March 17, 1970 E. C. NOLAN Re. 26,826

ULTRASONIC TYPE NET WEIGHT LOAD INDICATOR FOR VEHICLES

Original Filed June 10, 1968 2 Sheets-Sheet 1

FIG. 2

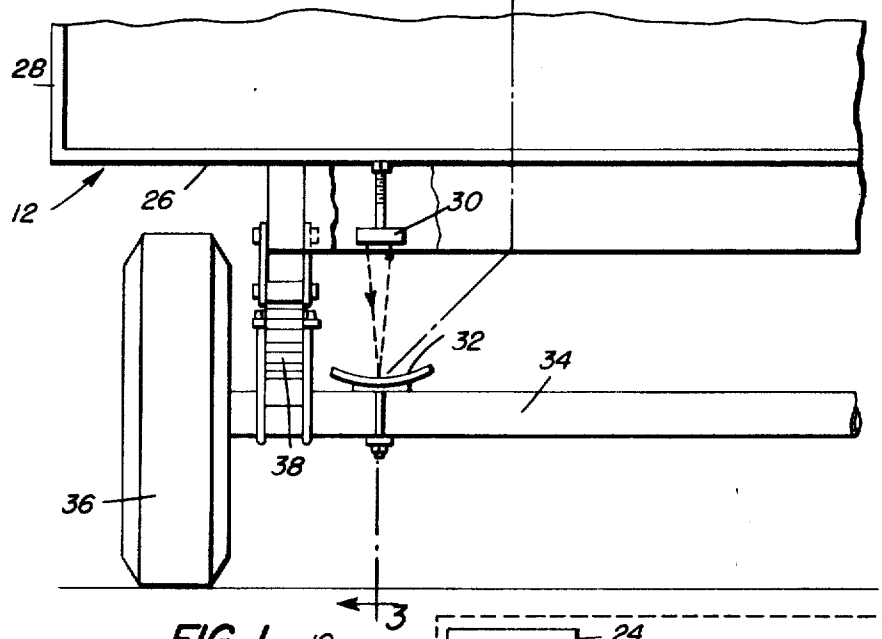
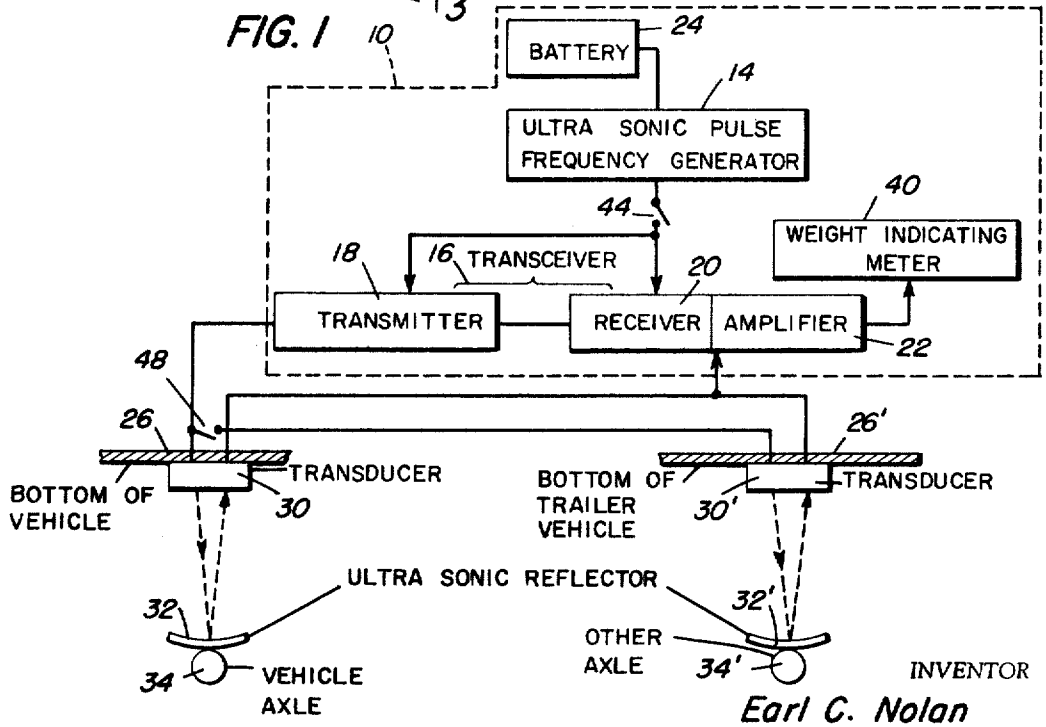


