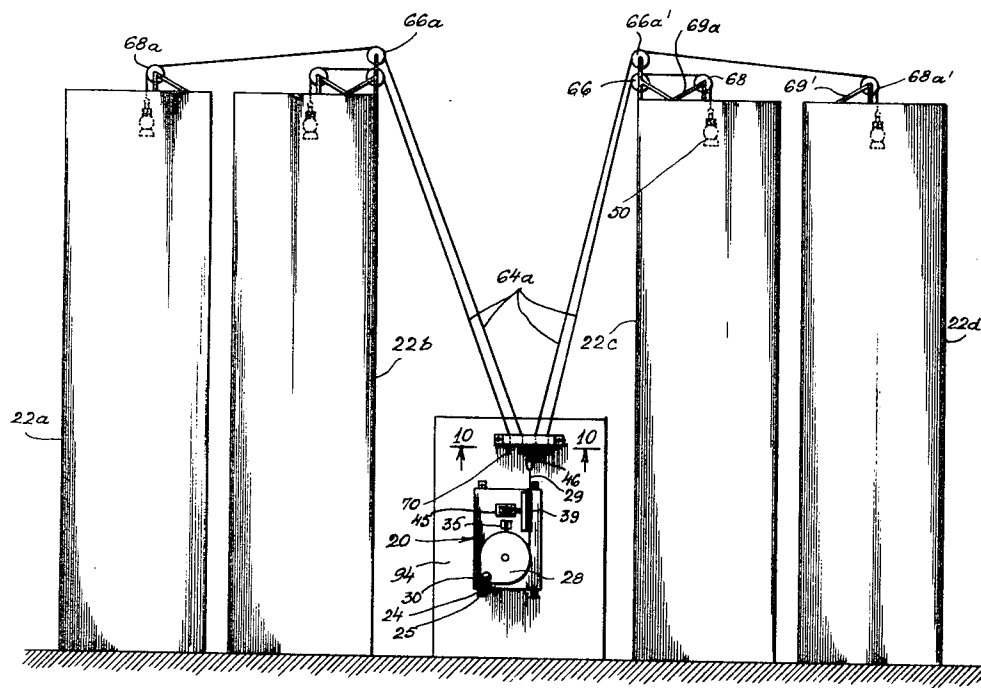


[72] Inventor **Ward H. Parsons**  
**1202 Green Glen Road, Birmingham, Ala.**  
**35216**  
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*Primary Examiner*—William D. Martin, Jr.  
*Attorney*—Polachek and Saulsbury

[54] **LEVEL MEASURING DEVICE FOR A CONTAINER OF BULK MATERIAL**  
**9 Claims, 16 Drawing Figs.**  
[52] U.S. Cl..... **33/126.5,**  
**33/138, 73/321**  
[51] Int. Cl..... **G01b 3/00**  
[50] Field of Search..... **33/126.5,**  
**126 R, 137, 138; 73/321**  
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**ABSTRACT:** A measuring device comprises a plate on which is mounted a digital counter, a pulley driving the counter, and a reel on which is wound a line. The line terminates in a coupling member engageable with a coupling member at the end of another line. The other line is entrained over sheaves carried by a framework on a silo. A weighted bell is attached to the other line and is suspended over material in the silo. A bracket on the side of the silo engages the other coupling member. A plurality of other lines and coupling members entrained over other adjacent silos can be provided. A bracket on a support for the plate will engage the other coupling members so that any one can be selected for engaging the first coupling member. The plate can be detachable mounted on the support for removal and mounting on another remote support.



