May 11, 1948. A. S. MILLIKIN ET AL 2,441,532

MACHINE OR APPARATUS FOR SURFACING ROADS

Filed Feb. 23, 1945 3 Sheets-Sheet 1

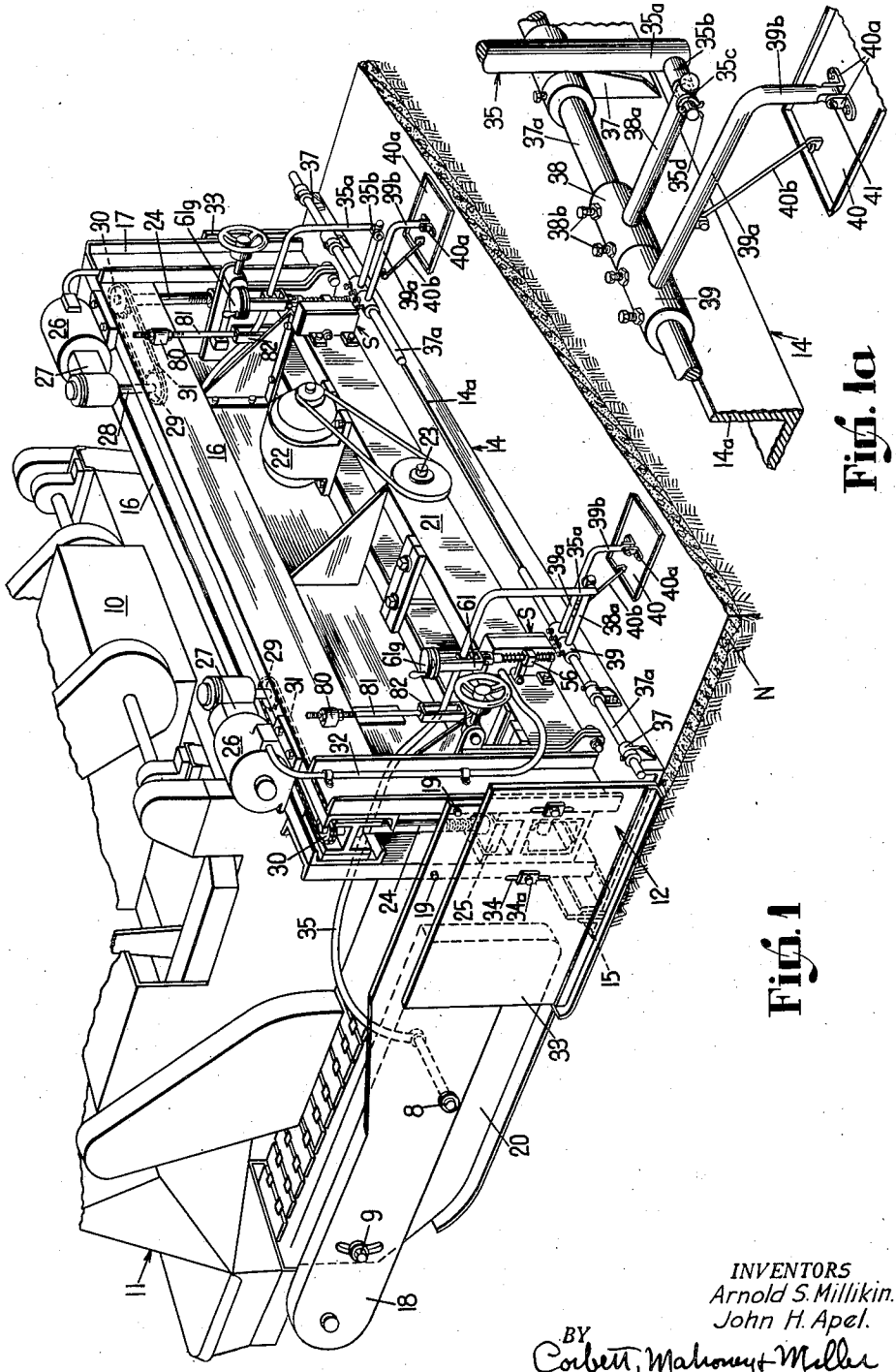


Fig. 1a

Fig. 1

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MACHINE OR APPARATUS FOR SURFACING ROADS