FIG. 1



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ULTRASONIC TYPE NET WEIGHT LOAD INDICATOR FOR VEHICLES

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FIG. 3

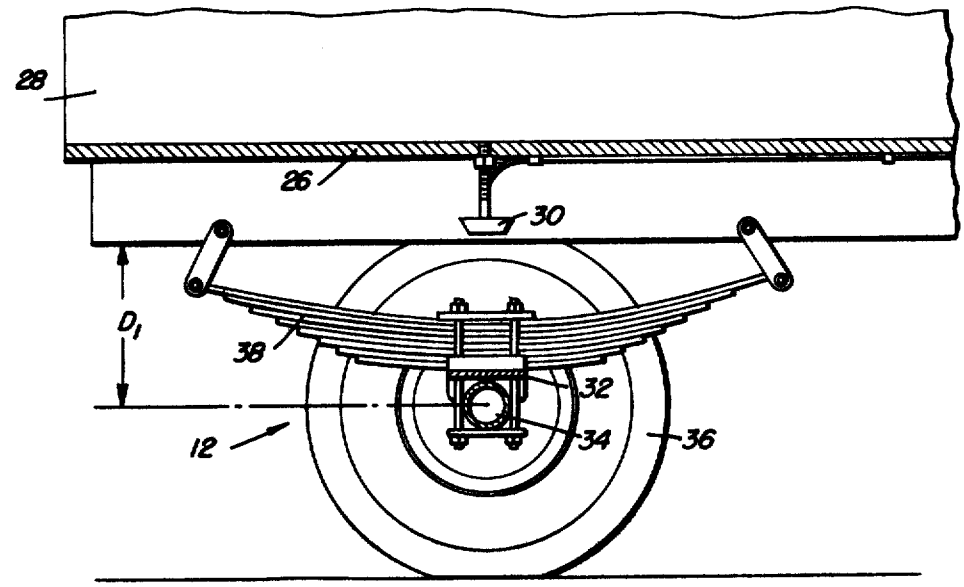
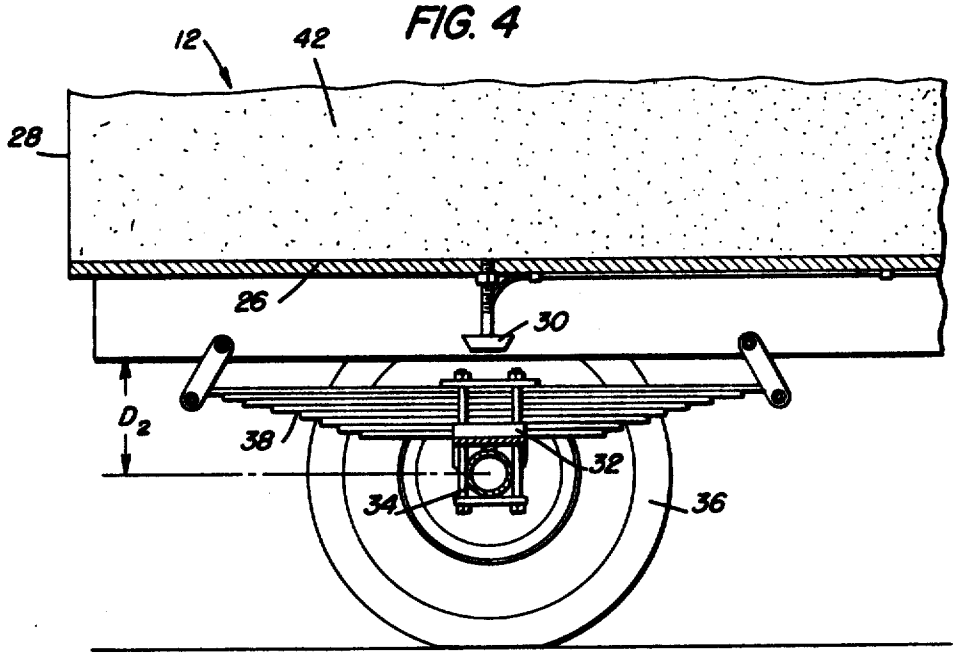