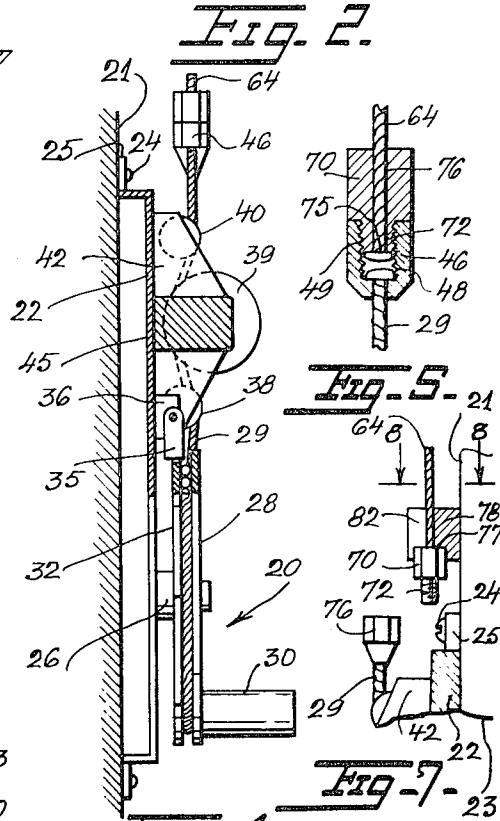
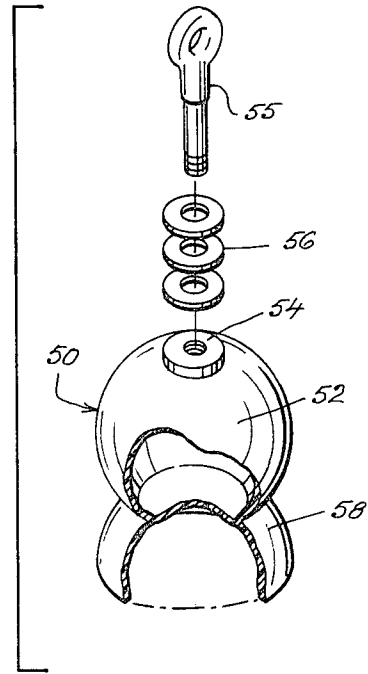
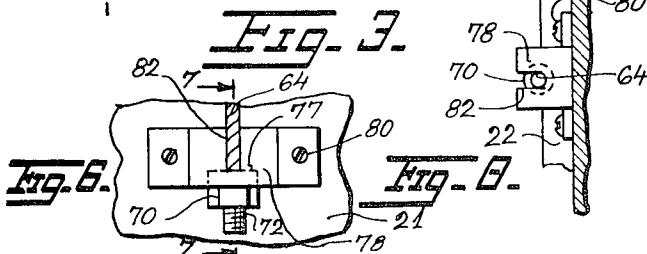
