United States Patent [19]

Barnes, III

[11] **3,813,181**

[45] **May 28, 1974**

[54] **FINE GRADE INDICATING SYSTEM**

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[22] Filed: **Apr. 21, 1972**

[21] Appl. No.: **246,370**

[52] **U.S. Cl.** **404/84,** 172/430, 37/DIG. 20

[51] **Int. Cl.** **E01c 23/00**

[58] **Field of Search** 404/84; 37/DIG. 20; 172/430, 4.5

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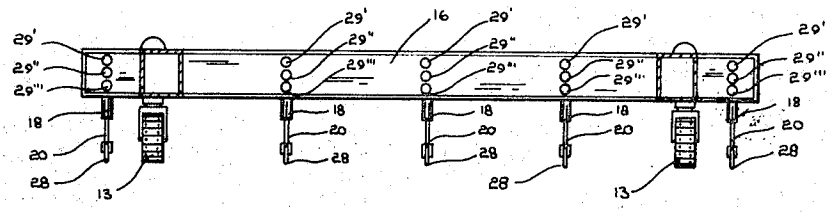
Primary Examiner—Nile C. Byers, Jr.

Attorney, Agent, or Firm—Mills and Coats

[57] **ABSTRACT**

In abstract, a preferred embodiment of this invention is a fine grade indicating device for attachment to highway fine grading machines so that either the operator of the machine or the highway inspector can determine at a glance the accuracy of the grade being prepared.

