Oct. 5, 1965 D. W. AMOS 3,210,710

CONTROL APPARATUS AND SENSOR

Filed April 20, 1962 4 Sheets-Sheet 1

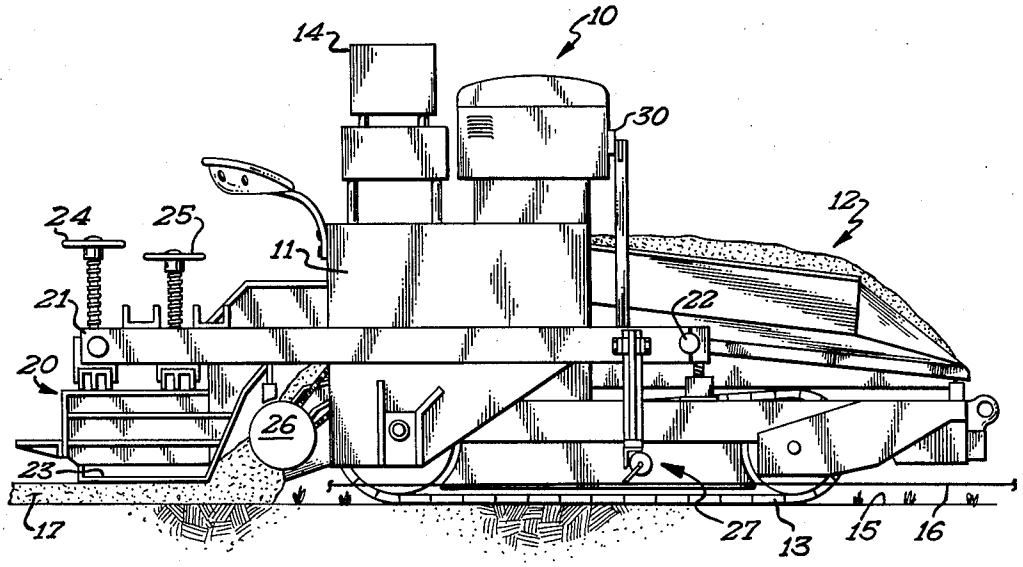

Fig 1

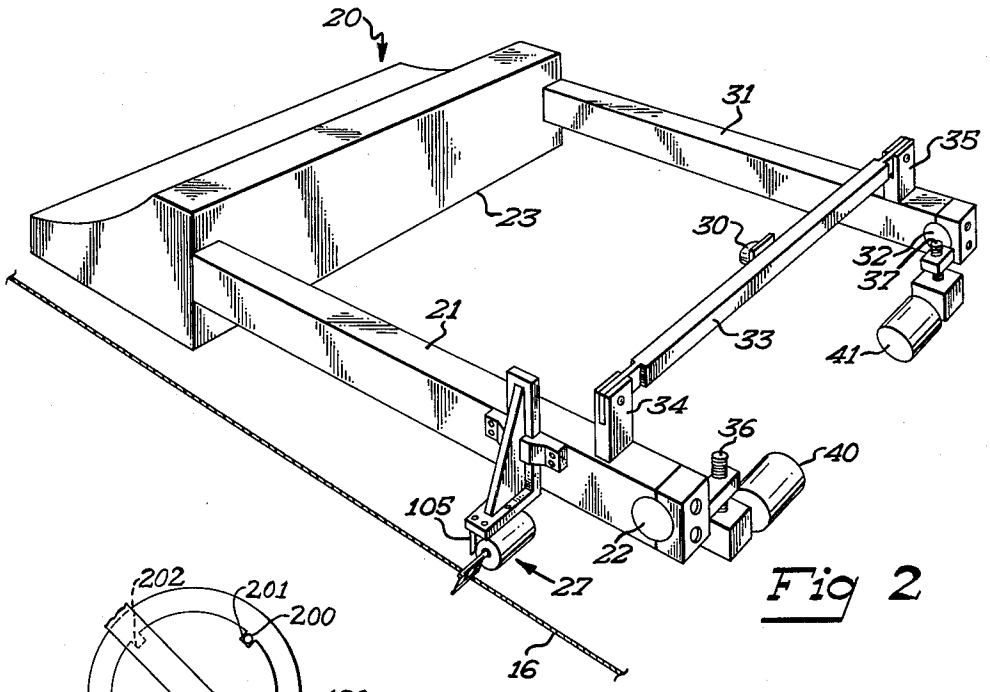

Fig 2

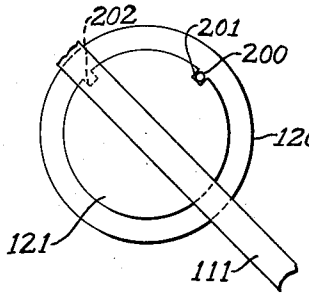

Fig 9

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CONTROL APPARATUS AND SENSOR