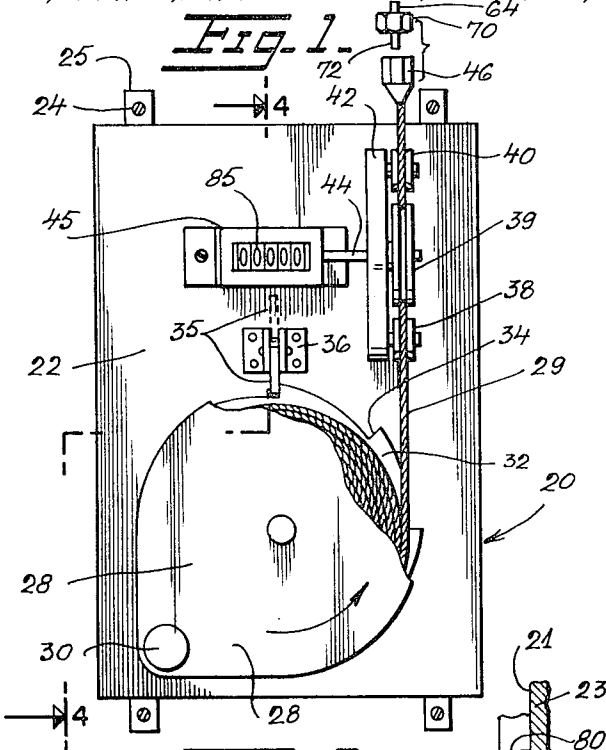
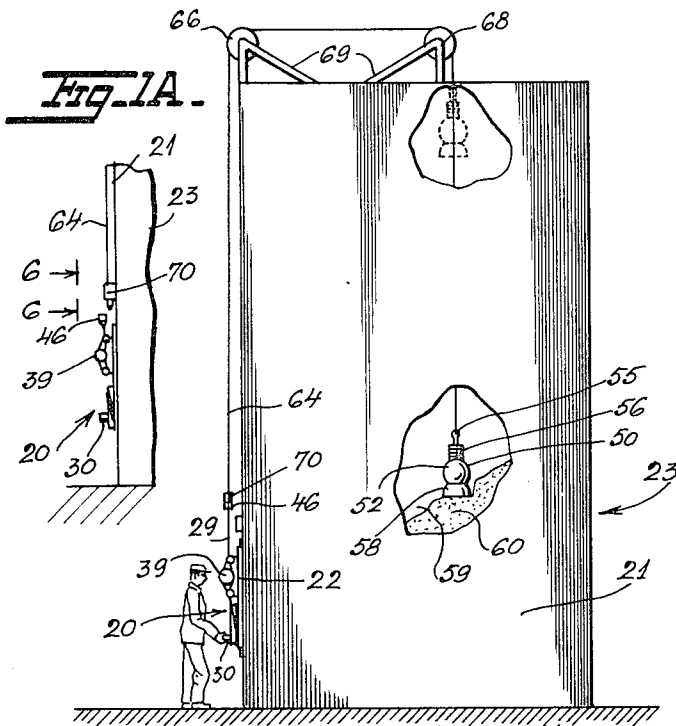
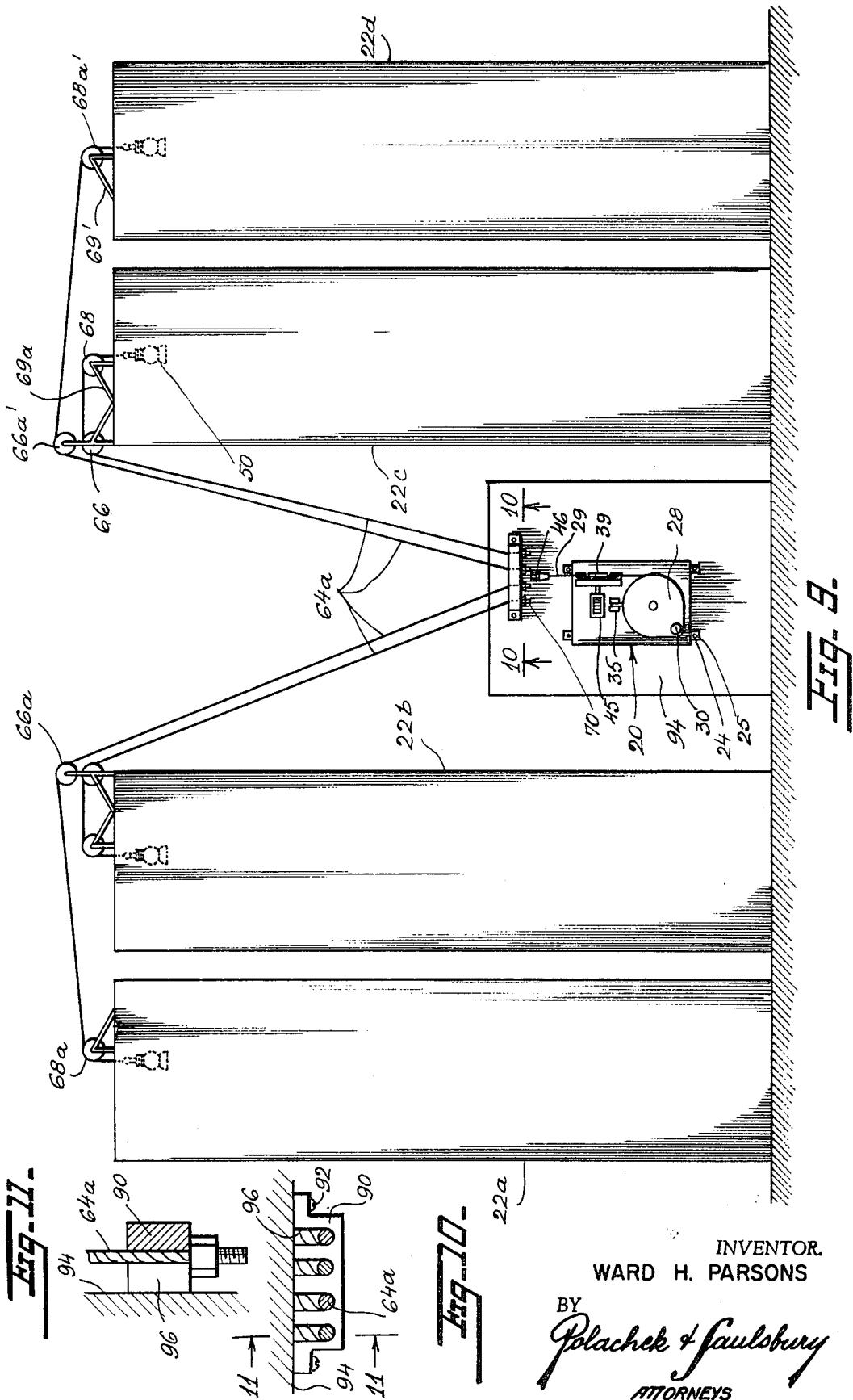