Filed Feb. 23, 1945 3 Sheets-Sheet 2

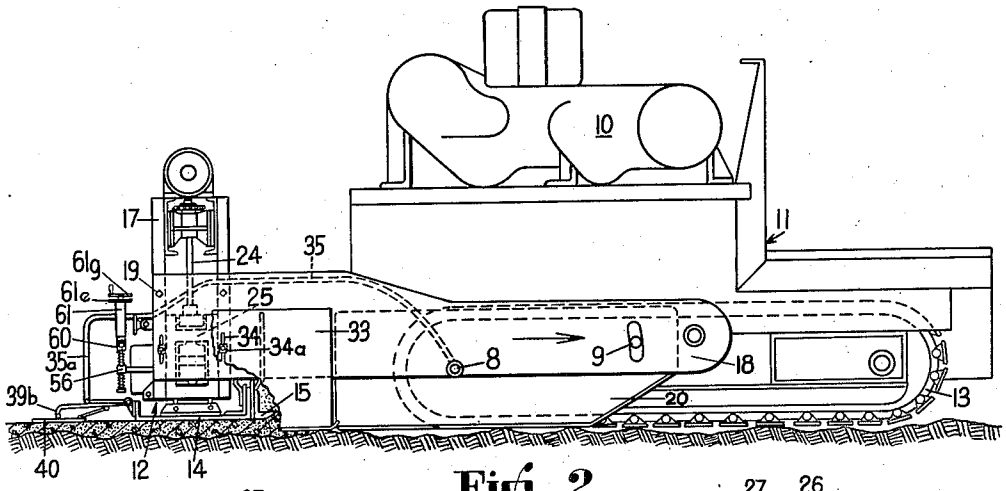


Fig. 2

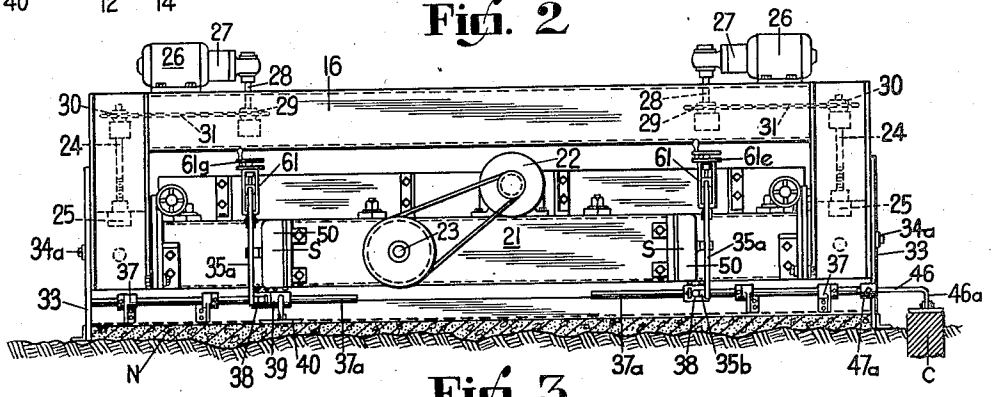


Fig. 3

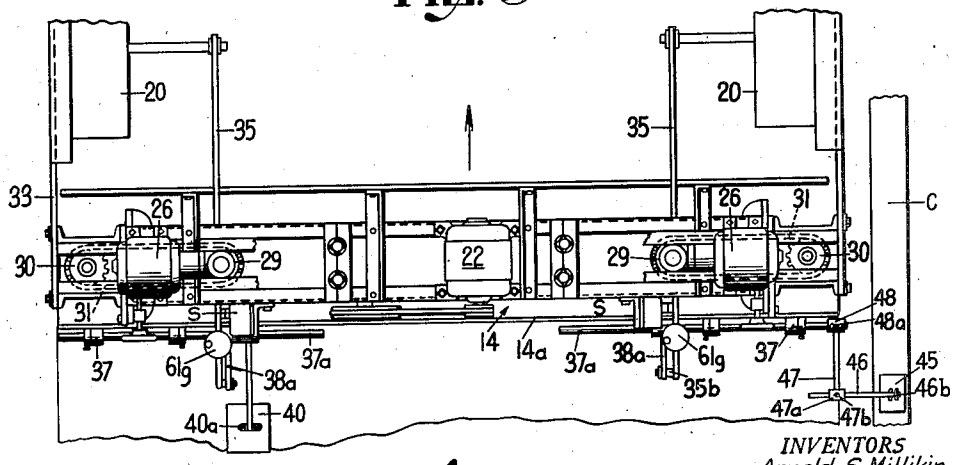


Fig. 4

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MACHINE OR APPARATUS FOR SURFACING ROADS