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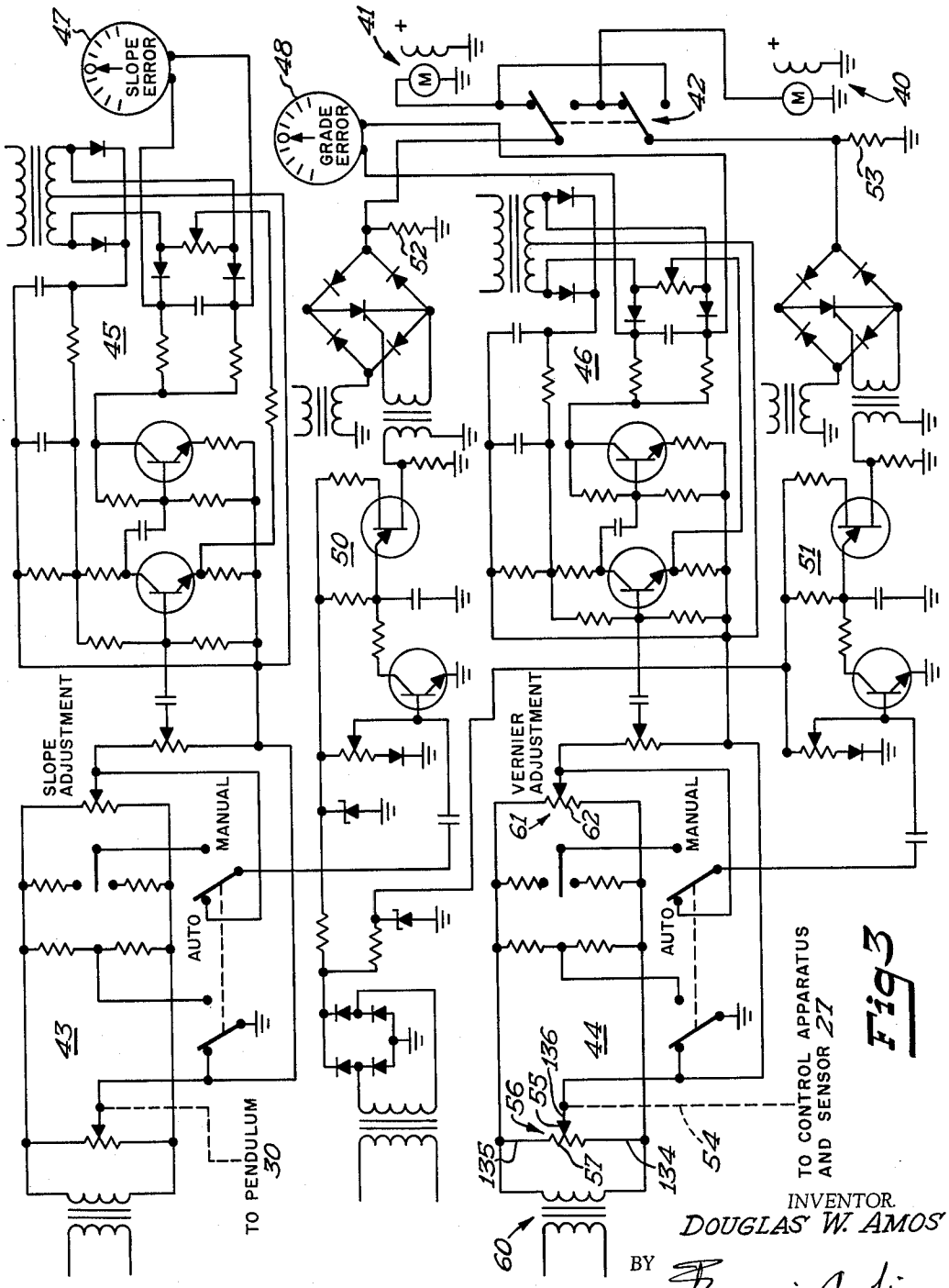

Fig 3

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CONTROL APPARATUS AND SENSOR