**Fig. 4.**

INVENTOR.  
WARD H. PARSONS

BY  
*Polachek & Saulsbury*  
ATTORNEYS



INVENTOR.  
WARD H. PARSONS

BY  
*Polachek & Faulstich*  
ATTORNEYS

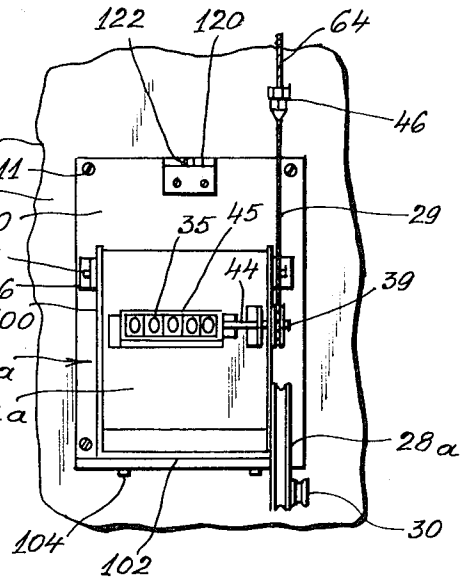
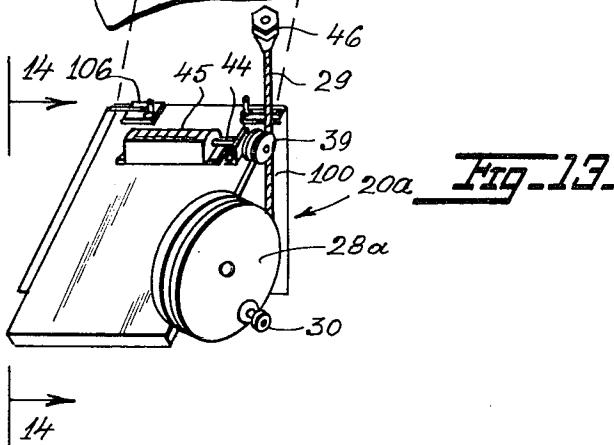
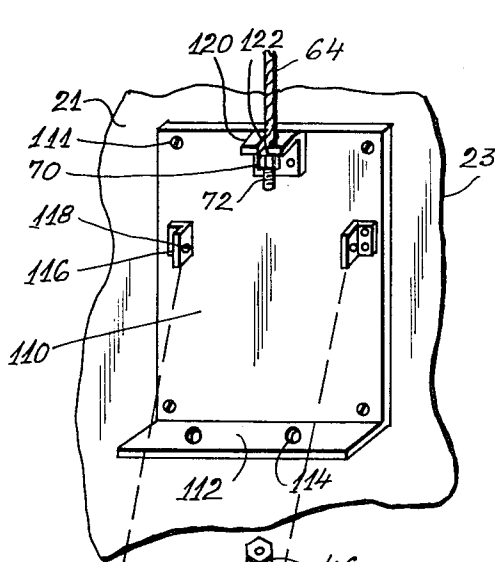