Filed Feb. 23, 1945 3 Sheets-Sheet 3

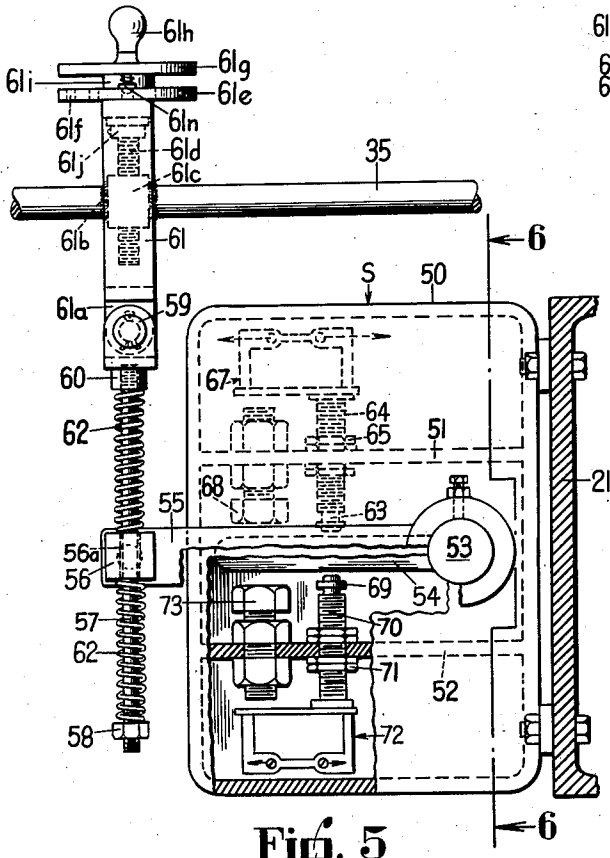


Fig. 5

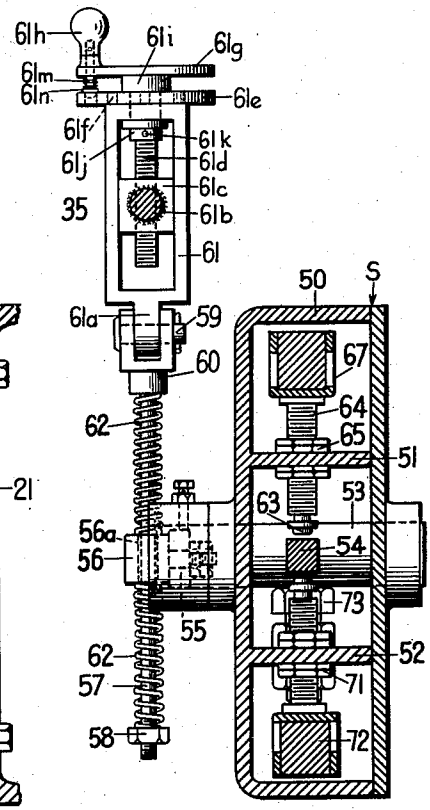


Fig. 6

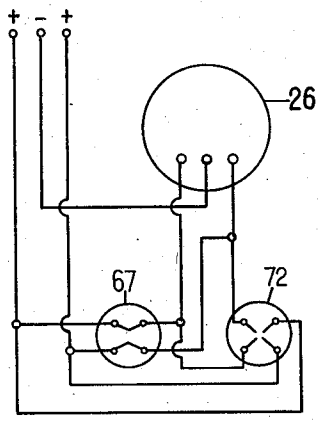


Fig. 7

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Patented May 11, 1948 2,441,532

UNITED STATES PATENT OFFICE

2,441,532

MACHINE OR APPARATUS FOR SURFACING ROADS

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Application February 23, 1945, Serial No. 579,350

12 Claims. (Cl. 94—46)

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Our present invention relates to a machine or apparatus for surfacing roads. It has to do particularly with an apparatus for producing a smooth and level surface on a layer of material which is being applied to an old road surface or to a rough graded surface. More particularly it has to do with means, preferably electrically actuated or operable control means, for raising and/or lowering the leveling and finishing unit of the machine, at predetermined times and in accordance with road surface conditions.

The improved machine or apparatus of our invention is particularly useful in connection with the laying and/or repairing of road and other surfaces formed from various materials, such as bituminous mixes, concrete, et cetera. The machine or apparatus as disclosed herein and with which the electrical control means embodying our present invention is associated is, generally speaking, similar in some respects to that embodied in United States Letters Patent No. 2,295,519, to Millikin and Pickard, issued September 8, 1942.

One of the objects of the present invention is to provide electrical or similar control means for a machine or apparatus, adapted particularly for surfacing roads and which is of such a nature that any irregularities in the surface being covered by the material will be averaged out in the finished surface so that said finished surface will be free of any and all sharp irregularities or bumps, due to the automatic action of said control means.

Another object of our invention is to provide improved control means, such as electrically actuated control means, for a machine or apparatus for surfacing roads, or the like, which latter is of such a nature that it may be used in resurfacing old road surfaces to produce a new surface having the same general grade as the old surface with the sharp irregularities thereof eliminated; or to produce a new surface having an entirely different grade than the old surface being covered.

Another object of our invention is to provide improved, preferably electrical control means, for a machine or apparatus for surfacing a road, which machine or apparatus includes a leveling and finishing unit adapted to smooth and level the surface of the material being applied, the machine or apparatus being of such a nature that the finishing unit resting upon the layer of material will not support any substantial weight of the machine in order to prevent undue compaction of the layer of material so as not to

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retard the "curing" or "setting" of the material.

A further object of our invention is to provide an improved machine or apparatus and electrical control means therefor of the foregoing character which are extremely effective and efficient but which are of comparatively simple construction.

Another object of our invention is to provide motor driven electrically actuated or operable means for raising and/or lowering the leveling and finishing unit, which means functions automatically upon the engagement of the material receiving and feeding unit of the machine or apparatus with raised portions or depressions occurring in the old road surface.

A further object of our invention is to provide a machine or apparatus of the foregoing character with self-contained electrical power means and a normally open electric switch mechanism which is capable of being rendered operative to raise and lower the leveling and finishing unit of the machine when the material receiving and feeding unit comes into contact with uneven portions of the old road surface, to thus quickly, accurately and automatically readjust the leveling and finishing unit with relation to the remainder of the machine or apparatus to permit the laying of the material in accordance with a predetermined or pre-calculated grade.

Generally speaking, and as shown merely by way of example, the machine or apparatus with which the control means of our present invention is associated, consists, preferably, of two main units. These units are a material receiving and feeding unit and a material leveling and finishing unit. The material receiving and feeding unit may be of any suitable type such, for example, as that disclosed by the above-mentioned Millikin and Pickard patent, and is carried by suitable traction means which operate upon the sub-grade or the old road surface being covered. The leveling and finishing unit is associated with the material receiving and feeding unit and arranged in tandem relationship with respect thereto in such a manner that relative vertical movement between these two units is permitted as the machine or apparatus moves over the surface of the roadway, or the like. The leveling and finishing unit embodies, as shown, a transversely extending "dead" screed and a high speed oscillating cut-off bar or compactor which is associated with the screed, the screed and bar being disposed or located behind the material receiving and feeding unit. Following the leveling and finishing unit and connected thereto is a so-called control member or a pair of transversely spaced control mem-

bers, for example, leveling pans, which are adapted to engage and ride over the surface of the material which has been laid for maintaining the proper surface elevation of the newly laid material. In normal operation over a given grade or surface which has been newly laid, the leveling and finishing unit and the control means or members (pans) remain substantially in parallelism. The machine or apparatus also includes means which is preferably electrically actuated automatically due to the uneven contour of the old road surface which the forward end of the machine travels over.

If the old road being newly surfaced has an adjacent curb or header which can be used as a grade line, laterally projecting levers carrying similar but smaller leveling pans, or the like may be employed to ride over the surface of said curb and thus serve to maintain the proper grade level.