FIG. 4



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United States Patent Office

Re. 26,826
Reissued Mar. 17, 1970

26,826

ULTRASONIC TYPE NET WEIGHT LOAD INDICATOR FOR VEHICLES

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Original No. 3,428,139, dated Feb. 18, 1969, Ser. No. 735,824, June 10, 1968. Application for reissue Apr. 8, 1969, Ser. No. 824,004

Int. Cl. G01g *19/08, 19/12;* B60p *5/00*

U.S. Cl. 177—137 13 Claims

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

ABSTRACT OF THE DISCLOSURE

This invention is a weight load indicator for vehicles and measures the net weight of the load of a vehicle or the weight on each axle, on a meter weight indicator located in the cab of the vehicle. It includes an ultrasonic pulse generator which is operated, when desired, to send a burst of sound through a transceiver to a transducer. The transducer is located on the underside of the vehicle and a sonic reflector is mounted on the vehicle axle, there being springs on the axle supporting the vehicle body. The reflector is in the sonic path of the transducer. A meter, calibrated in weight, is connected to the transceiver, and the meter is thus actuated to reflect the time it takes for the sound to echo back from the sonic reflector to the transducer, which varies in proportion to the compression of the vehicle springs under the weight of the load thereon. One or more trailer vehicles may have their loads indicated in the tractor vehicle cab by having a second transducer and a second sonic reflector similarly mounted on the trailer vehicle underside and axle through a selective switch to the same transceiver and ultrasonic pulse generator, and to the same meter.

OBJECTS OF THE INVENTION

This invention has for an object to provide an improved means for indicating the net weight of the load on a vehicle or the total weight on an axle, as well as on one or more trailer vehicles, if present, the weight indication taking place in the cab of the tractor vehicle. A further object of this invention is to utilize the vehicle springs as the primary measure of the weight of the load, and to measure the compression of the vehicle springs by electronically measuring the varying time it takes for an ultrasonic sound to be echoed between the vehicle underside and sonic reflector mounted on the vehicle axle, and transmitting this time element to a meter calibrated in weight and located in the vehicle cab. If desired, a transducer and sonic reflector may be provided for each axle to indicate each axle load, as well as the net weight load.

BACKGROUND OF THE INVENTION

One of the great problems today is to prevent the overloading of heavy trucks which travel on the highways. There are limits set for each entire truck and for each axle of a truck. This makes it imperative that the operator know during loading of his truck when he is approaching the maximum load limit for the entire vehicle, and the maximum load for each axle. Furthermore, in order to keep maintenance to a minimum, the operator should keep the loads in his truck evenly distributed relative to the wheels thereof.

In connection with trucks and aircraft and other carriers, it is important that they be properly loaded so that they will carry maximum load properly distributed but without overloading the carrier. In particular connection

with trucks and such ground vehicles, practically all states have strict laws regulating total load and axle load and such states likewise having weighing stations where trucks passing through the state are required to weigh in. Severe penalties are invoked for overweight trucks and considerable delay is encountered in carrying out the weighing operations.

BRIEF DESCRIPTION OF THE FIGURES

With the above and related objects in view, this invention consists in the details of construction and combination of parts, as will be more fully understood from the following description, when read in conjunction with the accompanying drawing, in which:

FIG. 1 is a diagrammatic showing of the entire invention.

