

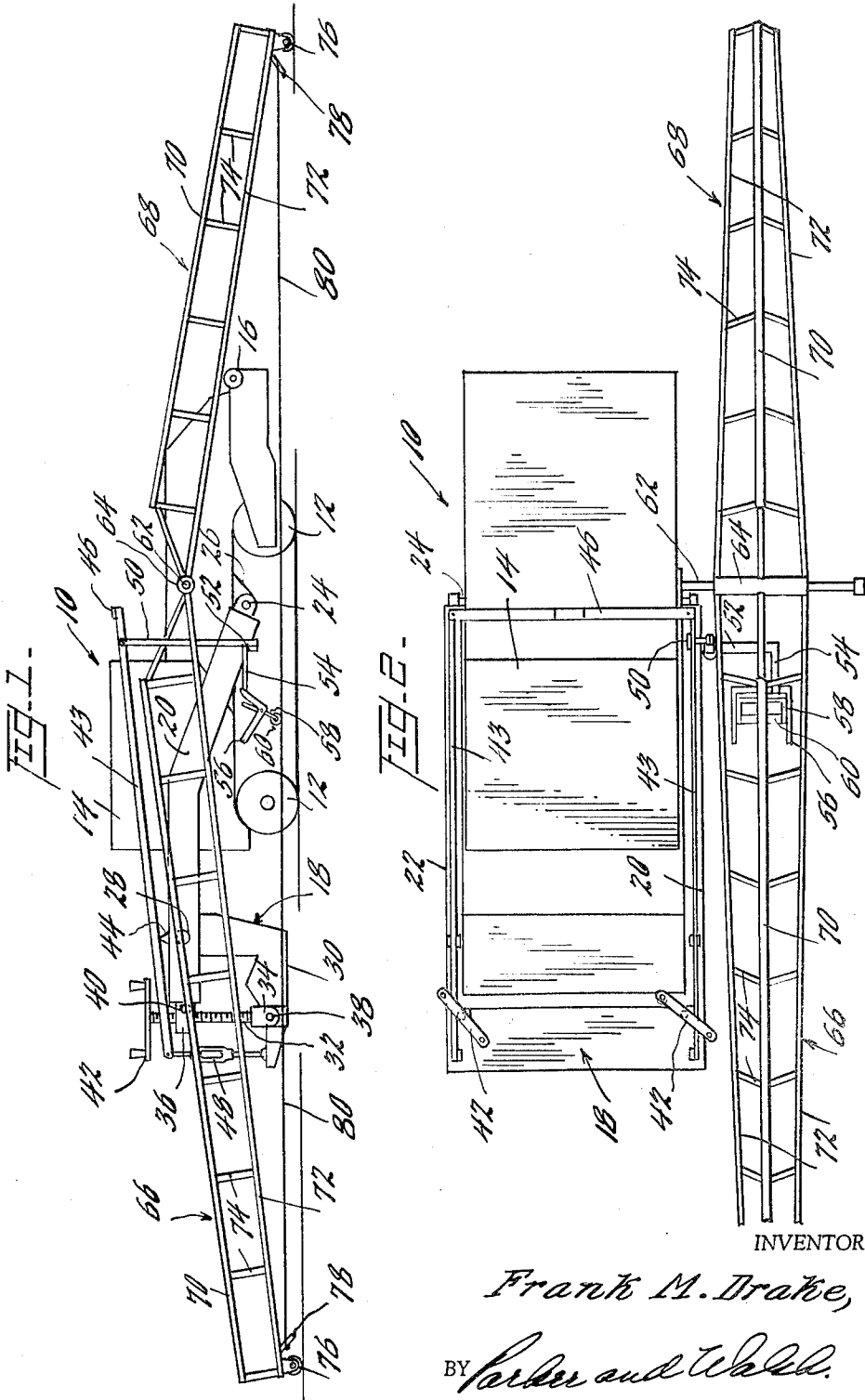
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STRINGLINE ATTACHMENT FOR PAVING MACHINE

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STRINGLINE ATTACHMENT FOR PAVING MACHINE

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This invention relates to paving machines, and in particular to machines for resurfacing existing roads. In such use, the worn road presents surface irregularities which would persist in the resurfaced road unless compensated for. Commonly, this problem is dealt with by appropriate manipulation of a levelling screed, in association with a sensing means for detecting irregularities in the road surface.