Filed April 20, 1962 4 Sheets-Sheet 3

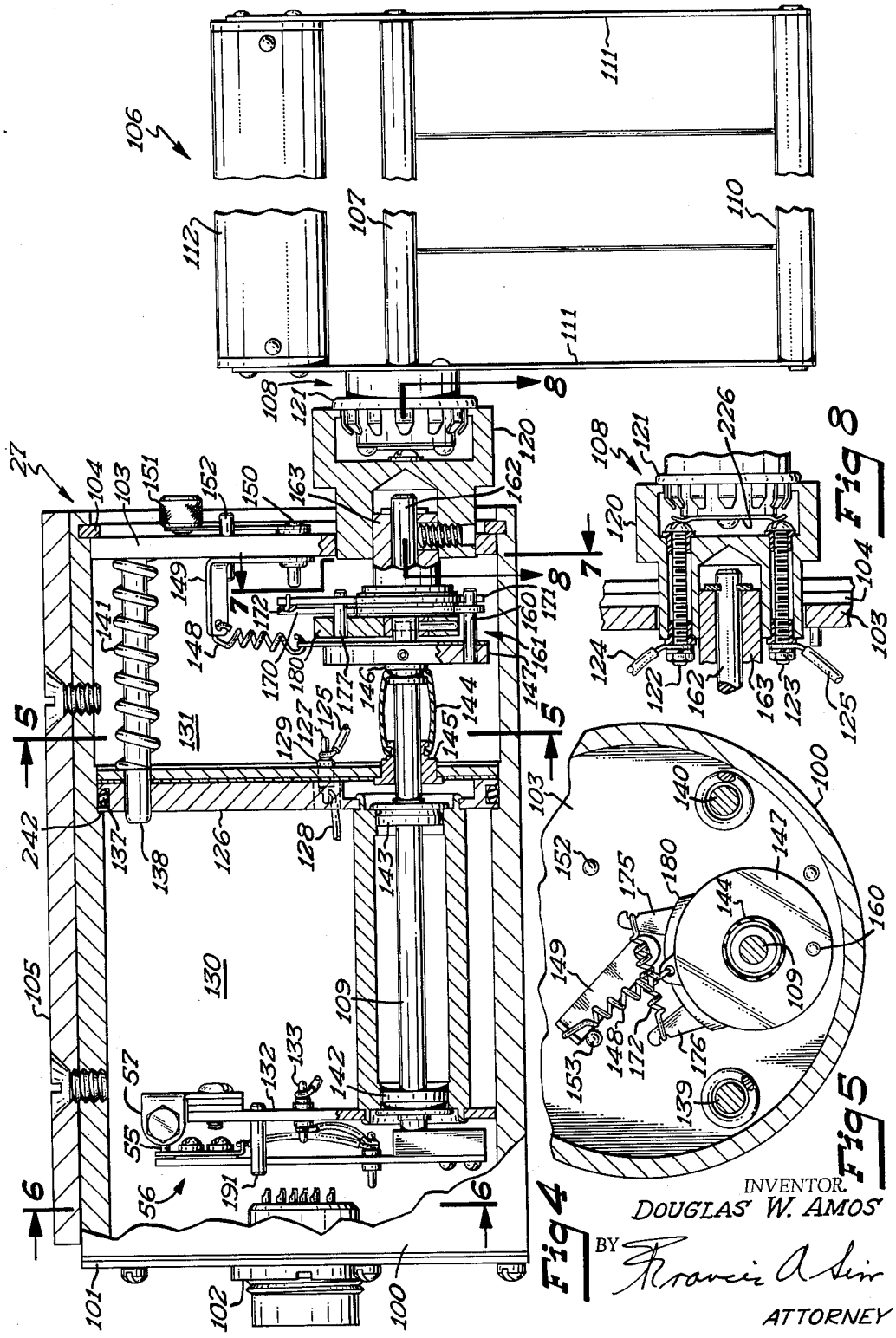

Fig 4

Fig 5

Fig 8

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CONTROL APPARATUS AND SENSOR

Filed April 20, 1962 4 Sheets-Sheet 4

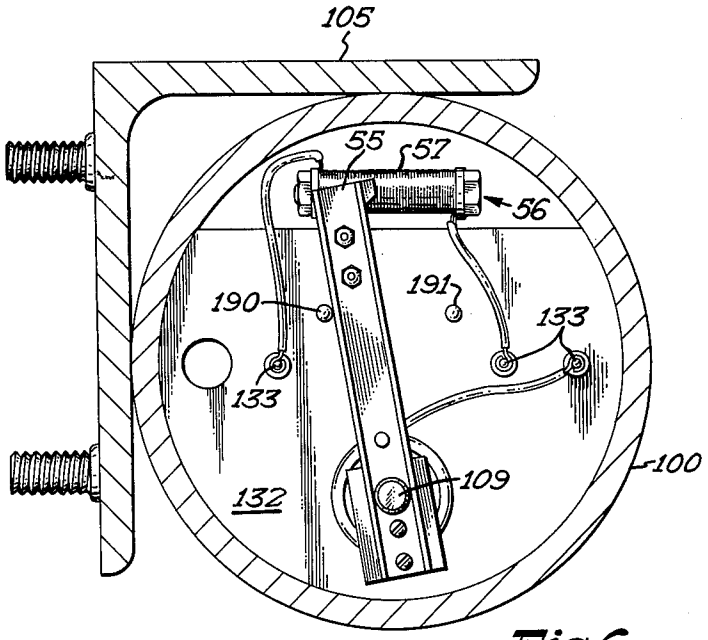

Fig 6

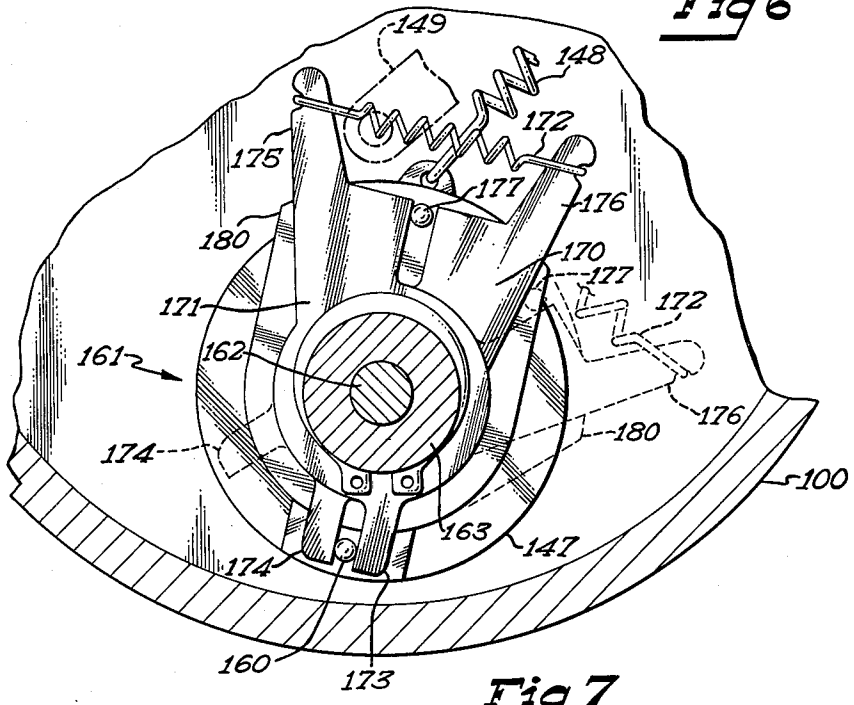

Fig 7

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United States Patent Office

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3,210,710

CONTROL APPARATUS AND SENSOR

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Filed Apr. 20, 1962, Ser. No. 189,124
8 Claims. (Cl. 338—68)

The present invention is concerned with an improved control apparatus and sensor, particularly adapted for use with road paving machines.

Roads are commonly surfaced with a surfacing material by means of paving machines including a hopper into which the material is deposited and out of which the material is fed, immediately in front of a screed or the like, to be deposited on the surface to be paved. The screed compacts and smooths the paving material to form a paved road surface. Thus, the height of the screed is effective to control the height or grade of the resulting paved road.

A type of paving machine of this general construction utilizes a floating screed which freely rests upon the paved surface by virtue of the weight of the screed. The angle of attack of the screed, that is the attitude of the bottom surface of the screed, determines the height of the resulting paved surface. More specifically, a paving machine of this type is provided with a propulsion unit which includes a pair of crawler treads or wheels disposed at opposite sides of the propulsion unit, to move the unit. The forward end of the propulsion unit may be provided with a hopper to receive the road surfacing material. This material is then fed out of the rear portion of the propulsion unit, onto the surface to be paved. Thus, as the propulsion unit moves along the roadway to be paved, the floating screed, towed behind the propulsion unit, is pulled over the road paving material and leaves a paved road surface. The floating screed, which is towed by the propulsion unit, may be towed by means of a pair of forwardly extending beams or arms, the forward portions of which are freely pivoted to the propulsion unit at opposite sides of the unit. The rear ends of the beams or arms are rigidly atached to the screed. Thus, as the height of the forward portion (or an intermediate section) of the beams is vertically raised or lowered, the angle of attack of the screed varies. The raising of the tow beams causes the vertical height of the roadbed to increase, while a lowering of the tow beam causes a change in angle of attack such that the surface of the roadbed is lowered.

