Jan. 27, 1970 C. D. HAYS ET AL 3,492,428

COIN LEVEL INDICATOR FOR COIN OPERATED APPARATUS

Filed Sept. 8, 1966 2 Sheets-Sheet 1

FIG. 1

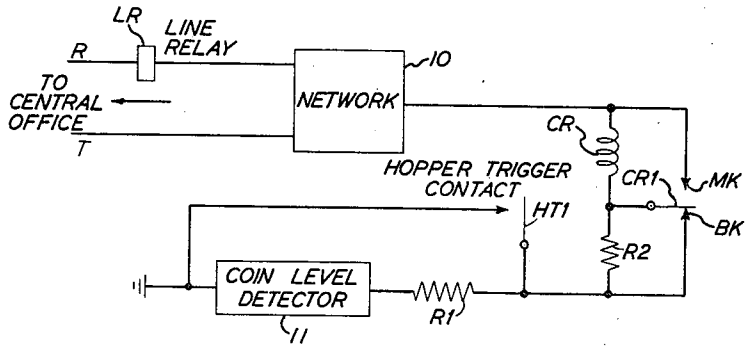
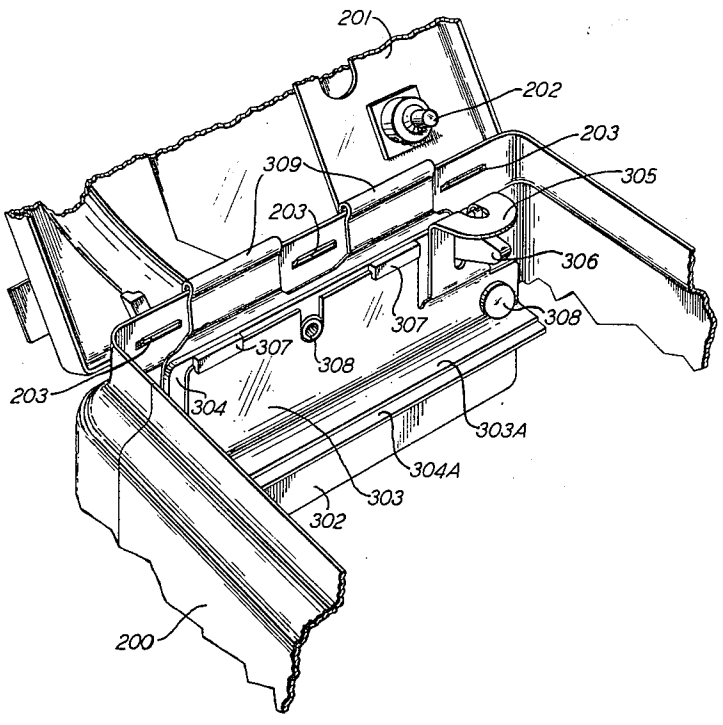