It will be apparent that since the material receiving and feeding unit operates on the rough sub-grade or old road surface, it will be moved vertically because of such irregularities. To reduce such movement, this unit is preferably carried by relatively long caterpillar traction elements. These elements and associated runners substantially prevent any small or minute irregularities from affecting this unit. The larger and sharp irregularities in the surface being covered will, however, produce some vertical movement of the material receiving and feeding unit. This vertical movement of the unit has a tendency to move the leveling and finishing unit which is pulled along behind the material receiving and feeding unit, vertically, and to thereby cause any sharp irregularities of the surface being covered to be reflected in the finished surface. Therefore, the control means above referred to is provided which, together with the leveling and finishing unit, automatically control the level of the last-named unit so as to average out any sudden rises and depressions in the surface being covered as reflected in the finished surface. That is to say, if the surface being covered has sharp rises and depressions, these will be reflected in the finished surface but will be in the nature of gradual rises and depressions which will be practically unnoticeable. Consequently, the surface produced by the apparatus will be an extremely smooth and even riding surface due to the automatic action of the electrical control means.

The foregoing and other objects and advantages of our invention will be apparent from the following description and appended claims when considered in connection with the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In said drawings:

Fig. 1 is a fragmentary rear perspective view of a machine or apparatus embodying the present invention.

Fig. 1*a* is an enlarged fragmentary detail perspective view of one of the leveling pans or members of Fig. 1 and its associated parts.

Fig. 2 is a right side elevational view of the machine or apparatus of Fig. 1.

Fig. 3 is a rear end elevational view of the finishing unit and controls of the machine or apparatus of the preceding figures.

Fig. 4 is a top plan view of the structure shown in Fig. 3.

Fig. 5 is an enlarged detail elevational view, partly in section and partly broken away, of one of the electric switch units or assemblies associated with the control means of the present invention.

Fig. 6 is a vertical sectional view taken substantially along the line 6—6 of Fig. 5, looking in the direction of the arrows; and

Fig. 7 is a diagrammatic view of an electrical circuit for operating the switch mechanism of Figs. 5 and 6.

Before explaining in detail the present invention it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. It is to be understood also that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring now to the drawings and particularly to Figs. 1 to 4, inclusive, thereof, one type of machine or apparatus for surfacing roads to which our present invention is applicable, is shown as a whole at **10**. As shown, it comprises a material receiving and feeding unit, shown as a whole at **11** and a following leveling and finishing unit, shown as a whole at **12**. The leveling and finishing unit is drawn along behind the material receiving and feeding unit.

The machine or apparatus **10** is carried by a pair of relatively long endless traction units **13**, one such being shown. These traction units or members will pass over small irregularities of the sub-grade or old road surface without causing any appreciable vertical movement of the unit **11**.

The leveling and finishing unit **12** comprises a screed **14** which may be a "dead" screed and a rapidly oscillatable cut-off bar or compactor **15**. The leveling and finishing unit is mounted upon framework including transverse frame members **16** and upright frame members **17**. This structure may be substantially the same as that disclosed in the co-pending application of Obert G. Mandt and Arnold S. Millikin, Serial No. 565,306.

The machine **10** is provided with longitudinal side frame members **18** which, as shown, are fastened at **19** to the upright frame members **17**. Each frame member **18** carries a runner **20**, see particularly Fig. 1, which is pivotally mounted at **8** for oscillating or rocking movement relative to the frame member **18**. The forward end of the runner **20** is also connected to the frame member **18** by a pin and slot connection, shown at **9**. Thus, when the traction members **13** are driven, the material leveling and finishing unit **12** will be drawn along behind the material receiving and feeding unit **11**.

The frame structure above the unit **12** also comprises a pair of transverse frame members **21** which carry an electric motor **22** drivingly connected to a drive shaft **23** which serves to oscillate the cut-off bar or compactor **15** in substantially the same manner as disclosed in the aforesaid co-pending application. Moreover, the upright frame members **17** carry means for supporting and raising and lowering the leveling and finishing unit **12**, such means being generally similar to that disclosed in the Mandt and Millikin application, insofar as the supporting means for the unit **12** is concerned. As shown, such supporting means comprises a vertically extending screw threaded shaft **24**, one such being located between each pair of the upright frame members **17**. The lower ends of the rods **24** carry hanger blocks **25**, see particularly Figs. 1, 2 and 3. The

leveling and finishing unit 12 is in turn supported and carried by these hanger blocks.

Carried by and adjacent opposite ends of the transverse frame member 16 are electric motors 26 to each of which is attached, in driving relationship, gear reduction mechanism within the gear box 27. It will be understood that the gears within the boxes 27 are driven by the motor shaft in each instance. The gear reduction mechanism includes a depending upright driving shaft 28 which carries at its lower end a sprocket 29. The upper end of each shaft 24 carries a sprocket 30 which is driven from the sprocket 29 through the medium of a sprocket chain 31. As clearly seen in Fig. 1, a power-operable unit consisting of the electric motor, gear reduction mechanism, driving and driven sprockets and chain is located adjacent each end of the frame members 16, the motor in each instance being connected by a conduit 32 to an electric switch unit S to be described below. It will be understood that each of the motors 26 is preferably of the reversible type so as to drive the driving sprocket 29 and its associated driven sprocket 30 and chain 31 in opposite directions. When the electric motors 26 are driven, the leveling and finishing unit 12 will be raised or lowered dependent upon the direction in which the electric motor is running. Therefore, the unit 12 may be rapidly and easily raised and lowered relative to the newly laid material N. Thus, it will be seen, that electrically operable means for raising and lowering the leveling and finishing unit 12 is carried by the framework above said unit.