A control system has been originated to automatically control the attitude of the screed, and to thus provide a road surface having a height established by a predetermined height datum which has been positioned along the surface to be paved. This system utilizes a pair of control apparatus, including transducers in the form of potentiometers whose wipers are controlled by the sensors, one of the apparatus being a height control disposed on one of the beams, the other being a pendulum slope control. A control apparatus of this type is described in the copending application of Richard C. Flom, Serial No. 144,667, filed October 12, 1961.

While the apparatus of my invention is shown used with an asphalt paving machine, it may also be used with other devices and machines such as concrete paving machines, formless paving machines, or subgrading machines. When the apparatus of my invention is mounted in a generally vertical attitude, it may be used to follow a datum, for example to steer a machine.

My invention is directed to the arrangement of the height control apparatus and sensor, adapted to be selectively located on one or the other or both of the tow beams of the screed, to thus be controlled by a height

datum which has previously been placed along the surface to be paved. This height control apparatus and sensor includes a follower sensor which may ride on, or cooperate with, a taut wire or a string, or may cooperate with the existing road surface adjoining the road surface then being formed. My height control apparatus and sensor, also called a follower sensor, includes a control potentiometer, the wiper of which is controlled and moved by the sensor which follows the guide wire or string. This sensor may also be a ski-type shoe attachment for following an existing adjoining road surface. Vertical motion of a portion of the sensor is translated into rotary motion which is used to position the wiper of the potentiometer.

The housing of my control apparatus is divided into two sections, one of which is sealed and includes the potentiometer. Thus, reliability of operation of the potentiometer is achieved. The potentiometer wiper is mounted on a shaft which extends from one compartment to the other, within the housing, by means of a seal preventing the passage of dust and the like into the sealed compartment housing the potentiometer. The sensor is attached to the shaft by means of a snap-on connection which allows the sensor to be knocked off, without damage, if it hits an obstacle.

An electrical interlock, including the snap-on connection as a portion thereof, is provided, such that a warning signal or a shutdown of the paving machine is achieved if the sensor is inadvertently knocked off.

Furthermore, to accommodate unusual degrees of movement of the sensor, the snap-on connection is coupled to the first mentioned shaft by means of an override mechanism. This override mechanism allows the potentiometer wiper to move to a limit of its range, where it hits a stop, with additional movement of the sensor taken up in the override mechanism without applying undue pressure to the potentiometer wiper, which is then positioned against the stop.

Furthermore, my control apparatus sensor, which may be positioned on either side of a paving machine, is provided with adjustable spring loading or biasing means which cooperates with the first mentioned shaft and biases the shaft for rotation in one direction or the other, depending upon the side of the machine with which the unit is used. Thus, the spring biasing determines the amount of force which must be overcome by the sensor, riding on the height reference datum, before movement of the potentiometer wiper is achieved.

My invention will be apparent to those skilled in the art upon reference to the following specification, claims and drawings, of which:

FIGURE 1 is a view of a paving machine of the floated screed type,

FIGURE 2 is a simplified showing of portions of the paving machine of FIGURE 1, showing my improved control apparatus and sensor as it relates to the structure of the paving machine,

FIGURE 3 is a schematic representation of an electronic control system with which my improved control apparatus and sensor may be utilized,

FIGURE 4 is a side view of my control apparatus and sensor, with a portion of the outer case broken away to show a sectional view of elements within the housing,

FIGURE 5 is a view of the override mechanism and the spring loading or biasing mechanism,

FIGURE 6 is a view of the potentiometer construction,

FIGURE 7 is a view of the override mechanism, taken from the side opposite the showing of FIGURE 5 and showing an alternate position thereof,

FIGURE 8 is a section view of the snap-on-connection construction including the electrical interlock, and

FIGURE 9 is a view of the manner of selectively mounting the sensor portion.

Referring specifically to FIGURE 1, reference numeral **10** identifies generally a paving machine having a propulsion unit **11** including a hopper **12** and crawler type threads **13**. This propulsion unit **10** includes a motor connected to drive the threads **13**, one of which is disposed at each side of the paving machine **10**. The hopper **12** of the paving machine is adapted to receive bituminous material, usually dumped into the hopper by trucks which haul the bituminous material between the roadbed to be paved and the plant which is producing the material. The paving machine **10** is adapted to be operated by an operator positioned on the paving machine, and reference numeral **14** identifies a control box whereby the operator may selectively automatically or manually control the road surface which is being produced by paving machine **10**.

Reference numeral **15** identifies a roadbed which is to be paved and along which a height reference datum **16** is provided, this height reference datum consisting of a wire, string, or the like which has been previously placed in position alongside the roadbed **15** at a predetermined height. Reference numeral **17** designates a finished road surface which has been produced by the paving machine as it moves in a forward direction, that is to the right as shown in FIGURE 1. If desired, the height datum may also be obtained from a previously produced roadbed mat, for purposes of matching one mat to another.