FIG. 2



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FIG. 3

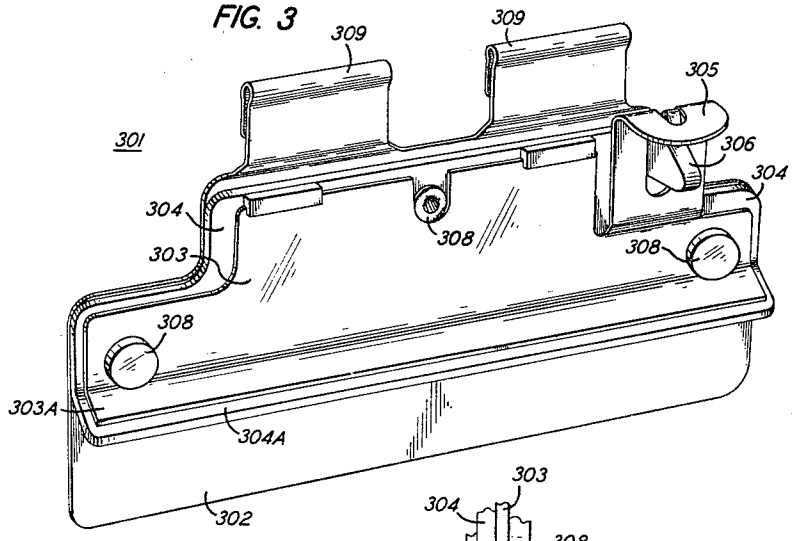


FIG. 6

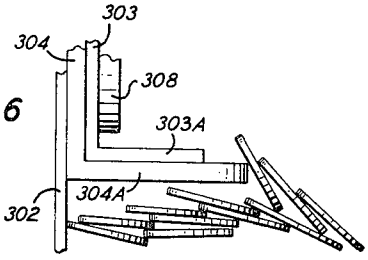


FIG. 4

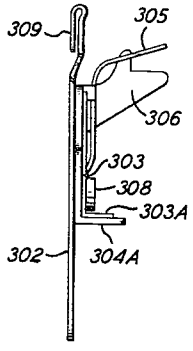


FIG. 7

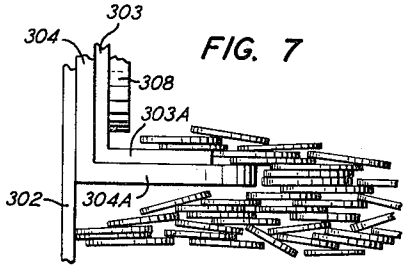
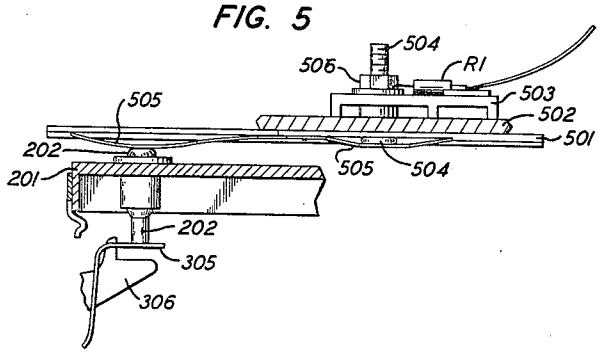


FIG. 5



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COIN LEVEL INDICATOR FOR COIN OPERATED APPARATUS

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8 Claims

ABSTRACT OF THE DISCLOSURE

In a cash receptacle for coin operated apparatus, an arrangement for the remote detection of the level of coins in the receptacle is provided by a dual element sensor which includes two substantially flat plate members affixed to the inside of one side of the receptacle. The plates are insulatedly separated from each other and at least one of the plates is insulatedly separated from the receptacle so that at a predetermined level, coins in the receptacle complete a short circuit path between the plates. Means are provided for detecting the completion of the indicated short circuit.

This invention relates to telemetering systems and more particularly to arrangements for sensing and indicating to a remote location a particular level of collection in the cash receptacle of coin operated apparatus.

A disadvantage share by virtually all coin operated devices from vending machines to telephones is that unpredictable usage patterns make it impossible to establish a fully efficient schedule of cash collections. Collections made too frequently fail to take advantage of the full capacity of the cash receptacle and accordingly, are economically wasteful in terms of man hours spent by the human route collectors. On the other hand, collections made too infrequently are at least equally undesirable in that full cash boxes may result in damaged or inoperative equipment that causes customer dissatisfaction and loss of revenue.

It has long been realized that the problems indicated could be met readily by the use of a telemetering system that has the capability of sensing when collected coins fill some preselected substantial fraction of the cash receptacle and the capability of transmitting to some remote control point a suitable signal indicia of this condition. With most coin operated apparatus the cost of providing a communication channel makes any form of a telemetering system prohibitively expensive. In the case of coin telephones, however, a communication channel in the form of telephone lines is available at no extra cost. Understandably, a substantial portion of the prior art in this area lies in the field of coin operated telephones. Patent 1,571,692 issued to P. G. T. DeVilliers. Feb. 2, 1926 is illustrative.