Floating side plates or forms 33 are mounted upon the uprights 17 at opposite ends of the unit 12. These plates, as shown, are provided with vertical slots 34 with which suitable bolts and nuts 34a cooperate to permit them to have free up and down movement over the uneven road surfaces at opposite sides of the machine beyond the ends of the unit 12. The plates 33 provide means movable with the machine or apparatus for determining the side edges of the newly laid material N. The screed 14 and the oscillating cut-off bar or compactor 15 preferably extend throughout the entire width or space between the forms or plates 33. As seen in Fig. 1, the plates 33 extend forwardly from the unit 12 beyond and in overlapping relationship to the rear end portions of the runners 20.

We have described the electrically operable means for raising and lowering the leveling and finishing unit comprising the screed and the cut-off bar or compactor and we shall now describe the control means for actuating or setting into motion the electrically operable means for raising and lowering said unit.

Referring particularly to Figs. 1, 2 and 4 of the drawings, it will be seen that a longitudinally and rearwardly extending control bar or member 35 is located at each side of the machine or apparatus. The forward end portion of each bar or member 35 is down-turned and pivotally or oscillatably connected to the pivot 8 at the inside of the runner 20. The member 35 extends rearwardly beneath the transverse frame members 16 and terminates in a rear down-turned end portion 35a. As shown, the screed 14 has at its rear end an upstanding portion or flange 14a. Adjacent each end of the flange 14a there is mounted a pair of spaced brackets 37. Each pair of brackets carries a rod 37a which is capable of turning movement in the brackets. The rods or shafts 37a each carry a cylindrical bracket or coupling member 38 which in turn carries a rearwardly extending relatively short arm 38a. The coupling member or bracket 38 is adjustably mounted upon the rod or shaft 37a and fixed thereon against longitudinal movement and rotation relative to said shaft by means of bolt and lock nut assemblies 38b. The rear down-turned end 35a of the control arm is provided with a laterally projecting normally horizontally disposed pin or short shaft 35b which has a reduced outer end portion which extends through a transverse hole located in and adjacent the outer end of the short arm 38a and has a rocking or oscillating fit in said hole. The members 35b and 38a, as shown, are held together by a washer 35c and a cotter pin 35d, see Fig. 1a. This connection permits relative rocking movement between the control arm 35 and the short arm or shaft 38a when the control arm 35 is moved up or down by one of the runners 20.

Another cylindrical bracket, or coupling member 39 is mounted on the rod or shaft 37a adjacent the member 38 and also carries a rearwardly projecting arm 39a having a down-turned end portion 39b. The arm 39a, as shown, is somewhat longer than the arm 38a. The lower end of arm portion 39b is loosely or swivelly connected to and supports a control or leveling member, such as a leveling pan 40, the parts being pivotally or rockably connected together by means of angle brackets 40a and a pivot pin or bolt 41. A tie-rod or link 49b loosely or swivelly connects the inner end portion of pan 40 with the arm 39a to prevent undue rocking or tilting movement of the pan 40 and to keep it in a straight line position and flatwise upon the newly laid surface N, Fig. 1. It will be understood that the parts just described and shown in detail in Fig. 1a are preferably duplicated adjacent both sides of the machine, as seen in Fig. 1, except when a curb, such as curb C, extends along the side of the surface to be newly laid, in which case one of the leveling members or pans 40 will be eliminated and an auxiliary or sidewise-projecting leveling member or pan, such as the pan 45 of Figs. 3 and 4, will be employed, as described below. By providing the separate support 39 for the arm 39a and leveling pan 40, this entire unit may be adjusted along the rod 37a, or removed therefrom, without disturbing the connection between the control arm 35 and the rod or shaft 38a.

It will be seen in Fig. 1 that the two pairs of arms 38a and 39a extend rearwardly normally in substantially horizontal position and in substantial parallelism and that the longitudinally extending control bars or members 35, in cooperation with the leveling members or pans 40 hold the parts normally in this position, with the control members or leveling pans resting flatwise upon the top surface of the newly laid material N. The pans 40 will thus provide at all times when in use, fulcrum means for the control arms 35. The pans 40 are adapted to travel in this condition and ride upon the newly laid or finished surface N as the machine or apparatus is moved forward by the traction units 13.

As suggested above, in the event there is a curb or header, such as that shown at C in Figs. 3 and 4, extending along the edge of the old road surface, an auxiliary leveling pan, such as the pan 45 mentioned above, may be employed to engage the top surface of and ride upon said curb. The pan 45, as shown, is located at the rear of the machine and at the right side of Figs. 3 and 4. It is mounted upon the down-turned outer end portion

46a of a transversely sidewise-projecting rod or shaft 46. This rod is preferably carried by a rearwardly projecting rod or shaft 47 whose inner end is carried by a bracket or coupling member 48 which is adjustably and removably mounted upon the outer end portion of the shaft or rod 37a located at that side of the machine. The bracket 48 is held in fixed relation to the shaft by means of suitable screws or a pair of bolt and lock nut assemblies 48a, see Fig. 4. The outer end of rod 47 carries a bracket or coupling member 47a having a round opening or socket therein to receive the adjacent end portion of the rod 46. The rod 46 and consequently the leveling pan 45 carried thereby, are adjustable in and out transversely of the machine and the rod 46 is preferably held rigidly in the coupling member 47a by a lock screw or bolt and lock nut assembly, indicated at 47b, Fig. 4. As seen in Figs. 3 and 4, the outer end portion 46a of the rod or shaft 46 is movably or pivotally connected at 46b to the pan 45. If desired, the small leveling pan assembly, including the pan 45 and the rods or shafts 46 and 47 may be removed, as a unit, from the supporting rod 37a by loosening the bolt and lock nuts 48a and sliding the cylindrical bearing or coupling member 48 off the end of rod 37a. Or, if the smaller leveling pan 45 and its associated parts are not required, the entire unit may be swung upwardly away from the surface N by loosening the lock bolt and nut assemblies 48a and left to hang in space above said surface.