Reference numeral **20** identifies generally a screed construction which is rigidly attached to a beam **21**, pivoted to the propulsion unit at a forward pivot **22**. Paving machine **10** of FIGURE 1 is provided with a pair of beams, one of which is positioned at each side of the propulsion unit with each of the beams pivoted at its forward end. The attitude of the screed, that is the angle of attack of the lower surface thereof, may be initially manually controlled by means of a pair of screed adjustment screws **24** and **25** which can be turned by the operator of the paving machine to control the angle of attack of the screed. The bituminous material is fed from hopper **12** to a spreader type mechanism **26** which is effective to spread the bituminous material on the roadbed **15** immediately in front of screed **20**, where the material is compacted by the screed into the finished road **17**. The screed assembly **20** may include a vibrating mechanism or tamping mechanism as well as a means for heating the bituminous material deposited under and in front of the screed.

The invention of the above mentioned copending application of Richard C. Flom deals with an improved control apparatus for automatically controlling the screed **20** in a manner to produce a predetermined finished road **17**. This is accomplished by means including my improved control apparatus and sensor **27** cooperating with the height datum **16**.

Referring now to FIGURE 2, in this figure is shown a simplified view of the screed, its supporting beams, their pivot points, a pendulum, and my improved control apparatus sensor. As in FIGURE 1, the screed assembly is identified by the reference numeral **20** having a bottom surface **23**. Beam **21**, having pivot **22**, is shown, as is the other beam **31** disposed at the back side of the paving machine **10**, as seen in FIGURE 1. Beam **31** is provided with a pivot **32**. The control apparatus and sensor **27** of the invention is shown adjustably positioned on beam **21** and in engagement with the height datum **16**. A pendulum **30** is supported on a transverse beam **33** which is pivotally mounted at a pair of upper supports **34**, **35** associated with the beams **21** and **31** respectively. Thus, as the pivot points of beams **21** and **31** move up and down, the beam **33** is maintained in transverse alignment with pivot points **22** and **32**. Pendulum **30**, responsive to gravity, thus assumes a position indicative of the slope of beam **33**. The height of the pivots **22** and **32** is

controlled by a pair of pivot adjusting screws **36** and **37** which are controlled by a pair of reversible D.C. motors **40** and **41**.

As mentioned, screed, assembly **20** floats on the bituminous material deposited thereunder and is attached to the propulsion unit **11** by means of the pivots **22** and **32**. Thus, the angle of attack of the bottom surface **23** of the screed is controlled by the vertical movement of these pivot points. Should the pivot points **22** and **32** be driven in an upward direction, the bottom surface **23** of the screed assembly is tilted in an upward direction. Thus, the screed climbs up on top of the greater thickness of bituminous material which is deposited under the screed. The height of the finished road surface **17** is then increased. Should the pivot points **22** and **32** be lowered, the bottom surface **23** of the screed assembly is tilted in a downward direction and the screed digs into the bituminous material deposited in front of the screed and thus the finished road surface **17** is reduced in thickness, that is the height is decreased. Furthermore, the transverse slope of the finished road surface **17** may be controlled by raising or lowering the pivots **22** and **32** in a differential fashion. Thus, as pivot **22** is lowered, while pivot **32** is raised, screen assembly **20** is tilted to raise the righthand end as seen in FIGURE 2, while lowering the lefthand end. The resulting road surface **17** is then sloped toward the height datum **16**.

Referring now to FIGURE 3, in this circuit is disclosed a schematic diagram of an electronic circuit by which the paving machine and thus the finished road surface may be manually or automatically controlled at the option of the operator of the paving machine. The disclosure of FIGURE 3 corresponds to a portion of the disclosure of the above mentioned copending application of Richard C. Flom.

This figure discloses two signal channels, one of which is operative with the pendulum **30** and the other of which is operative with my improved control apparatus and sensor **27**. The outputs of each of these signal channels may be selectively connected to control the D.C. reversible motors **40** and **41** under the control of manually operative switch means **42**.

The basic components of the control system of FIGURE 3 constitute A.C. bridge circuits **43** and **44**, meter drive circuits **45** and **46** connected to indicating meters **47** and **48** respectively, and motor drive circuits **50** and **51** which provide reversible polarity D.C. voltage across output resistors **52** and **53** respectively. The output resistors **52** and **53** may be selectively connected to either of the motors **40** and **41**, depending upon the position of manual switch **42**.

The lower portion of the schematic diagram of FIGURE 3 discloses the portion controlled by the control apparatus and sensor of the present invention. The control apparatus and sensor **27** of FIGURES 1 and 2 is mechanically connected, by means identified by reference numeral **54**, to control the position of wiper **55** of potentiometer **56** having a resistance element **57**. Potentiometer **56** constitutes a portion of the A.C. bridge circuit **44** whose input voltage is supplied by means of a transformer **60** having a primary winding connected to a source of alternating voltage, not shown.

Referring now to FIGURE 4, the improved control apparatus and sensor of my invention is disclosed, again identified generally by means of reference numeral **27**. Apparatus **27** can be seen, for example by reference to FIGURE 6, to be contained within a circular can-like housing **100**, which housing is broken away to disclose the interior portions of apparatus **27**. The lefthand end of the housing **100**, as disclosed in FIGURE 4, is closed by a cover member **101** mounting an electrical connector **102**. The other end of housing **100** is closed by a cover member **103** held in position by a C-ring closure member **104** adapted to cooperate with a recess formed on the interior surface of the housing **100**. As can also be seen

in FIGURES 4 and 6, the housing 100 is connected to support means 105, this support means being identified in FIGURE 2 as that means by which the control apparatus and sensor 27 is mechanically mounted to the beam 21 of the paving machine.