6 Claims, 7 Drawing Figures



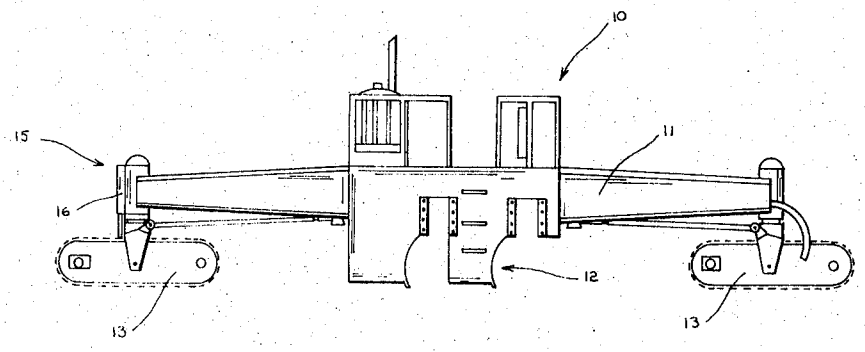

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fig.2

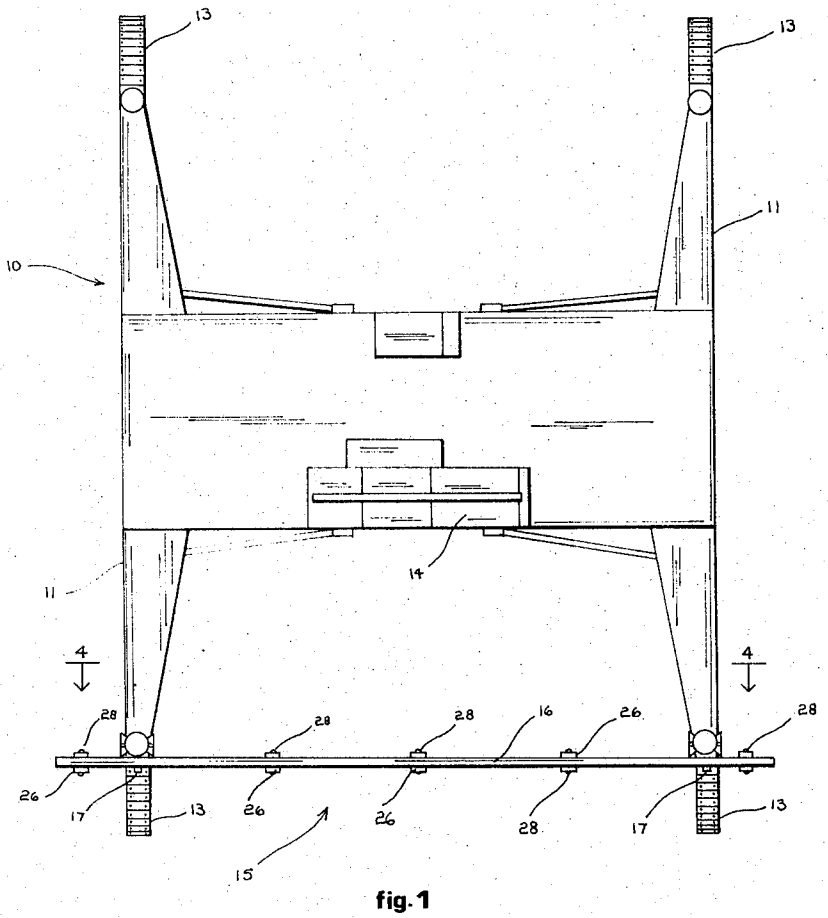

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fig.1

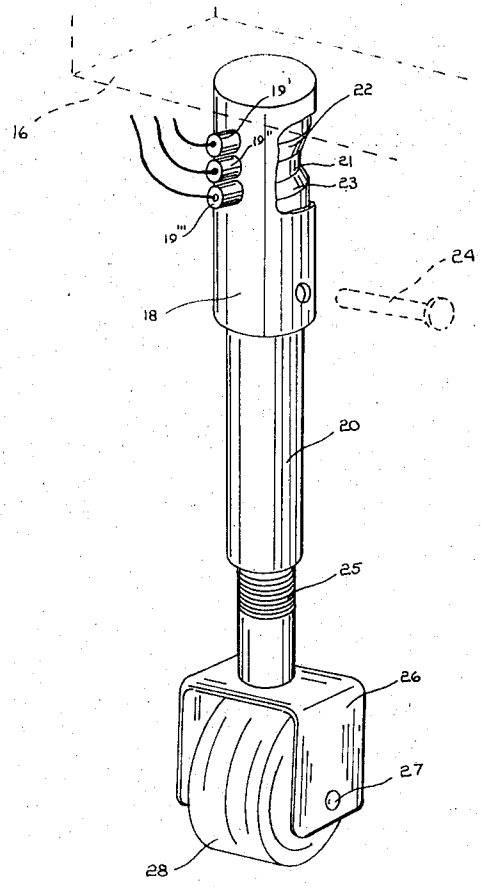


fig. 5

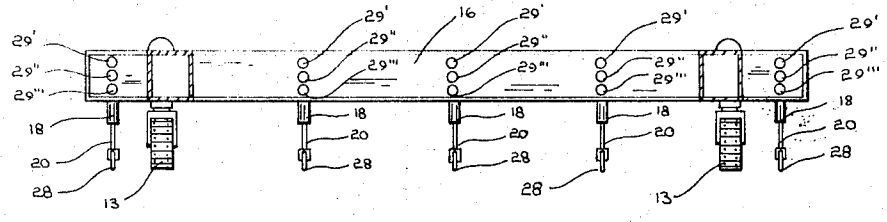


fig. 4

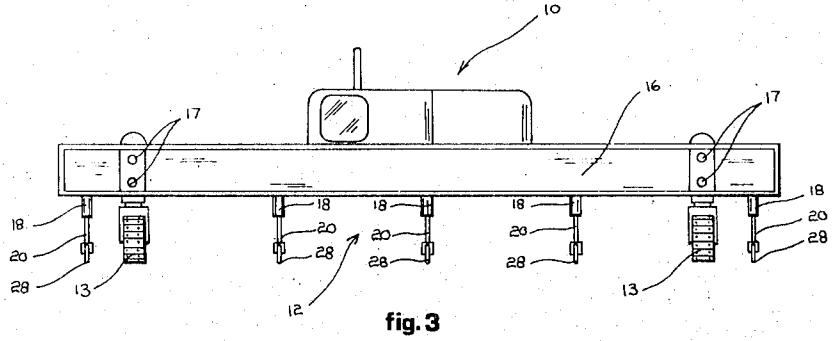


fig. 3

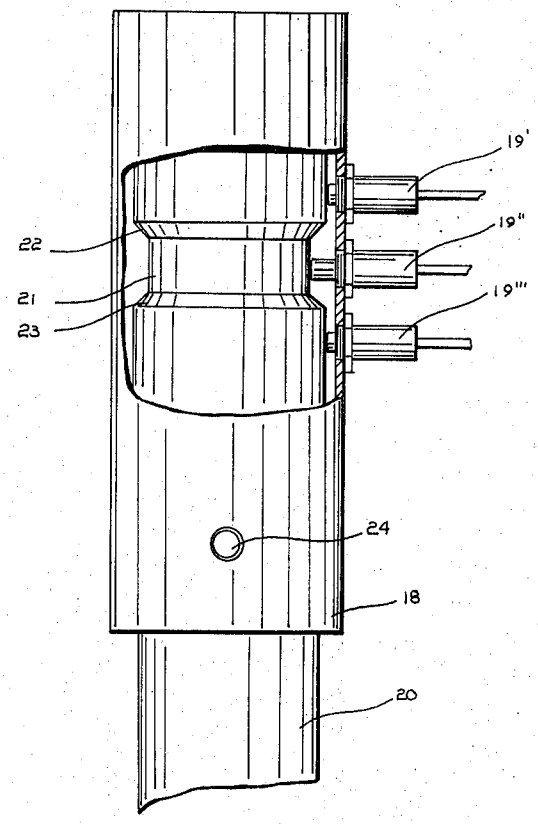


fig. 6

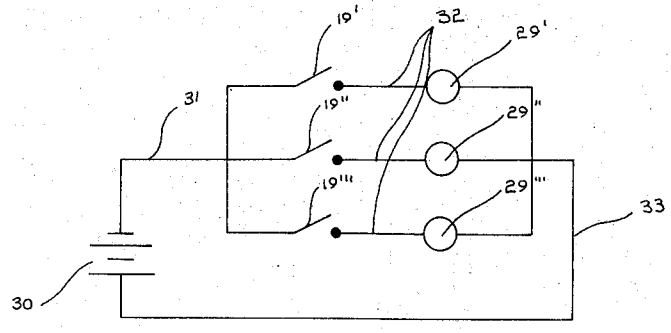


fig. 7

FINE GRADE INDICATING SYSTEM

This invention relates to road grading systems and more particularly to fine grading equipment and means for indicating the accuracy of operation of such equipment.

In the past, various pieces of equipment and machines have been developed for grading road beds. An example of one of the more refined units is disclosed in U.S. Pat. No. 3,540,360 issued to C.M.I. Corporation. As with all of this type of equipment, checks have to be made to ascertain that a smooth, level, fine grade has been prepared. This is particularly important since fine grading is the last step prior to the paving operation.

Some attempts have been made using optical systems to determine fine grade but the system of pulling a line across the road between the grade lines and taking periodic measurements from such cross line to the road surface is used widely and is considered the only practical means of checking grades accurately. This type of operation requires a man on each side of the road bed adjacent the grade line and a third man taking the actual measurements. This type of grade checking is not only slow and laborious, but it also involves the labor of three workmen.

After much research and study into the above mentioned problems, the present invention has been developed to provide a grade level indicating system that is accurate in operation and constant in indication. This system can be mounted on a fine grading machine to monitor the accuracy of operation of such machine. A highway inspector can either walk beside the machine or can actually ride thereon and ascertain grade levels at all times. This not only eliminates two linemen from the grade determining operation, but also gives the grade machine operator a warning when the device has not been operating properly so that he can stop and make adjustments as necessary.

In view of the above, it is an object of the present invention to provide an accurate grade determining indicator that is automatic in operation.

Another object of the present invention is to provide a grade indicating system for fine grading machines which automatically indicate unacceptable variations in grade level.

Another object of the present invention is to provide a grade indicating system including indicator lights for showing above grade, below grade, and on grade conditions.

A further object of the present invention is to provide a road bed fine grade indicating system including a plurality of pressure sensitive switches for controlling grade level read-outs.

An even further object of the present invention is to provide, in a fine grade indicating system, a means for locking the indicator switches during transport.

Another object of the present invention is to provide a fine grade level indicating system including a wheel or grade sensor and means for finely adjusting the initial setting thereof.

Other objects and advantages of the present invention will become apparent and obvious from a study of the following description and the accompanying drawings which are merely illustrative of such invention.