The pair of leveling pans 40, or one of said pans 40 and the smaller pan 45, whichever combination is being used, rest upon the newly laid surface N and the curb C, respectively, during normal operation of the machine and provide, in effect, a common fulcrum for both of the longitudinal control arms or rods 35. Therefore, any up and down movement of the material receiving and feeding unit 11 and/or the runners 20, will be transmitted in considerable lesser degree to the leveling pans 40 or 45. In lieu of the pans, suitable rollers or other surface-contacting members (not shown) may be employed.

In normal operation over a given grade or surface which has been newly laid, the leveling and finishing unit 12 and the control member or leveling pans 40 and 45, whichever combination of the latter is being used, remain substantially in parallelism, as mentioned above. When, however, this parallel condition is changed through any variation in the grade line, there is provided electrically controlled switch mechanism which will be automatically actuated to start the electric motors 26 to immediately raise or lower the leveling finishing unit 12, dependent upon the requirements in accordance with the type of variation in the old road surface, i. e. whether it be a rise or depression in said surface, until the parts again resume their normal positions or condition in parallelism. Such electrically operated switch mechanism is shown in detail in Figs. 5 and 6 of the drawings. As seen in Fig. 1, a control switch box S is mounted upon the transverse frame member 21 below and adjacent to each of the rearwardly extending control arms or bars 35. Each of the switch assemblies S comprises a casing, shown as a whole at 50, having a pair of horizontally disposed partitions or webs 51 and 52 therein which serve to divide the switch box into three compartments. A transverse shaft 53 extends through the side walls of the casing 50 and carries a normally horizontal oscillatable arm or member 54. The shaft 53 extends outwardly beyond a wall of the casing 50 and carries a fixed normally horizontal external arm 55. The outer end of the arm carries a block 56 which is provided with a vertical bore or hole 56a. This block 56 is preferably swivelly mounted on the end portion of the arm 55 to permit tilting of a rod or pin 57, now to be described. In other words, when the angularity of pin or rod 57 changes from its normal or vertical position as seen in Fig. 2, there will be no binding effect between the parts. Extending through said bore is the normally upright or vertically disposed rod or pin 57 which is threaded at its opposite ends, the lower threaded end carrying an adjustable stop nut 58. The upper end of the rod 57 is threaded into the threaded base portion or boss of a U-shaped connecting member or coupling 60. The member 60 is pivotally connected by a pin 59 to a depending ear or projection 61a carried by a vertically disposed oblong frame member 61 through which the rearwardly extending control arm or bar 35 projects. Thus, the upright rod 57 carries or supports the members 60 and 61 and has a sliding fit in the hole or bore 56a, see Fig. 5. Separate compression coil springs 62 surround the rod 57 above and below the enlargement 56. The inner ends of these springs find bearings upon said enlargement, with their outer ends bearing against the adjustable nut 58 and the boss of the coupling member 60, respectively.

As best seen in Fig. 5, the longitudinal control arm 35 is severed in the vicinity of the frame member 61 and its opposed and spaced end portions are welded, or otherwise secured at 61b, to the adjacent side faces or surfaces of a square or rectangular block 61c, the block thus becoming an integral part of the control arm 35 and being carried by and capable of movement therewith. The block 61c is provided with a vertical bore which is internally threaded to receive a vertically disposed externally threaded or screw shaft 61d which extends downwardly into the frame member 61.

The frame member 61 carries at its upper end a fixed indexing disk 61e having a series of vertical holes or sockets 61f arranged in a circle adjacent its periphery. The screw shaft 61d has fixed to its upper end a crank disk or wheel 61g carrying an operating handle 61h. A hub portion or boss 61i on the crank disk 61g provides means for spacing said disk from the indexing disk 61e. A stop ring or member 61j, keyed or pinned at 61k to the screw shaft 61d prevents up and down movement of the crank disk and screw shaft relative to the frame member 61.

The handle 61h carries a depending pin 61m and a surrounding compression spring which bears at its lower end against a stop 61n to normally maintain the lower end of the pin in engagement with one of the holes or sockets 61f of the indexing disk. When it is desired to turn or rotate the crank disk 61g in either direction relative to the indexing disk 61e, the handle is lifted in an upward direction to release the pin from engagement with the hole or socket. The handle is now used to turn or rotate the crank disk and in turn rotate the screw shaft in either direction. Since the block 61c is a fixed part of the control arm 35, such rotation of the crank disk and screw shaft will serve to raise or lower the frame member 61 and the shaft or pin 57 to vary the position of the shaft 57 with relation to the control arm 35 and to move the switch arms 54 and 55 to their normal or neutral hori-

zontal position to compensate for different grade levels for which the finishing unit 12 and the leveling pans 40 and 45 may be adjusted. The pressure which the springs 62 exert upon the enlargement 56 of arm 55 may be varied by adjusting the nut 58 to compensate for any such longitudinal adjustment of the rod or pin 57 and its supported frame member 61 with relation to the control arm, which has been effected by actuating the crank disk 61g as mentioned above.