Reference numeral 106 identifies generally the sensor portion of my invention. Sensor 106 includes a rod 107 defining a center of rotation or the axis of the control apparatus and sensor. This rod cooperates with a snap-on connector 108, including mating member 120 and 121, to facilitate mechanical mounting of member 106 to means including a rotatable shaft 109 connected to potentiometer wiper 55, by means to be described. Sensor 106 also includes a spaced wire engaging portion 110 comprising a rod disposed generally parallel to rod 107 and attached to the snap-on connection 108 and to the rod 107 by support means 111. This portion 110 of the sensor 106 is the portion which is adapted to engage the datum means 16 of FIGURE 1 to effect rotation of rod 107, and through the snap-on connection 108, to effect rotation of shaft 109, and thus rotation of potentiometer wiper 55. Sensor 106 also includes a wind compensation counterweight portion 112 comprising a cylinder disposed on the opposite side of rod 107 from the above mentioned portion 110. The size and spacing of the wind compensation counterweight portion 112 is such as to compensate for not only the weight of portion 110, as it affects rotation of rod 107, but also to provide a cross-sectional area resisting the effect of wind on the portions 110 and its supports 111 which are disposed on the opposite side of rod 107, remembering that rod 107 defines the center of rotation of the sensor 106.

Referring now to FIGURE 8, the snap-on connection 108 is shown in greater detail, and is seen to include mating mechanical coupling members 120–121 to physically mount the sensor 106 with respect to the remaining portions of the control apparatus as disclosed in FIGURE 1. Coupling members 120 and 121 preferably carry mating positioning lugs or the like to allow only one attitude of coupling of coupling members. Member 120 is rotatably mounted in the cover member 103 and carries a pair of bolts or rivets 122 and 123 connected to conductors 124 and 125 respectively and functioning as electrical terminals. Bolts 122 and 123 are mounted within the member 120 by means of insulating bushings to thus insulate the bolts from member 120. The interior portion of the snap-on connection 108 includes a bridging electrical contact 226 which, with sensor 106 mounted on member 120, completes an electrical connection from conductor 124 through bolt 122, contact 226, and bolt 123 to electrical conductor 125.

In FIGURE 1, a terminal 127 is seen to lead the conductor 125 through an interior wall 126 to a further conductor 128. The terminal 127 is led through the wall 126 and is insulated from the wall 126 by means including a sealing member 129, this sealing member preventing the passage of dust and the like between the two compartments of the control apparatus identified generally by means of reference numerals 130 and 131.

Conductor 124 of FIGURE 8 is likewise provided with a terminal similar to terminal 127 and thus conductors 124 and 125 are led to terminals of connector 102 at the interior surface of wall 101, these terminals being the interior projecting portions of the connector 102, as shown. A cable, mating with the exterior portion of connector 102, connects conductors 124 and 125 to electrical control means, not shown. For example, the closed switch represented by the bolt 122, contact 226 and bolt 123 may be electrically connected in series with the circuit controlling the forward motion of the machine. For example, the clutches to drive wheels or the like from the internal combustion engine powering the paving machine of FIGURE 1 may be rendered inoperative. As an alternative, this closed switch may be connected into an alarm circuit to sound an alarm or to flash an alarm light to indicate to the paving machine operator that the sensor 106 has accidentally become disengaged, for example, by striking an obstruction location in the vicinity of the datum 16.

As has been mentioned, the position of potentiometer wiper 55 is controlled by the position of sensor 106. Potentiometer 56 is mounted on a mounting member 132 which in turn carries three terminals 133 (see FIGURE 6) adapted to be connected to the resistance end terminals and to the wiper of the potentiometer assembly. The terminals 133 are in turn connected to the interior portions of connector 102. The above mentioned cable connects the potentiometer assembly to the control system of FIGURE 3. Referring to FIGURE 3, the reference numerals 134, 135 and 136 designate the conductors of the potentiometer assembly which are connected to the electronic control system of FIGURE 3.

Turning now to the interior construction of the control apparatus, which includes the two compartments 130 and 131, these compartments are separated by the wall 126, including a sealing O-ring 137. In the process of assembly, the cover member 103 is positioned by means of positioning lug 138 (as seen in FIGURE 4) and the inside diameter of the housing. Shorter lugs 139 and 140 are seen in FIGURE 5. Each of these lugs includes a mating coil spring 141. Cover member 103 is forced to the interior of housing 100 such that C-ring 104 may engage groove 100. This action causes the interior wall 126 to be forced into engagement with a lip 242 formed on the interior surface of housing 100 to thus form the two interior compartments 130 and 131.

Shaft 109 is journalled in bearings 142 and 143 and is then led through wall 126 by means including a flexible boot 144. The lefthand end of boot 144 is connected to a collar member 145 fixed to wall portion 126. The righthand end of boot 144 is connected to the sleeve 146, which sleeve is fixed to shaft 109. Sleeve 146 includes, as an integral portion thereof, a disc 147 which is adapted to be spring biased against rotation in one direction or the other by means of a spring 148. The position of this spring is controlled by a lever 149 which, through a pivot 150, is connected to a manual actuator 151 cooperating with a pair of stops 152 and 153 (also see FIGURE 5).

Thus, disc 147 rotates with shaft 190. At the lower portion of disc 147 is positioned a drive pin 160 which cooperates with an override mechanism designated generally by means of reference numeral 161.

Override mechanism 161 is the mechanism by which the sensor 106 is connected to shaft 109. Sensor 106, mounted by means of snap-on connection 108, causes rotation of member 120 and thus also causes rotation of a shaft 162 which is disposed within a collar 163. Both collar 163 and shaft 162 are fixed to member 120 to rotate therewith.

Loosely disposed or pivoted on member 163 are two drive links 170 and 171, which are interconnected by means of a spring 172, see FIGURES 4, 5 and 7. The construction of this aspect of my invention can be seen more clearly in FIGURE 7 wherein the shape of the links 171 and 172 can be seen. Link 171 is provided with a lower arm 173 cooperating with the drive pin 160 of disc 147. Drive link 172 is likewise provided with a lower arm 174 which cooperates with the drive pin 160, pin 160 being captured between arms 173 and 174. Each of the links 171 and 172 is provided with upper arms 175 and 176 respectively, these upper arms cooperating with and capturing a further drive pin 177 between the arms 175 and 176. Pin 177 is carried by a rotatable disc-like member 180 which is fixed to shaft 162 so as to rotate with this shaft.