**Fig. 12.**

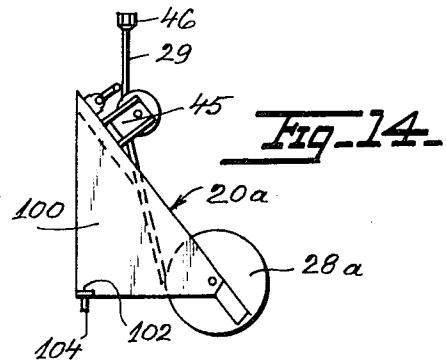


**Fig. 14.**

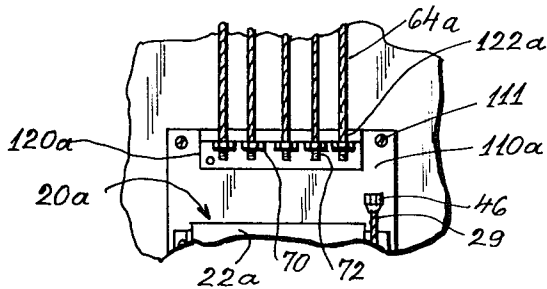


**Fig. 15.**

INVENTOR.  
 Ward H. Parsons  
 BY  
*Polachek & Faulstich*  
 ATTORNEYS

# LEVEL MEASURING DEVICE FOR A CONTAINER OF BULK MATERIAL

This invention concerns a level measuring device for a container such as a silo, vat, bin or the like.

Devices heretofore commercially available for measuring the level of material in a bulk container such as silo have generally been quite complicated and expensive. Their use has therefore been impractical in remote locations. Consequently, the level of material in a silo has been determined by a person climbing to the top of a silo and dropping a rope or tape into the silo until it touches the material stored therein, and then measuring the length of the rope. There is a large measure of danger in this method because of the height of the silo. The present invention avoids this situation.

The present invention has a principal object provision of a relatively simple, inexpensive device for measuring the level of material in a bulk container, hereinafter referred to as a silo, while the operator stands on the ground.

A further object is to provide a device which can quickly measure the levels of material in a plurality of adjacent silos.

Another object is to provide a portable level measuring device for a silo containing bulk material.

According to the invention the device comprises a plate or board mountable on the side of a silo. On the plate is rotatably mounted a reel carrying a first rope or line. The line terminates in a quickly attachable first coupling member. The line is entrained around a pulley which is coupled to a mechanical, digital counter also mounted on the plate. A sheave or pulley assembly is mounted on top of a silo. A second line is engaged on the sheave assembly and terminates at one end in a second coupling member quickly engageable with the coupling member on the first line. The second coupling member is engaged at a bracket mounted on a side of the silo. The other end of the second line terminates in a weighted bell suspended over the material in the silo. When the two coupling members are mutually engaged with each other, the first and second lines can be played out by turning the reel while the counter indicates digitally the length of line passing the counter. Meanwhile the weighted bell is being lowered into the silo. When the bell reaches the level of material in the silo and stops descending, the reading on the counter is the distance from the level of material to the top of the silo. Since the height of the silo is known, the height of material in the silo is determined by subtracting the reading of the counter from the known height of the silo. Alternatively the height of the silo can be set on the counter, and as the line is played out the reading of the counter can reduce. Then when the line stops playing out, the reduced reading of the counter will be the correct height of the material in the silo, and no computation will be required.