In its generalized form, such a screed is towed along behind the main body of the paving machine, at the rear ends of a pair of relatively long arms, swingably mounted by means of trunnions on the paving machine. With this arrangement, the lower, trowelling surface of the screed may assume an angle of attack in riding over the fluid paving material, and for a given arm, as to arrangement and effective length, and attitude of the screed with respect to the arm, as well as physical character of the material being spread, there is a critical value of the angle of attack, which persists as long as the paving machine treads or wheels are pursuing a level, forward path. However, when irregularities are encountered, compensation is made, and to this end, the screed is arranged for pivotal motion, to vary the angle of attack, such adjustment being usually provided for by means of a screw and handwheel at each end of the screed. Usually a sensing means is provided, to detect irregularities of the pavement in advance of the screed, and the screed adjusted accordingly. The sensing means may partake of various forms, with signals being detected visually or electrically, or by other means, and the screed is either adjusted manually, or automatically through suitable servo-mechanisms. Thus, basically, the sensors detected swing in the screed arms as the paving machine departed from a normal, level line, but in later, improved modifications, the attitude of the screed in relation to the main body of the machine has been magnified by a lever system super-imposed on the screed arms and providing a magnified swing of a so-called "projected point" of the screed surface, for pick-up by the sensor. Although the latter system will be employed in illustrating the workings of the present invention, it will be understood that the invention may also be practiced in association with any acceptable sensing means.

In conventional, re-paving practice, it is customary to lay a stringline along and to one side of the center of a roadway, supported on stakes at about 25 foot intervals, and defining the proposed level of the new paving surface. In the initial pass of tamping and spreading the surfacing material, the screed attitude is varied, as required by the sensor, to compensate for indicated departures of the sensor from the stringline. Control of surfaces on subsequent passes utilizes what is known as a "flat line," wherein the stringline is placed flat on the previously laid surface, and spans any irregularity that might remain from the initial spreading operation. Thus, there is a gradual and continuing improvement for each pass, but the laying of a stringline by a crew of men, for each pass, is entailed. The flat line is effective if the initial pass has been properly accomplished; or in other words, if irregularities have been reduced in length to less than fifty feet.

It is a general object of the invention to improve the sensing mechanism, looking to more efficient reduction of irregularities during any given pass. Another object is to avoid the need for staking out stringlines. More particularly, it is an object to provide a stringline for sensing

which forms a part of the paving machine, and is carried along therewith. A still further object of the invention to substantially increase the effective length of the main body of the machine, so that irregularities of great length may be made manifest by attitudes of mechanism forming part of the machine.

These and objects, which will be apparent, are attained by the present invention, a preferred form of which is described in the following specification, as illustrated in the drawing, in which:

FIGURE 1 is a side elevational view of a paving machine, on which is mounted a travelling stringline, according to the invention; and

FIGURE 2 is a top plan view of the apparatus shown in FIGURE 1.

Referring to the drawing by characters of reference, there is shown a paving machine, the body of which is indicated generally by the numeral 10. The machine is supported on suitable endless track systems 12, and carries a hopper 14, for dispensing the paving mix in advance of the screed 18. A bumper roller 16 on the forward edge of the hopper 14, limits the backing movement of dump trucks used in filling the hopper.

In its smoothing operation, the screed 18 floats on the surfacing material, and to this end, is carried by a pair of rocker arms 20, 22, located on opposite sides of machine 10, and independently swingable on a common, horizontal axis, by virtue of pivotal mounting of their forward ends on trunnions 24, carried by brackets 26, depending from machine 10. The two ends of the screed 18 are attached to the respective rocker arms 20, 22 by pivot pins 28, so that the angular disposition of the bottom, or trowelling surface 30, of a screed end with respect to its associated rocker arm may be varied. In order to make this adjustment, the screed-rocker arm system is provided, at each end, with an adjusting screw 32, which is anchored for free rotation in a block 34, carried rearwardly of the screed and is threaded in a block 36, carried at the rear end of the associated rocker arm. Although the screed, rocker arm, and screw present a fixed quadrilateral during operation, there is a skewing action during screw adjustment, and for this reason, block 34 is mounted on a pivot 38, and block 36 on a pivot 40. Screws 32 are turned by double cranks 42, and it will be seen that screw action tending to move block 36 toward block 34 will lower the angle of attack of the screed in its free drag by the rocker arms.