With this construction in mind, the rotation of follower sensor 106 about its axis (rod 107) and the manner in which shaft 109, and thus potentiometer 56, is controlled will be considered. With the apparatus as disclosed in

FIGURE 4, manual control member **151** is positioned so as to engage stop **153** (see FIGURE 5). Disc **147** is therefore biased to a clockwise position, as viewed from the follower sensor, the view of FIGURE 7. Thus, potentiometer wiper **55** of potentiometer **56** is biased to its extreme lefthand position, to engage stop **190**, the view of FIGURE 6. Likewise, sensor **106** is tilted from a true vertical position such that the windage and counterweight portion **112** leads the portion **110**. Thus, control member **151**, set as shown in FIGURE 4, is set as it would be when the control apparatus and sensor **27** is mounted on the left side of the paving machine.

When the control apparatus is mounted on the right side of the paving machine, as seen in FIGURE 1, then the manual control member **151** is shifted so as to engage stop **152**. This causes spring **148** and lever **149** to shift such that lever **149** also engages stop **152**. With this setting of member **151**, follower sensor is tilted from the true vertical position with the windage and counterweight member **112** again leading member **110**, the leading attitude of member **112** being related to the control apparatus and sensor **27** as it is mounted on the right side of the paving machine of FIGURE 1.

In other words, manual control member **151** and sensor **106** are both tilted from the true vertical, but they are tilted in opposite directions. The sense or attitude of this tilt is reversed when the unit is shifted from one side of the paving machine to the other.

FIGURE 9 shows a partial view of the connector member **120** which carries a positioning pin **200** mating with notches **201** and **202** formed on member **121**. Notches **201** and **202** are spaced at 90 degrees. When control member **151** is as shown in FIGURE 4, notch **201** cooperates with pin **200**, as shown. When control member **151** is shifted to engage stop **152**, the sensor **106** is removed and replaced in position, rotated 90 degrees, with notch **202** cooperating with pin **200**.

Assuming that the control apparatus and sensor **27** is mounted on the left side of the paving machine, the vertical height of unit **27** is adjusted to produce a midposition of wiper **55**. Subsequent changes in its vertical position, as the paving machine encounters irregular terrain, causes the portion **110** of the sensor **106** to be raised or lowered, causing rotation of rod **107**. Rotation of this rod causes rotation of shaft **162** by virtue of the rotation of coupling members **120–121**. In this manner drive pin **177** is caused to rotate about the axis of rod **107** and shaft **109**. This rotation transmits a force to the arm **175** or **176** of the drive links **171** and **172** (depending upon the direction of this rotation). As one of these drive links rotates, for example link **176** rotates in a clockwise direction as seen in FIGURE 7, this rotation is transmitted to link **171** through spring **172**. Thus, link **171** likewise rotates in a clockwise direction, and by virtue of its lower arm **173**, this clockwise rotation is transferred to drive pin **160** fixed to disc **147**. Disc **147** rotates and causes clockwise rotation of rod **109** and potentiometer wiper **56**.

It will be remembered that the apparatus as shown in FIGURE 7 is disposed with the manual control member **151** positioned such that wiper **55** is biased toward its lefthand extremity, that is toward engaging stop **190**. Thus, the above described rotation of rod **109** causes the wiper to move from a center position toward stop **190**. As this rotation continues, the point is reached where stop **190** is engaged. At this point, override mechanism **161** functions to prevent undue stress being applied to the potentiometer construction. Further clockwise movement of drive link **172** (as seen in FIGURE 7), for example to the dotted line position of FIGURE 7, causes stress to be built up within spring **172**. However, pin **160** does not rotate beyond the position where potentiometer wiper engages stop **190** by virtue of the resilient coupling of spring **172** which couples the drive link **172** to the drive link **171**.

While the above description has been concerned with clockwise rotation of the shaft **162** as viewed in FIGURE 7, counterclockwise rotation of this shaft causes rotation of the potentiometer wiper from a center position, as shown in FIGURE 6, toward stop **191**, its extreme righthand position, whereupon continued rotation of drive link **172** is interrupted while drive link **171** continues to rotate in a counterclockwise direction, this additional movement being taken up by spring **172**.

From the above description, it can be seen that I have provided an improved control apparatus and sensor particularly adapted for use in the automatic control of a road paving machine.

Modifications of the present invention will be apparent to those skilled in the art and it is thus intended that the scope of the present invention be limited to the scope of the appended claims.

I claim as my invention:

1. A follower sensor for use with a land vehicle carrying an instrumentality which is movable relative to the vehicle, which instrumentality is to be maintained at a controlled height relative to an established land based reference datum, the sensor comprising; a housing adapted to be mounted on the vehicle and movable with the instrumentality, a rotatable shaft mounted within said housing, output means controlled by said shaft to provide an output dependent upon the position of rotation of said shaft; follower means having a first portion mechanically and detachably secured to said shaft, a second portion spaced from said first portion and rigidly attached thereto, said second portion being adapted to cooperate with the reference datum and to produce rotation of said shaft, and a third portion spaced from said first portion generally opposite said second portion, said third portion being constructed and arranged to constitute means to counterbalance said follower means and to compensate for wind resistance and the like tending to affect said follower means; and electrical circuit means adapted to be electrically connected through the detachable connection of said first portion to said shaft, said circuit means constituting control means effective in the event said follower means is mechanically detached from said shaft.

2. A follower sensor for use with a road paving machine having a movable paving instrumentality adapted to be controlled in accordance with a pre-established datum, and having; electrical control means having output means adapted to control the position of the instrumentality, comprising; a housing adapted to be mounted on the machine and to be movable with movement of the instrumentality, a shaft rotatably mounted within said housing, a potentiometer having a movable wiper connected to said shaft and movable therewith, means adapted to connect said potentiometer in controlling relation to the electrical control means, a snap-on mechanical coupling mounted on said shaft, a follower sensor mechanically mounted on said shaft by virtue of said snap-on coupling to facilitate the accidental striking and mechanical disengagement of said follower sensor, said follower sensor being adapted to follow the datum to cause rotation of said shaft and a resulting movement of the instrumentality and said housing, and further electrical circuit means including said snap-on coupling and effective to be electrically actuated upon accidental disengagement of said follower sensor.