The device can readily be removed from the silo and mounted on another silo, or it can service several silos which are located close together and which are each provided with a sheave assembly, line and weighted bell. The lines of all silos will terminate in coupling members which can be engaged on a single bracket.

The invention will be explained in further detail in connection with the drawing, wherein:

FIG. 1 is side view of a silo provided with a level measuring device embodying the invention, portions of the silo wall being broken away.

FIG. 1A is a fragmentary view similar to a part of FIG. 1 showing disengaged coupling members.

FIG. 2 is an exploded perspective view of parts of the weighted bell employed with the device of FIG. 1.

FIG. 3 is an enlarged front elevational view of the device, the coupling members being shown disengaged as in FIG. 1A.

FIG. 4 is a vertical sectional view taken on line 4—4 of FIG. 3, the coupling members being shown mutually engaged.

FIG. 5 is a further enlarged sectional view taken through the engaged coupling members.

FIG. 6 is an enlarged side elevational view of the bracket on the side of the silo engaging a line and coupling member, taken on line 6—6 of FIG. 1A.

FIG. 7 is a vertical sectional view taken on line 7—7 of FIG. 6.

FIG. 8 is a fragmentary horizontal sectional view taken on line 8—8 of FIG. 7.

FIG. 9 is a side elevational view of the device of FIG. 1, shown in association with a plurality of silos.

FIG. 10 is an enlarged horizontal sectional view taken on line 10—10 of FIG. 9.

FIG. 11 is a vertical sectional view taken on line 11—11 of FIG. 10.

FIG. 12 is a front view of another device embodying the invention.

FIG. 13 is an exploded perspective view of parts of the device of FIG. 12.

FIG. 14 is a side view of part of the device taken on line 14—14 of FIG. 13.

FIG. 15 is a fragmentary front elevational view similar to a part of FIG. 12 showing an arrangement for engaging multiple lines.

Referring first to FIGS. 1—8, there is shown a level measuring device 20 comprising a rectangular board or plate 22 which is removably secured to the sidewall 21 of an axially vertical silo 23 by means of screws 24 engaged in brackets 25 near corners of the plate. Mounted on the plate is a bearing 26. A reel 28 is rotatably journaled on the bearing. A line 29 is wound up on the reel as best shown in FIGS. 3 and 4. The reel has a handle 30 by means of which it is manually turned. The reel has an inner flange 32 formed with peripheral teeth 34 which engage a stop member 35 pivotally mounted by bracket 36 on the plate. The free end of the line is entrained in front of a pulley 38, behind a pulley 39 and in front of a pulley 40. The pulleys 38, 39 and 40 are rotatably carried by a pulley frame 42 on plate 22. Pulley 39 is carried by a shaft 44 which extends laterally from a digital counter 45 mounted on plate 22. The line 29 terminates in a coupling member 46. As best shown in FIGS. 5, this may be an internally threaded nut. A head or knot 48 on the end of line 29 is engaged in the bottom of bore 49.

The device further includes a weighted bell 50 best shown in FIGS. 1 and 2. The bell has a spherical upper portion 52 formed with a threaded hole 54 in which is engaged the lower threaded end of eye 55. A plurality of massive rings 56 may be engaged on the shank of the eye to increase the weight of the bell. The bell has a lower hemispherical portion 58 which digs into the surface 59 of granular material 60 in silo 23 as shown in FIG. 1, and comes to rest on this surface. Attached to eye 55 is one end of another line 64. This line is entrained over pulleys or sheaves 66, 68 carried by a framework 69, at the top of silo 23. Pulley 68 is located near the central axis of the silo while pulley 66 is located over sidewall 21. The other end of line 64 is secured in another coupling member 70. As best shown in FIG. 5, this coupling member has a threaded bolt or stud 72 at its free end which engages in threaded bore 49 of coupling member 46. Line 64 has a knot or head 75 at its free end. The line extends through a bore 76 in member 70 and head 75 abuts the bottom end of stud 72. The two coupling members can be quickly engaged with each other and just as quickly detached.