The critical angle of the screed determines a constant thickness of laid material, assuming an even bed. However, when irregularities are encountered, these are followed by the main body of the machine, which causes a relative swing of the rocker arms, and hence the effective angle of the screed, which would result in too thin or too thick a layer unless adjustments were made. The end result sought is to have the path of progress of the screed at or parallel to the stringline, and to this end, departures of a reference point on the machine with respect to the stringline are picked up by the sensor, and the screed appropriately adjusted so as to continue to move parallel to the stringline.

In the illustrated embodiment, the sensing means is mounted on a leverage system which magnifies angular changes of the screed by locating the sensor at a point projected forwardly of the screed. This arrangement, which is conventional, is shown as comprising a pair of long lever arms 43, rockable on a pair of knife-edge supports 44, joined at their forward ends by a cross bar 46, and the rear end of each connected to the tail end of screed 18 through a turnbuckle link 48. The sensing means, which may consist of any of several conventional types, and which is therefore shown only very generally, is carried by an arm 50, carrying a laterally extending

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arm 52, from which a further arm 54 extends rearwardly, the latter carrying a cradle 56, in which a trolley-type sensor having a shaft 58, and roller 60, are mounted. It will be understood that the sensor 58-60, whatever its specific type, will have a sensitivity to contact with a stringline, of the order of that found in sensitive micro switches, so as to be capable of engendering a signal upon the slightest departure from contact. There is, thus, little or no load on the stringline.

The present invention contemplates a stringline, in association with conventional paving mechanism, of which the foregoing described structure is a typical, and preferred example. That is to say, whereas the sensor contact 60 would ordinarily cooperate with a stake-supported stringline, the present invention contemplates its coaction with a string carried by, and therefore travelling with, the paving machine. Thus, one side of the machine carries a stub shaft 62, on which is journaled the central sleeve 64 of a walking beam comprising a rear arm 66 and a front arm 68. The arms are of considerable length, and in order to provide against bending they are constructed along the lines of a dihedral angle in cross-section, and are of open-work construction, to keep weight to a minimum. Thus, each has a central, longitudinal rail, or backbone 70, and two, outer, longitudinal rails 72, the inner rail being joined to the outer rails by chevron struts, or herringbone ribs 74. Further transverse struts may be provided on the under side of arms 66, 68, if deemed necessary or desirable. However, since these arms are intended only to carry a stringline, the load demands are very slight. Each arm carries, at its outer end, a ground roller 76, which may be of the caster type. Adjacent the rollers, each arm has an angularly disposed bracket 78, and to these brackets the two ends of the travelling stringline 80 are attached. Although not shown, it will be understood that proper tensioning means for the stringline will be provided, either built-in, or as a separate tool. In lieu of the wire or cord 80, a light ray running between the wheels 76 may be used as a reference line, and in this case a photocell may be used as a sensor. In the case of a string or wire, it is also possible to use two rocker arms, mounted on two separate shafts, and in this case the line will be automatically tensioned at all times.

The use of the travelling stringline is tantamount to using a paving machine having an extremely long wheel base for picking up road irregularities. The sensor is located about midway between the supporting wheels 76, and therefore averages out the vertical spread in any given irregularity. The results differ from those of the flat line, mentioned above, in that in the case of the flat line the paver fills up the low places and builds up to the high places, whereas in the case of the travelling stringline the paver fills up approximately half of the low places and builds up to only half of the high places. The travelling line produces a profile which, while not free of irregularities, is nevertheless considerably smoothed in comparison to the profile over which it travels. As a result, the surface obtained on the third and fourth passes is quite smooth, particularly if the surface being recovered has only relatively short sags and humps.

The effectiveness or smoothing ability of the travelling stringline depends on the relation of the distance between the support wheels therefor and the lengths of the existing irregularities. When the overall length of an irregularity is greater than twice the distance between the support wheels, the ends of the irregularities become individual irregularities, and the overall irregularity is only decreased. While the travelling stringline minimizes all irregularities, it eliminates shorter ones.

