath the screed plate 38, as will be understood.

It will be seen that the cover or shield plates 80 and 81 define with the mold board 17 a space 88 which overlies and opens downward into the openings 71 in top plate 48 at the front thereof. The stack 46 opens into a conduit or duct 90 of rectangular cross section supported from the underface of top plate 48 and extending substantially the full length thereof, to within a short distance of the end plates 44. Duct 90 preferably is closed at its ends and is disposed with its bottom wall a short distance above the upper face of the screed plate 30, bottom wall 91 being provided with suitably disposed openings 92 for directing the hot products of combustion from the burner 45 downward against the upper face of the screed plate 38. If desired, the duct 90 may be provided interiorly with suitably disposed baffles for assuring uniform distribution of the hot products of combustion, and the housing within which duct 90 is disposed may also be provided with suitably disposed baffles. As previously noted, the burner 45 preferably is of the pressure or blower type assuring that the hot products of combustion therefrom will be discharged downwardly through stack 46 into the duct 90 and will flow lengthwise along the latter and through the openings into the housing and against the upper face of the screed plate 38. The hot products of combustion flow from the housing through the openings 71 into space 88 in contact with the mold board 17 and with the bars 83 and 84 of the reinforcing frame therefor, which also assist in heating the mold board by conduction. The ends of the space 88 are closed by the plates or gussets 77 and the hot products of combustion, after heating the mold board 17, may escape through the opening or slot 82 to atmosphere. The mold board 17 is thus effectively heated when the heater is turned on, usually during stoppages of the machine, and is maintained at a temperature such that the mix in contact with mold board 17 will not cool and adhere thereto. I thus provide means whereby both the screed plate and the mold board may be effectively heated from a common source of heat, thus guarding against delays due to adhering of cooled mix to either of those members and assuring smooth flow of the mix over the mold board during operation of the machine, which is conducive to accuracy and high speed operation.

It will be understood that changes in detail may be resorted to without departing from the field and scope of my invention, and I intend to include all such variations, as fall within the appended claims, in this application in which the preferred form only of my invention has been disclosed.

I claim:

1. In a road surfacing machine, a tractor, supporting means extending rearward from said tractor, a screed assembly mounted on said supporting means and comprising a substantially closed housing having a bottom screed plate, a mold board at the front of said assembly, a distributor in front of said mold board for distributing a surfacing mix transversely of said machine, means for delivering a surfacing mix to said distributor and mold board, said mold board extending from adjacent the bottom of said housing upward above the latter, a cover plate in back of said mold board defining therewith a space extending upward from said housing for flow of hot products of combustion over the rearward face of said mold board, the portion of said mold board below the top of said housing having heat conducting contact with the latter and said housing having openings into said space adjacent the bottom thereof, a burner, and means for conducting hot products of combustion from said burner into said housing and over the upper surface of said screed plate effective for heating the latter, the hot products of combustion flowing from said housing through said openings into said space and over said mold board effective for heating it.

2. In a road surfacing machine, a tractor, supporting means extending rearward from said tractor, a screed assembly mounted on said supporting means and comprising a substantially closed housing having a bottom screed plate, a mold board at the front of said assembly, a distributor in front of said mold board for distributing a surfacing mix transversely of said machine, means for delivering a surfacing mix to said distributor and mold board, said mold board extending from adjacent the bottom of said housing upward above the latter, a cover plate in back of said mold board defining therewith a space extending upward from said housing for flow of hot products of combustion over the rearward face of said mold board, said housing having openings into said space adjacent the bottom thereof and a downwardly extending front flange and the portion of said mold board below the top of said housing seating on said flange in heat conducting contact therewith, a burner, and conduit means effective for conducting hot products of combustion from said burner into said housing and over the upper surface of said screed plate effective for heating the latter, the hot products of combustion flowing from said housing through said openings into said space and over said mold board effective for heating it.

3. In a road surfacing machine, a tractor, supporting means extending rearward from said tractor, a screed assembly mounted on said supporting means and comprising a substantially closed housing having a bottom screed plate, a mold board at the front of said assembly, a distributor in front of said mold board for distributing a surfacing mix transversely of said machine, means for delivering a surfacing mix to said distributor and mold board, said mold board extending from adjacent the bottom of said housing upward a substantial distance above the latter, a cover plate in back of said mold board defining therewith a space extending upward from said housing for flow of hot products of combustion over the rearward face of said mold board, said housing having openings into said space adjacent the bottom thereof and a downwardly extending front flange in heat conducting contact with said screed plate and the portion of said mold board below the top of said housing seating on said flange in heat conducting contact therewith, a burner, and conduit means extending within said housing effective for conducting hot products of com-

bustion from said burner into said housing and over the upper surface of said screed plate effective for heating the latter, the hot products of combustion flowing from said housing through said openings into said space and over said mold board effective for heating it.