FIG. 2 is a fragmentary showing of the sonic transducer on the underside of a vehicle over a sonic reflector on the axle of the vehicle.

FIG. 3 is a side view of FIG. 2, the vehicle carrying no net load.

FIG. 4 is a view similar to FIG. 3, with a heavy load on the vehicle.

DETAILED DESCRIPTION OF THE INVENTION

There is shown at **10**, diagrammatically, the cab of a vehicle **12** to which this invention has been applied. In or adjacent the cab **10**, there is located an ultrasonic pulse frequency generator **14**.

The ultrasonic *frequency pulse* [sound] from generator **14** is picked up by a transceiver **16**, which includes a transmitter **18**, receiver **20** and amplifier **22**, all in circuit with a battery **24** which, for convenience, may be the battery of the vehicle **12**. Mounted on the underside or bottom **26** of the load body **28** of the vehicle **12** is a transducer **30** in a position directly over a sonic reflector **32**. The reflector **32** is mounted on a vehicle axle **34** on which the vehicle wheel **36** is journaled, and the axle **34** is provided with the spring **38** supporting the body **28**, the spring compressing in proportion to the load **42** placed on the body **28** between a minimum unloaded position shown in FIG. 3 to a maximum loaded position shown in FIG. 4, thus varying the distance between the transducer **30** and the sonic reflector **32** in proportion to the weight of the load **42**.

The transducer **30** is also in circuit through the receiver **20** to meter **40** calibrated to indicate weight and located in the cab **10**, a switch **44** being suitably located in the circuit within the cab **10**.

OPERATION OF INVENTION

In operation, if the invention is used only for informing the operator of the net weight of the load, the meter **40** is calibrated to indicate no weight when the vehicle is empty to the maximum weight when the vehicle **12** is fully loaded as in FIG. 4. When this information is desired, as while the vehicle **12** is being loaded, the driver, from time to time, closes the switch **44**, sending a burst of ultrasonic pulse, possibly of the nature of 15,000 per minute, from the generator **14** through the circuit of the transmitter **18** to the transducer **30**, and the ultrasonic sound goes from the transducer **30** to the reflector **32** and reflects or echoes back to the transducer **30**, the time for such echo varying according to the variation in the distance between the body botttom **26** and the axle **34** as determined by the compression of the spring **38**, thus being in proportion to the net weight of the load **42**. From the receiver **20**, the circuit goes to the weight indicating meter **40**. The driver thus can read his net weight immediately. If the vehicle **12** has a trailer vehicle **46** attached thereto, such trailer **46** has a second transducer **30'** on its bottom **26'**, with a sonic reflector **32'** mounted on the trailer axle **34'** and a

switch **48** is provided to switch the circuit from the first transducer **30** of the tractor vehicle **12** to the second transducer **30'** [on axle **34'**] on the trailer vehicle **46**.

Potentiometers are provided in the circuit to calibrate the scale of the meter **40** to fit each different loading situation normally encountered. Sensitivity of the meter **40** may be increased by adjusting the amplification **22** to the receiver **20**. In addition, this invention may be used for the total weight on each axle **34**, not only of the tractor vehicle **12**, but also of the trailer vehicle or vehicles **46**, by providing a transducer and reflector for each axle **34** and **34'** of each vehicle **12** and **46**, and a meter **40** or meters **40** suitably calibrated, to indicate the total load on each axle **34** and **34'**, thus enabling the driver to keep the weight of the axle load, during loading, within the legal limit permitted for each axle **34** and **34'**.

ABSTRACT OF THE DRAWING

In the drawings, like numbers refer to like parts, and for the purposes of explication, marshalled below are the numbered parts of the improved net weight load indicator for vehicles:

10—cab of **12**
12—vehicle
14—ultrasonic pulse frequency generator
16—transceiver
18—transmitter
20—receiver
22—amplifier
24—battery
26—underside or bottom of **28**
26'—underside or bottom of trailer
28—vehicle body
30—transducer
30'—second transducer on **26'**
32—sonic reflector
32'—second reflector on **34'**
34—axle
34'—second axle
36—wheel
38—spring of **12**
40—meter calibrated in weight
42—load
44—switch in circuit to meter **40**
46—[tractor] *trailer* vehicle
48—switch to select circuit to either transducer **30** or **30'**

Although this invention has been described in considerable detail, such description is intended as being illustrative rather than limiting, since the invention may be variously embodied.