The travelling stringline effects a great saving in manpower, since it requires no setting and resetting of a stationary stringline. This inherent principle, with con-

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tinuity of effect, eliminates breaks in the operation due to changing of stationary stringlines.

While a certain, preferred embodiment has been shown and described, various modifications will be apparent, in the light of this disclosure, and the invention should not, therefore, be deemed as limited, except insofar as shall appear from the spirit and scope of the appended claims.

I claim:

1. In a paving machine of the type having a main body, mobile on a roadway, a screed carried in towed relation on a pair of rocker arms pivoted on said body, means adjustably connecting said screed and said arms to vary the attitude of said screed with respect to said rocker arms, means operatively associated with said screed magnifying changes in attitude of said screed and sensing means carried by said magnifying means, the improvement comprising first means pivotally supported by the machine and travelling on the roadway well in advance thereof, second means pivotally supported on the machine and travelling on the roadway to the rear of the machine and third means connecting points on the first two means adjacent their respective contacts with the roadway, in a straight line, said sensing means being located to respond to a point midway of said third means, whereby the attitude of the screed is made responsive to the average of changes in level of the roadway at the contact points.

2. A machine as in claim 1 wherein said first and second means are arms comprising a walking beam pivotally supported by the machine having roadway contacts at the ends of the beam arms and the third means is a stringline extending between points adjacent the roadway contacts.

3. A machine as in claim 1 wherein the roadway contacting elements are caster wheels.

4. In a paving machine of the type having a main body, mobile on a roadway, a screed carried in towed relation on a pair of rocker arms pivoted on said body, means adjustably connecting said screed and said arms to vary the attitude of said screed with respect to said rocker arms, and sensing means operatively associated with said screed, the improvement comprising an elongated walking beam medially pivoted to and extending well in advance of and to the rear of said body, on a shaft extending laterally from one side thereof, a ground-engaging wheel carried at each of the outer ends of said walking beam, anchor means for a stringline carried by said walking beam near each end thereof, and a stringline attached at its ends to said anchor means said sensing means being in contact with a point midway of said stringline.

5. In a paving machine of the type having a main body, mobile on a roadway, a screed carried in towed relation on a pair of rocker arms pivoted on said body, means adjustably connecting said screed and said arms to vary the attitude of said screed with respect to said rocker arms, and sensing means operatively associated with said screed, the improvement comprising an elongated walking beam medially pivoted to and extending well in advance of and to the rear of said body, on a shaft extending laterally from one side thereof, a ground-engaging member carried at each of the ends of said walking beam, and a stringline, said stringline being anchored to said walking beam near each end thereof said sensing means being in contact with a point midway of said stringline.

6. In a paving machine of the type having a main body, mobile on a roadway, a screed carried in towed relation on a pair of rocker arms pivoted on said body, means adjustably connecting said screed and said arms to vary the attitude of said screed with respect to said rocker arms, and sensing means operatively associated with said screed, the improvement comprising an elongated walking beam medially pivoted to and extending well in advance of and to the rear of said body, on a shaft extending laterally from one side thereof, and a

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ground-engaging wheel carried at each of the outer ends of said walking beam, a stringline, said walking beam carrying said stringline between said wheels said sensing means being in contact with a point midway of said stringline.

7. In a paving machine of the type having a main body, mobile on a roadway, and a screed mounted for swinging movement, as a whole, about a transverse axis on said body, and adapted for adjustment of attitude apart from its axis of swing, by sensor means responsive to an element responding to a condition of the roadway, the improvement comprising a pair of arms extending, respectively, forwardly and rearwardly of said body, at one side thereof, and adapted for swinging movement on a pivot, mounted on the main body, in a vertical plane, a ground-engaging member carried at the end of each arm, and a reference guide line extending from an outer portion of one of said arms to an outer portion of the other of said arms a point on the reference guideline being the element used as the basis for adjusting the attitude of the screed.

8. A machine as in claim 7, said wheels being of the caster type.

9. A machine as in claim 7, said arms being mounted on separate axes.

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