IN THE DRAWINGS

FIG. 1 is a top plan view of a typical fine grading machine showing the grade determining system of the present invention operatively mounted thereon;

FIG. 2 is a side elevational view of such machine showing the system of the present invention;

FIG. 3 is a rear elevational view of the machine and the system of the present invention;

FIG. 4 is a section taken through lines 4—4 of FIG. 1;

FIG. 5 is a perspective view of one of the indicating arms used with the present invention;

FIG. 6 is a sectional view of a typical switch head; and

FIG. 7 is a schematic of a typical indicator circuit.

With further reference to the drawings, a typical fine grade machine indicated generally at **10** includes longitudinal frame members **11** and fine grading means incorporated into the area indicated generally at **12.** Tractor type crawler means **13** are operatively mounted at each end of each of the frames **11** and are driven by main power engine **14.**

To the rear portion **15** of the trading machine **10** is attached sensor support frame **16.** This frame is preferably removably mounted on machine **10** by means such as bolts **17.**

To the lower or bottom portion of frame **16,** as oriented in the drawings, is secured a plurality of generally cylindrical shaped sleeves **18.** Each of these sleeves contain at least three threaded openings into which pressure sensitive switches **19** are adapted to be placed. These switches **19** are longitudinally spaced and are of the biased-to-closed, pressure type. In other words, each switch **19** preferably is of the type that includes a plunger trip **19'** that is biased to a closed position.

Sensor arms **20** are provided for operative mounting within sleeves **18** and include a depressed area **21** around their upper ends. On each side of each depressed area **21** is, respectively, an upper beveled shoulder **22** and a lower beveled shoulder **23,** as can clearly be seen in FIGS. **5** and **6.**

Whenever one of said pressure switches **19** is in alignment with a depressed area **21** of its respective sensor arm **20,** the circuit is closed through such switch. If on the other hand, the sensor arm **20** moves so that the closed switch engages either the upper or lower beveled shoulder **22** or **23,** the plunger **19'** of switch **19** will be compressed against its bias means to open the circuit through such switch.

A locking pin **24** is provided which can be inserted through sleeve **18** and into or through sensor arm **20** to lock these two elements in relative position during transport of the present invention.

In the lower end of sensor arm **20,** opposite switching activating area **21,** is a threaded longitudinal opening. Into this opening is threaded shaft **25.** A wheel or roller mounting bracket **26** is either fixedly or pivotably mounted on the lower end of threaded shaft **25.** An axle **27** is provided in bracket **26** which rotatively mounts ground contact wheel or roller **28.** Thus it can be readily seen that the overall length or distance between ground engaging wheel **28** and the lower portion of sensor support frame **16** can be adjusted by twistingly threading shaft **25** inwardly or outwardly.

Pressure switches **19** are actually three separate switches indicated on the drawings as **19, 19''** and

19'''. These switches are either open or closed depending on the position of switch activating bevels 22 and 23 of sensor arm 20. In parallel with each of the sensor switches is an indicator light 29', 29'' and 29'''. Thus it can be seen, particularly when referering to the schematic of FIG. 7, that each of the switches 19 has associated therewith a respective indicator light 29.

A convenient power source such as that indicated at 30 in FIG. 7 is operatively connected to one end of line 37. This line splits into three paths which attach respectively to switches 19', 19'' and 19'''. Connector lines 32 connect the switches 19 with their respective indicator lights 29. From lights 29 the circuit is completed back to the power source by either a common ground therewith or by means such as line 33.

When it is desired to mount the grade indicating device of the present invention on a fine grading machine such as that indicated generally at 10, all that is necessary is for the sensor support frame 16 to be bolted or otherwise connected to the rear portion 15 of the machine. The sensor arms 20 are then moved either upwardly or downwardly until the depressed area 21 is centered adjacent switch 19'' as seen in FIG. 5. This allows switches 19' and 19''' to be opened by their respective adjacent shoulders 22 and 23. Threaded shaft 25 is adjusted either inwardly or outwardly to set the ground engaging wheel or roller 28 at the proper location relative to the depressed area 21 of sensor shaft 20. Once these adjustments have been made in each of the sensing mechanisms, the device is ready for operation.