When coupling members 46 and 70 are disengaged as shown in FIGS. 1A, 3, 6, 7 and 8, coupling member 70 seats in a recess 77 formed in bracket 78. This bracket is secured to sidewall 21 of the silo by screws 80. A slot 82 is formed in the body of the bracket so that line 64 can be engaged laterally in the bracket. The tension on line 64 imposed by bell 50 holds the coupling member 70 in recess 77. Line 64 can be quickly disengaged from the bracket and coupling member can then be engaged with coupling member 46 as shown in FIGS. 1, 4 and 5.

In operation of the device, the stop member 35 can be turned upwardly as indicated by dotted lines in FIG. 3 to disengage teeth 34 of flange 32. Then the reel 28 can be turned counterclockwise as viewed in FIG. 3 to play out line 29. If pulley 39 has a circumference of one foot, then digits 85 in

counter 45 will indicate in feet the length of line 29 played out until bell 50 come to rest on material 60. If the counter is set so digits 85 indicate the height of the silo, and if the counter then reduces in indication as pulley 39 turns, then the final reading of the counter will be actual height of the material 60 in the silo.

The device 20 can be detached from the sidewall of the silo by disengaging screws 24, and can be carried to the site of another silo for measuring the height of material therein. The other silo will be provided with another line 64 coupling member 70, bracket 78, bell 50 and other parts of the assembly as shown FIGS. 1 and 2.

FIGS. 9, 10 and 11 show measuring device 20 used in association with a plurality of silos 22a-22d. Lines 64a all terminate at coupling members 70 which are engaged underneath bracket 90. This bracket is secured by screws 92 to a support 94 such as a vertical fence, wall or the like. Slots 96 may be formed in the back of the bracket to facilitate engaging the lines on the bracket before it is attached to support 94. Device 20 on support 94 is the same as already described in connection with FIGS. 11-8.

At the tops of silos 22a and 22d are single pulleys or sheaves 68a, 68a' supported by frameworks 69'. Pulleys 66a and 66a' are mounted on frameworks 69a carried by silos 22b and 22c respectively for carrying the lines from silos 22a, 22d. Frameworks 69a also carry pulleys 66 and 68 for their own lines 64. Each line 64a terminates in a weighted bell 50. By this arrangement any one line 64a terminates in a weighted bell 50. By this arrangement any one line 64a can be selected. The coupling member 70 of the selected line will be engaged with coupling member 46 of device 20 without disengaging the selected line 64a from bracket 90. Counter 45 will read the height of material in the selected silo as line 29 is played out as explained in connection with FIGS. 1-8. The advantage of the arrangement of FIG. 9, is that single measuring device 20 serves to service a plurality of silos.

FIGS. 13, 14 and 15 show another portable level measuring device 20a. Parts corresponding to those of device 20 are identically numbered. Device 20a can replace device 20 in the arrangements of FIGS. 1 and 9. Device 20a has a baseplate 22a on which is mounted counter 45 as in device 20. On shaft 44 of the counter is mounted pulley 39. Reel 28a is mounted on plate 22a and rotates in a plane perpendicular to the plane of the plate. This contrasts with the device 20, where reel 28 rotates in a plane parallel to the plate 22. Line 29 is wound on reel 28a and is entrained behind pulley 39. Line 29 terminates in coupling member 46.

Secured to plate 22a at lateral edges thereof are triangular sideplates 100. Extending downwardly from bottom flanges 102 joining the sideplates are spaced pins 104. Mounted on plate 22a near upper corners thereof are two slide bolts 106.

A mounting plate 110 is provided for the device 20a. This plate can be secured by screws 111 on silo wall 21. Plate 110 has a bottom flange 112 formed with holes 114 to receive pins 104. Two further angle brackets or flanges 116 are mounted near lateral edges of plate 110. Flanges 116 have holds 118 to receive the slide bolts 106. A bracket 120 is secured near the upper edge of plate 110. This bracket has a slot 122 in which is engaged the lower end of line 64 on which is secured coupling member 70.