3. In combination; a hollow cup-shaped housing having an open end and a closed end, an electrical connector mounted in said closed end, a first wall within said housing positioned generally normal to the axis of said housing and dividing said housing into a first and a second compartment, a rotatable shaft mounted in said first wall to extend between said first and second compartments generally parallel to the axis of said housing, a potentiometer mounted in said first compartment with the wiper thereof connected to be moved by rotation of said shaft, electrical conductors connecting said potentiometer to

said electrical connector, a closure wall mounted at the open end of said housing, a snap-on mechanical connection rotatably mounted in said closure wall and including electrical switch means mounted on said snap-on connection, a follower sensor mounted on said snap-on connection and adapted when so mounted to actuate said electrical switch means, an override mechanism within said second compartment connecting said snap-on connection to said shaft to limit the degree of rotation of said shaft as said snap-on connection rotates, and electrical conductors connecting said electrical switch means to said electrical connector.

4. In combination; a hollow cup-shaped housing having an open end and a closed end, an electrical connector mounted in said closed end, a first wall posoitioned within said housing generally normal to the axis of said housing and dividing said housing into a first sealed compartment and a second compartment, a rotatable shaft mounted by virtue of a sealed support in said first wall to extend between said first and second compartments generally parallel to the axis of said housing, a potentiometer mounted in said first compartment with the wiper thereof connected to be moved by rotation of said shaft, electrical conductors connecting said potentiometer to said electrical connector, a closure wall mounted at the open end of said housing, a snap-on mechanical connection rotatably mounted in said closure wall and including electrical switch means, a follower sensor mounted on said snap-on connection and adapted when so mounted to actuate said electrical switch means, a mechanical override mechanism within said second compartment connecting said snap-on connection to said shaft to limit the degree of rotation of said shaft as said snap-on connection rotates, and electrical conductors connecting said electrical switch means to said electrical connector and including sealed portions extending through said first wall.

5. In combination; a hollow cup-shaped housing having an open end and a closed end, an electrical connector mounted in said closed end, a first wall positioned within said housing generally normal to the axis of said housing and dividing said housing into a first and a second compartment, a rotatable shaft mounted in said first wall to extend between said first and second compartments generally parallel to the axis of said housing, a potentiometer mounted in said first compartment with the wiper thereof connected to be moved by rotation of said shaft, electrical conductors connected said potentiometer to said electrical connector, a closure wall mounted at the open end of said housing, a snap-on mechanical connection rotatably mounted in said closure wall and including electrical switch means, a follower sensor mechanically mounted on said snap-on connection and adapted when so mounted to actuate said switch means, a mechanical override mechanism within said second compartment mechanically connecting said snap-on connection to said shaft to limit the degree of rotation of said shaft as said snap-on connection rotates, electrical conductors connecting said switch means to said electrical connector, and directional spring loading means connected between said housing and said shaft and selectively adjustable to spring bias said shaft for rotation in one direction or the other to thus establish a force which must be overcome by said follower sensor to achieve movement of said shaft and said potentiometer wiper.

6. A follower sensor for use with a road paving machine having a screed assembly to form a road surface, with a portion of the screed assembly being generally vertically movable, the sensor comprising; a housing adapted to be mounted on the screed portion so as to move vertically as the screed portion moves, a rotatable shaft mounted within said housing, a potentiometer having a wiper controlled by rotation of said shaft, stop means to limit rotation of said wiper, override mechanism mounted on said shaft, a snap-on mechanical connection mounted on said override mechanism, said override mechanism functioning to limit the rotation of said shaft and said potentiometer wiper as said snap-on connection rotates, a follower member adapted to cooperate with generally horizontal datum means, and means removably mounting said follower member on said snap-on connection.

7. A follower sensor for use with a road paving machine having a screed assembly to form a road surface, with a portion of the screed assembly being generally vertically movable, and electrical control means connected to control the vertical position of the screed portion; a housing adapted to be mounted to move as the screed portion moves, a rotatable shaft mounted within said housing, a potentiometer having a wiper controlled by rotation of said shaft, means adapted to connect said potentiometer in controlling relation to the electrical control means, an override mechanism mounted on said shaft, a snap-on mechanical connection mounted on said override mechanism, said override mechanism functioning to limit the rotation of said shaft and said potentiometer wiper as said snap-on connection rotates, a follower member adapted to cooperate with generally horizontal datum means, means removably mounting said follower member on said snap-on connection, and further circuit means adapted to be electrically connected through said snap-on connection when said follower member is mounted thereon.

8. A follower sensor for use with a road paving machine having a generally vertically movable screed assembly to form a generally horizontal road surface, and having electrical control means to control the vertical position of a portion of the screed assembly; a housing adapted to be mounted to move vertically as the portion of the screed assembly moves, a rotatable shaft mounted within said housing, a potentiometer having a wiper controlled by rotation of said shaft, means adapted to connect said potentiometer in controlling relation to the electrical control means, an override mechanism mounted on said shaft, a mechanical snap-on connection mounted on said override mechanism, said override mechanism functioning to limit the rotation of said shaft and said potentiometer wiper as said snap-on connection rotates, a follower member comprising a rod defining a center of rotation and including mechanical means cooperating with said snap-on connection to removably mount said rod on said snap-on connection, said follower member including a first portion connected to said rod and spaced therefrom and adapted to engage generally horizontal datum means to effect rotation of said rod, said follower member including a wind compensation counterweight portion connected to said rod and spaced therefrom on the opposite side from said first portion, means removably mounting said follower member on said snap-on connection, and further electrical circuit means adapted to be electrically actuated when said follower member is mounted on said snap-on coupling.

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