As best seen in Fig. 1 of the drawings, it is desirable to provide independent means for maintaining each of the control arms 35 in its proper position or relationship with respect to the oblong frame member 61. Such means, as shown, comprises a bracket 80 carried by the rear channel 16 through which bracket a depending rod 81 extends. The upper end of the rod 81 is threaded and held in the desired vertical position of adjustment by means of lock nuts. The lower end of the rod 81 carries a loop-like or oblong frame member 82 through which the control arm extends. A similar assembly is provided adjacent opposite sides of the channel 16, one for each of the control arms 35. The unit 80, 81 and 82, while serving as guide means for maintaining the arm 35 in position against undue transverse movement or weaving, may also serve as stop means to limit the upward and downward movement of the control arm beyond predetermined points and thus serve as safety means to prevent damage to the screw shaft 61d and its associated parts.

It will be remembered that under normal operating conditions, the control pans 40 or 45, or any combination of them which is being used, remain in parallelism with the leveling and finishing unit 12 and when in such position, the arms 54 and 55 of both of the switch assemblies S are in their normal horizontal or inoperative positions, as shown in Fig. 5. The function of the springs 62 is to maintain the arms 54 and 55 normally in their horizontal or centered position and to also provide cushioning means for said arms in the event the control arm 35 moves the rod or pin 57 longitudinally beyond a predetermined point. Such cushioning effect prevents any possibility of damage to the switch mechanism as will be presently described.

The upper web or partition 51 of the switch box carries a snap-action switch assembly comprising a contact button or member 63 carried by a threaded member 64 which is fixed to the web by lock nuts 65 and the snap-action portion of the switch assembly, shown as a whole at 67. The web or partition 51 also carries an adjustable stop member 68 to prevent movement of the switch arm 54 beyond a predetermined point to prevent any possibility of damage to the contact button 63 or other elements of the snap-action switch assembly.

The web or partition 52 carries a similar snap-action switch assembly comprising a contact button 69 carried by a threaded member 70 which is held in position with relation to the web by lock nuts 71, and the snap-action portion of the switch assembly, shown as a whole at 72. The web or partition 52 also carries an adjustable stop member 73 which serves to prevent movement of the switch arm 54 beyond a predetermined point and thus prevents damage to the switch contact button 69 and other elements of the snap-action switch assembly. Since the snap-action switch assemblies are of standard construction and purchased in the open market, it is thought unnecessary herein to describe them more in detail. It will suffice to say that when the arm 54 is oscillated by movement of the control arm 35 into position to engage the contact button 63, the snap-action switch mechanism 67 is immediately operated to start one of the electric motors 26 to raise or lower, as the case may be, the leveling and finishing unit 12. When the arm 54 is oscillated in the opposite direction into engagement with the button 69, the snap-action switch mechanism 72 functions immediately to operate the electric motor in the opposite direction and to likewise move the leveling and finishing unit 12 in a reverse direction.

As soon as the variation in the old road surface which has caused the shifting of the unit 12 has been compensated for and the leveling pans and said unit have again assumed their normal positions in parallelism, the control arms 35, through the medium of the vertical shafts or pins 57, will immediately move the arms 54 and 55 to their normal horizontal positions releasing the contact buttons with which the arms 54 have been in contact to open the switches and stop the electric motors 26. It will be understood that this action and operation of the various associated parts of the machine or apparatus will occur automatically whenever a variation in the old road surface is encountered by the forward unit 11 of the machine and the runners 20.

In Fig. 7 there is illustrated a diagram of a conventional electrical circuit for electrically connecting the snap-action switches 67 and 72 of each of the switch units S with its respective electric motor 26.

From the foregoing it will be seen that we have provided a pair of sensitive and automatically operated normally open electric switch assemblies for operating the electric motors 26 in either direction, which motors in turn drive the mechanism previously described for effecting the raising or lowering of the leveling and finishing unit 12 to compenate for any variation in the old road surface which variation is transmitted from the front end of the machine, namely from the unit 11 and runners 20 to the leveling and finishing unit. Thus, by virtue of our novel structure a desired and predetermined grade for the finished surface is automatically and accurately maintained. It will be understood that the control means or leveling pans 40 or 45, whichever are being used for the particular job being done, are set or adjusted at the desired grade level for the new surface and by such setting this level is automatically maintained during the travel of the road surfacing machine or apparatus. The switch contact-engaging arms or members 54 are also checked and adjusted to their horizontal positions as seen in Fig. 5 in accordance with the particular grade setting of the leveling pans. The traction elements 13 and the runners 20 substantially prevent any small or minute irregularities in the old road surface from affecting the position of the material receiving and feeding unit 11. Larger and sharp irregularities in the surface being covered will, however, produce some vertical movement of the material receiving and feeding unit 11. Such vertical movement of this unit has a tendency to move the leveling and finishing unit 12, vertically, and to thereby cause any sharp irregularities of the surface being covered to be reflected in the finished surface. However, the control means above referred to operates automatically along with the leveling and finishing unit 12 to automatically

control the level of said last-named unit to average out any sudden rises and depressions in the surface being covered as reflected in the finished surface. While any sharp rises and depressions in the surface being covered will be reflected in the finished surface they will, however, be in the nature of gradual rises and depressions which will be hardly noticeable so that the surface produced by the apparatus of our invention will be an exceedingly smooth and even riding surface by virtue of the automatic action of the elevating means for the leveling and finishing unit and the electrically controlled means for actuating the elevating means.