Having thus set forth and disclosed the nature of this invention what is claimed is:

1. In connection with a road vehicle (**12**) having a body (**28**), a cab (**10**), springs (**38**) for supporting said vehicle body (**28**) on axles (**34**) on which wheels (**36**) are journalled, the improvement comprising an ultrasonic pulse frequency generator (**14**), an ultrasonic transceiver (**16**) exposed thereto, a transducer (**30**) mounted on the underside of the vehicle body (**28**) over an axle (**34**) in circuit with said transceiver (**16**), an ultrasonic reflector (**32**) mounted on said axle (**34**) in the sonic path of said transducer (**30**), a weight indicating meter (**40**) in circuit with said transceiver (**16**), and a circuit providing source of electricity (**24**) connected in circuit with said transceiver (**16**).

2. The combination of claim **1**, said transceiver (**16**) including a transmitter (**18**), a receiver (**20**), and an amplifier (**22**).

3. The combination of claim **2**, said circuit providing source of electricity being the vehicle battery (**24**).

4. The combination of claim **3**, said weight indicating meter (**40**) being located in the vehicle cab (**10**).

5. The combination of claim **4**, and a trailer vehicle (**46**) secured to said first vehicle (**12**), a second transducer (**30'**) in circuit with said transceiver (**16**) secured to the underside (**26'**) of the trailer vehicle over a trailer axle (**34'**) supporting the trailer body on springs (**38**), a second ultrasonic reflector (**32'**) mounted on the trailer vehicle axle (**34'**) in the sonic path of said second transducer (**30'**), and a circuit switch (**48**) located in said cab (**10**) of said first vehicle (**12**) for selectively completing the circuit from said transceiver (**16**) to either said first transducer (**30**) or to said second transducer (**30'**).

6. The combination of claim **4**, and a second sonic reflector ([**32**,] **32'**) mounted on a second axle ([**34**,] **34'**), and a second transducer ([**30**,] **30'**) mounted on the vehicle underside ([**26**,] **26'**) in the sonic echo path of said second reflector ([**32**,] **32'**), and a switch (**48**) for connecting said second transducer ([**30**,] **30'**) in place of said first transducer (**30**) in circuit to indicate the weight on the second axle ([**34**,] **34'**).

7. The combination of claim **6**, said second axle (*34'*) [(**34**)] being a second axle (**34'**) on [the] same vehicle (**12**) to thus indicate axle loading.

8. The combination of claim **6**, said second axle (**34'**) being *an* [a second] axle (**34'**) on [the] *a* trailer vehicle (**46**) to thus indicate the load on said axle (**34'**) of the *trailer* [tractor] vehicle (**46**).

9. A system for measuring the weight of a load comprising,

(a) a support for the load,

(b) spring means interposed between the support and a base and yieldable under load,

(c) means for initiating bursts of compressional wave energy at one end of a path and receiving the energy at the termination of the path,

(d) said path including the distance extending between a fixed station on the support and a fixed station on the base,

(e) and means for measuring the elapsed time of travel of the energy between the ends of the path for indicating the weight of the load.

10. The system of claim 9, wherein the means for receiving the energy at the termination of the path is located at one of the stations.

11. The system of claim 9, wherein the means for initiating bursts of compressional wave energy includes a generator of compressional wave energy of an ultrasonic frequency located at one of the fixed stations.

12. The system of claim 9, wherein the support for the load is the body of a wheeled vehicle and the base is an axle having wheels journaled thereon.

13. The system of claim 12, wherein the means for directing bursts of energy includes a generator of compressional waves at an ultrasonic frequency mounted at one of said stations.

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U.S. Cl. X.R.

177—210; 340—1