4. In a road surfacing machine, a tractor, supporting means extending rearward from said tractor, a screed assembly mounted on said supporting means and comprising a substantially closed housing having a bottom screed plate, a mold board at the front of said assembly, a distributor in front of said mold board for distributing a surfacing mix transversely of said machine, means for delivering a surfacing mix to said distributor and mold board, said mold board extending from adjacent the bottom of said housing upward a substantial distance above the latter, a cover plate in back of said mold board defining therewith a space extending upward from said housing for flow of hot products of combustion over the rearward face of said mold board, said screed plate having an upwardly extending front flange and said housing having openings into said space adjacent the bottom thereof and a downwardly extending front flange seating on said screed plate flange in heat conducting contact therewith, the portion of said mold board below the top of said housing seating on said housing flange in heat conducting contact therewith, a burner, and conduit means extending within said housing effective for conducting hot products of combustion from said burner into said housing and over the upper surface of said screed plate effective for heating the latter, the hot products of combustion flowing from said housing through said openings into said space and over said mold board effective for heating it.

5. In a road surfacing machine, a tractor unit for receiving a surfacing mix and discharging it rearward onto the road way, a distributor at the rear of said tractor unit disposed to receive the mix discharged therefrom and spread it toward the sides of a roadway being surfaced in the advancement of said tractor unit, supports extending from said tractor unit rearward beyond said distributor, a screed assembly mounted on said supports comprising a substantially closed housing having a bottom screed plate, a mold board at the front of said housing extending a substantial distance thereabove and seating at its lower portion on the front of said housing in heat conducting contact therewith, said mold board being disposed to direct surfacing mix from said distributor downward to said screed plate, a cover plate extending from the top of said housing upward along the upper portion of said mold board in spaced relation to and adjacent the back thereof defining therewith a space extending substantially the full length of said mold board, a conduit for hot combustion gases within said housing extending lengthwise thereof and having openings disposed to direct such gases downward onto the upper face of said screed plate, said housing having openings in free communication with said space adjacent the bottom thereof for flow into and through the latter of hot combustion gases from within said housing, a burner on said housing, and a stack opening from said burner into said conduit for delivering the hot products of combustion to the latter.

6. In a road surfacing machine, a tractor unit for receiving a surfacing mix and discharging it rearward onto the roadway, a distributor at the rear of said tractor unit disposed to receive the mix discharged therefrom and spread it toward the sides of a roadway being surfaced in the advancement of said tractor unit, supports extending from said tractor unit rearward beyond said distributor, a screed assembly mounted on said supports comprising a substantially closed housing of approximately rectangular cross section having a bottom screed plate and provided at its upper forward corner portion with a plurality of openings spaced apart lengthwise thereof, a mold board at the front of said housing extending a substantial distance thereabove and seating at its lower portion on the front of said housing in heat conducting contact therewith, said mold board being disposed to direct surfacing mix from said distributor downward to said screed plate, a cover plate extending from the top of said housing upward along the upper portion of said mold board in spaced relation to and adjacent the back thereof defining therewith a space extending substantially the full length of said mold board and overlying said openings, a conduit for hot combustion gases within said housing extending lengthwise thereof and having openings disposed to direct such gases downward onto the upper face of said screed plate, a burner on said housing, and a stack opening from said burner into said conduit for delivering the hot products of combustion to the latter.

7. In a road surfacing machine, a tractor unit for receiving a surfacing mix and discharging it rearward onto the roadway, a distributor at the rear of said tractor unit disposed to receive the mix discharged therefrom and spread it toward the sides of a roadway being surfaced in the advancement of said tractor unit, supports extending from said tractor unit rearward beyond said distributor, a screed assembly mounted on said supports comprising a substantially closed housing of approximately rectangular cross section having a bottom screed plate and provided at its upper forward corner portion with a plurality of openings spaced apart lengthwise thereof, a mold board at the front of said housing extending a substantial distance thereabove and seating at its lower portion on the front of said housing in heat conducting contact therewith, said mold board being disposed to direct surfacing mix from said distributor downward to said screed plate, a cover plate extending from the top of said housing upward along the upper portion of said mold board in spaced relation to and adjacent the back thereof defining therewith a space extending substantially the full length of said mold board and overlying said openings, a conduit for hot combustion gases within said housing extending lengthwise thereof and having openings disposed to direct such gases downward onto the upper face of said screed plate, a burner mounted on the top of said housing, and a stack opening from said burner into said conduit for delivering the hot products of combustion to the latter.

8. In a road surfacing machine, a tractor unit for receiving a surfacing mix and discharging it rearward onto the roadway, a distributor at the rear of said tractor unit disposed to receive the mix discharged therefrom and spread it toward the sides of a roadway being surfaced in the advancement of said tractor unit, supports extending from said tractor unit rearward beyond said distributor, a screed assembly mounted on said supports comprising a substantially closed housing having a bottom screed plate, a mold board at the front of said housing extending a substantial distance thereabove and seating at its lower portion on the front of said housing in heat conducting contact therewith, said mold board being disposed to direct surfacing mix from said distributor downward to said screed plate, a cover plate extending from the top of said housing upward along the upper portion of said mold board in spaced relation to and adjacent the back thereof defining therewith a space extending substantially the full length of said mold board, a conduit for hot combustion gases within said housing extending lengthwise thereof with its bottom portion adjacent the upper face of said screed plate and provided with openings effective for directing such gases downward onto the upper face of said screed plate, said housing having openings in free communication with said space adjacent the bottom thereof for flow into and through the latter of hot combustion gases from within said housing, a burner on said housing, and a stack opening from said

burner into said conduit for delivering the hot products of combustion to the latter.

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