Having thus described our invention, what we claim is:

1. Control means for a road surfacing machine in which the machine includes traction members and runners connected together, a material receiving and feeding unit and a leveling and finishing unit adapted to be drawn over a newly laid surface behind the first-named unit, and in which the machine includes electrically operable elevator means for raising and lowering said leveling and finishing unit at predetermined times; said control means comprising leveling members engaging the newly laid surface, control arms interconnecting the leveling members and runners, an electric switch assembly carried by said frame adjacent each of said control arms, and means carried by said control arms and connected to said switch assemblies whereby to operate the switch assemblies and elevator means upon movement of said control arms when said runners encounter a variation in the road surface to be paved.

2. Control means according to claim 1 wherein the means carried by the control arms is manually adjustable with relation to said arms and includes cushioning means whereby to permit movement of the control arms beyond a predetermined point without damaging the electric switch assemblies.

3. In combination with the elevator means for a leveling and finishing unit of a road surfacing machine in which a control member is in contact with the newly laid surface and a movable control arm connects the control member with a forward portion of the machine; an electric switch assembly, said switch assembly comprising a housing carried by said unit and having a pair of snap-action switches therein, an oscillatable arm interposed between said switches and adapted upon movement to contact and close the same, stop members disposed at opposite sides of said oscillatable arm, a second oscillatable arm disposed outside said housing and connected to the first-named arm for oscillating the same, and a cushioned connection between the outer end of said second arm for connecting the same to said movable control arm whereby upon contact of the forward portion of the machine with a variation in the surface to be paved the oscillatable switch arms are caused to actuate either of the snap-action switches to operate the elevator means to move vertically the leveling and finishing unit.

4. A combination according to claim 3 wherein said cushioned connection comprises an upright shaft adjustably connected at its upper end to said movable control arm and having a slidable connection with said second oscillatable switch arm, and compression springs surrounding said upright shaft and engaging said second switch arm whereby to maintain the oscillatable switch

arms normally out of contact with said snap-action switches.

5. A road surfacing machine comprising a material receiving and feeding unit, a leveling and finishing unit disposed behind the first-named unit and including a pair of runners which are spaced transversely of the machine, electrically operable means for moving vertically the leveling and finishing unit relative to the receiving and feeding unit at predetermined times, and control means operatively connected with said electrically operable means and including a leveling pan resting on the newly laid road surface, a movable control arm interconnecting said pan and one of said runners, a normally open electric switch for actuating said electrically operable means, and means located intermediate the ends of the control arm for connecting the arm to the electric switch whereby to close the switch and operate said electrically operable means when the runner encounters a variation in the surface to be paved.

6. A power-driven road surfacing machine including traction members and runners engageable with the old road surface, a material receiving and feeding unit at the forward end of the machine, a frame structure located at the rear end of the machine and connected thereto to travel along with said machine, a leveling and finishing unit carried by and disposed below said frame structure, electrically operable elevating means carried by the frame structure and connected to said last-named unit for moving vertically the unit at predetermined times, and control means operatively connected with said electrically operable elevating means for operating said elevating means to move the leveling and finishing unit vertically when the material receiving and feeding unit and the runners encounter a variation in the surface to be paved, said control means comprising a normally open electric switch mechanism, a leveling pan in engagement with the newly laid surface, and means connected to said frame for operatively connecting the pan and switch mechanism together for actuating said switch mechanism at predetermined times.

7. A road surfacing machine including power-driven tractor means and comprising a material receiving and feeding unit adapted to travel over a surface to be paved, said machine also including runners engaging the surface, a leveling and finishing unit connected to said material receiving and feeding unit and including a screed and an oscillating cut-off bar, electrically operable means for raising and lowering said leveling and finishing unit, control means at the rear end of the machine having a portion adapted to ride upon the newly laid finished surface and connected with said receiving and feeding unit whereby upon contact of said last-named unit with a variation in the surface to be paved the electrically operable means is actuated to automatically move vertically the finishing unit dependent upon whether or not the variations in said surface is a raised portion or a depression, and control arms interconnecting said receiving and feeding unit and said control means, said portions of the control means which rides upon the newly laid surface providing a fulcrum for said control arms during any positional variations thereof from normal.

8. A road surfacing machine comprising a material leveling member, means for supporting and adjusting said leveling member on the machine

and including electrically operable means adapted to be actuated to move said leveling member to various vertical positions on the machine, means for supporting said machine for movement along the surface to be covered, and means for actuating said electrically operable means to automatically change the vertical position of said leveling member on the machine as the machine moves vertically in passing along over the surface to be covered, said means comprising a control member supported on the machine for vertical movement relative to the leveling member and adapted to ride on a surface having a predetermined grade line, an electric switch for actuating said electrically operable means and means for operatively connecting said control member to said switch so that said switch will be actuated to operate said electrically operable means to move said leveling member vertically whenever the leveling member moves vertically relative to the control member.

9. A structure according to claim 8 wherein said control member is supported on the machine for vertical movement at a point behind said leveling member and is adapted to ride on the surface produced by said leveling member, said control member being carried by the rear end of a lever arm, said arm having its forward end pivotally connected to the machine, and means located intermediate the ends of said arm for operatively connecting the arm to said switch.

10. A structure according to claim 8 wherein said control member is supported on the machine for vertical movement at a point behind said leveling member and is carried by the rear end

of a lever arm, said arm having its forward end pivotally connected to the machine, and means located intermediate the ends of said arm for operatively connecting the arm to said switch.

11. A structure according to claim 8 wherein said control member is supported on the machine for vertical movement at a point behind said leveling member and is carried by the rear end of a lever arm, said arm having its forward end pivotally connected to the machine, said switch being supported by said leveling member, an arm for actuating said switch and carried by said lever arm in spaced relationship thereto, and manually adjustable means for varying the distance between said lever arm and said switch-actuating arm.

12. Control means according to claim 1 wherein the means carried by the control arms is manually adjustable with relation to said arms.

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