Device 20a can be quickly mounted on plate 110 without using any tools by inserting pins 104 into holes 114 in flange 112, and engaging slide bolts 106 in holes 118 of flanges 116. The sideplates 110 serve to dispose plate 22a at an angle to plate 110 and to allow room for turning reel 28a. Coupling members 46 and 70 can be engaged with each other for determining the height of material in a silo 23 in the same manner as described in connection with device 20. Plate 110 will remain in place when device 20a is removed. This contrasts with the arrangement of device 20 where mounting plate 22 must be unscrewed from silo wall 21.

FIG. 15 shows mounting plate 110a provided with a bracket 120a having multiple slots 122a for engaging a plurality of

lines or cables 64a thereon. Each cable has a coupling member 70 on its lower end similar to the arrangement of FIG. 9. Any one of lines 64a can be selected for determining the height of material in the silo associated with the selected line.

In all forms of the invention described, quick detachable coupling members are provided so that the measuring device is separable from the container of material to be gauged. Thus one portable measuring device can service a plurality of silos at the same or different locations.

What is claimed is:

1. A level measuring device for a container of bulk material, comprising a plate mountable at a side of the container; a digital counter on said plate; a pulley carried by the plate and operatively engaged with the counter for progressively advancing digit indicators thereof when the pulley is turned; a reel rotatably carried by the plate; a first line wound on the reel and entrained on said pulley, said line being unwindable when the reel is turned; a first coupling member on the free end of the line quickly engageable with another coupling member at the end of another line entrained over said container for measuring the depth of material in the container; a weighted bell; another line engaged at one end thereof with said bell; a framework mounted on top of said container and carrying a sheave; said other line being entrained over the sheave and suspending said bell over material in the container; another coupling member at the other end of the line; and a bracket on said side of the container engaging said other coupling member to hold the bell suspended over said material, whereby the first and other coupling members can be mutually engaged and the reel can be turned to unwind the first line while the pulley turns and the counter indicates digitally the length of the first line passing the counter.

2. A level measuring device as defined in claim 1, wherein said reel is disposed to turn in a plane parallel to the plane of said plate.

3. A level measuring device as defined in claim 1, wherein said reel is disposed to turn in a plane perpendicular to the plane of said plate.

4. A level measuring device as defined in claim 1, further comprising another plate attachable to a support; and means for engaging the first named plate on said other plate, whereby the first named plate can be detached from said other plate while the first named plate remains attached to said support.

5. A level measuring device as defined in claim 1, further comprising further plates secured to opposite lateral edges of the first named plate so that said first plate is disposed angularly to said other plate, said reel being mounted on said first plate to rotate in a plane perpendicular to the plane of the first plate.

6. A level measuring device as defined in claim 1, further comprising releasable stop means engageable with said reel to prevent turning the reel and unwinding the first line.

7. A level measuring device as defined in claim 1, further comprising a plurality of weighted bells; a plurality of other lines each engaged at one end thereof with one of said bells; a plurality of frameworks each mounted on top of a different container; a plurality of sheaves carried by the respective frameworks; each of said other lines being entrained on the sheaves of at least one framework with each one of the bells suspended over a different one of the containers; a plurality of other coupling members being releasable engaged on said bracket for selectively engaging said first coupling member, whereby the reel can be turned to unwind the first line while the bell of a selected line descends in a selected container and the pulley turns the counter to indicate digitally the length of first line passing the counter.

8. A level measuring device as defined in claim 7, wherein said reel is disposed to turn in a plane parallel to the plane of said plate.

9. A level measuring device as defined in claim 7, further comprising another plate attachable to a support; and means for engaging the first named plate on said other plate, whereby the first named plate can be detached from said other plate while the first named plate remains attached to said support.