As the grading machine 10 moves over the bed 33 being prepared, the fine grading portion 12 thereof grades such bed to within a fine tolerance. As the machine passes over the bed, finally grading the same, the sensor wheels or rollers 28 mounted on the rear portion 16 of such machine sense the grade level. Should a low place be encountered, the effected sensor arm 20, by its own weight, will move downwardly so that wheel 28 can stay in contact with the bed. As this happens, upper bevel 22 will engage closed switch 19'' to open the same. At the same time, the plunger of switch 19''' will move into the depressed area 21 and thus close the circuit through such switch. Thus it can be seen that the downward movement of sensor arm 20 will open the circuit and thus cut off indicator lamp 29'' and close the circuit or turn on indicator lamp 29'''. Since each sensor wheel has its own operatively connected sensor indicator system, the low light on the sensor frame 16 adjacent the wheel following the unacceptable grade contour will be turned on. Since the high and low lights are preferably red with the grade lights being green, the attention of the operator of the grading machine will immediately be alerted. Also if an inspector is riding on the machine, he likewise will be in a position to view the indication or unacceptable variation.

As soon as the grade level of the road bed returns to within the desirable tolerances, the ground engaging wheel 28 will move sensor 20 back to a centralized position so that switch 19'' is closed and both switches 19' and 19''' are open thus indicating green for normally acceptable grade.

Whenever an above grade situation is encountered, the same action occurs as with a low grade condition except that switch 19' is closed with switches 19'' and 19''' being open thus provided a high grade indication by illuminating the upper light adjacent the sensor unit effected.

Even though indicator lights are shown as facing forward toward the drive area of the grading machine, such lights could obviously be displayed rearwardly, either concurrently with forward display or in lieu thereof. Also these condition indicators could be mounted on the console or control panel 34 of the grading machine, either in combination with the indicators heretofore described or in lieu thereof.

Likewise a view port or window can be provided in sleeve 18 so that exact centering of the depressed area 21 can be ascertained relative to switch 19'' when wheel 29 is exactly "on grade." Also a biasing means such as a spring (not shown) can be provided between the upper portion of sensor arm 20 and the closed end of sleeve 18 whereby positive bed engagement by wheel 28 can be ascertained.

From the above, it is obvious that the present invention has the advantages of providing an accurate, constant indication of the grade level conditions being prepared by the fine grading machine upon which such indicator is mounted. A further advantage of the present invention is to provide a relatively inexpensive, yet extremely accurate grade indication means which eliminates at least two workers that have heretofore been required to accurately determine whether acceptable fine grade levels are being prepared. Another advantage of the present invention is simplicity in operation and repair and yet extremely accurate in operation.

The present invention may, of course, be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

What is claimed is:

1. A high-low-on-grade level indicating system for use in conjunction with a road bed type fine grading machine adapted to operate on a grading surface, comprising: a support means rigidly mounted on said machine aft of its grading mechanism, said support means including at least one generally vertical hollow sleeve-like means; a sensor arm slideably mounted within said sleeve-like means and moveable up and down therein; ground engaging means operatively connected to said sensor arm for engaging the grading surface and moving said sensor arm vertically up or down in response to changes in grade detected by said ground engaging means as it traverses the grading surface; a plurality of switch means, including a series of individual switches, associated with said high-low-on-grade level system; switch manipulating means assigned with said sensor arm and operatively connected to said plurality of switch means for actuating respective switches of said switch means in response to the up or down movement of said sensor arm within said sleeve-like means; and a plurality of grade indicator means operatively connected to said switch means for indicating the grade level detected by said ground engaging means in response to the actuation of said switch manipulating means by the up or down movement of said sensor arm within said sleeve-like means resulting from corresponding up or down movement of said ground engaging means.

2. The level indicator system of claim 1 wherein the switch manipulating means is a depressed area in a portion of said sensor arm with cam shoulders on either side thereof for operation of the switch means.

3. The level indicator system of claim 1 wherein the grade indicator means are light indicators.

4. The level indicator system of claim 3 wherein the grade indicator lights are color coded for condition indication.

5. The level indicator system of claim 4 wherein the ground engaging means is a wheel-like roller means.

6. The high-low-on-grade level indicator of claim 2 wherein said hollow sleeve-like means includes an opening in the vicinity adjacent said depressed area and the cam shoulders; and wherein said plurality of switch means comprises three vertically spaced switches extending through said opening within said sleeve-like means and disposed closely adjacent the depressed area within said sensor arm and said cam shoulders such that said switches are engaged by said sensor arm except in the case where the depressed area horizontally aligns with a respective switch of said switch means.

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