A number of prior art arrangements rely on completing a conducting path to ground through the accumulated coins as soon as the coins reach some predetermined level in the box. It is known, for example, to employ a conductor in the form of a probe which is mounted through one side of the cash box and which protrudes into the approximate center of the box. When the apex of the normally conical coin stack contacts the probe, a short circuit path to ground, which may be the bottom of the box, is completed through the coins. The coins tend to shift around slightly, however, with each additional deposit. This condition, coupled with the comparatively very

limited conducting area of the probe, tends to make the short circuit path intermittent for some undertermined period and therefore unreliable as an indicator of the level of the accumulated coins. Additionally, one or more coins at the top of the stack are often supported in an edgewise position by leaning against the probe, causing a premature signal. Subsequent deposits tend to knock the leaning coins down, adding further to the unreliability of the shorting path.

Accordingly, a broad object of the invention is to increase the efficiency of collecting accumulated deposits of coins from coin operated apparatus.

A more specific object is to increase the reliability of coin level detecting arrangements.

Another object is to avoid any reduction in the physical security of a coin receptacle resulting from the installation of a coin level detecting system.

These and other objects are achieved in accordance with the principles of the invention by the utilization of a substantially flat dual element sensor plate that includes a signal plate and a ground plate separated by an insulating plate. The ground plate is clipped flat against the rear wall of the coin receptacle and is in electrically conductive contact with the receptacle cover. The cover in turn bears against a grounded portion of the surrounding vault. The ground plate extends into the lower portion of the coin receptacle and its relatively large surface is exposed to contact with deposited coins as soon as the coin stack starts to build. The signal plate and insulating plate are affixed to the upper portion of the ground plate at a preselected level and triggering of a monitoring circuit occurs whenever the coin level is sufficient to establish a short circuit path through the coins from the signal plate to the ground plate.

One key aspect of the invention relates to the size of the two coin contacting members, the signal plate and the ground plate, which cover a substantial portion of one wall of the coin receptacle in contrast to prior art arrangements that utilize cylindrical probes. Not only is contact reliability enhanced by increasing the contact area with the deposited coins by several orders of magnitude, but also, the reduction in coin storage capacity attendant to the use of probes is virtually eliminated.

In accordance with a particular feature of the invention the lower edge of the signal plate is bent outwardly forming a ledge to facilitate good contact pressure between the coins and the signal plate. The underside of the ledge is protected from conducting contact with the coin stack by a similar ledge formed by the insulating plate. As a result, signaling reliability is enhanced when the coin level exceeds the preselected level and complete protection is provided against those temporary and therefore unrealiable conducting paths that might otherwise be established between the signal plate and the ground plate by edge-balanced or leaning coins.

Another feature of the invention pertains to the relation between the coin level detector apparatus and the coin telephone control circuitry that ensures complete isolation of the detector apparatus whenever uncollected coins are present in the coin hopper. This arrangement avoids the possibility of any interference with normal coin control by the coin level detector apparatus.

One particularly attractive feature relates to the ease with which a conventional coin telephone may be modified to include a coin level detection arrangement in accordance with the invention. The necessary elements may be supplied in kit form and the assembly and installation can readily be accomplished within a few minutes with minimum technical skill.

The principles of the invention as well as additional objects and features thereof will be fully apprehended from

the following detailed description of an illustrative embodiment and from the drawing in which:

FIG. 1 is a simplified schematic circuit diagram of a coin telephone that includes a coin level detector arrangement in accordance with the invention;

FIG. 2 is a perspective view of a coin level detecting arrangement assembled in a coin receptacle;

FIG. 3 is a perspective view of the dual element sensor plate;

FIG. 4 is a side view of the sensor plate shown in FIG. 3;

FIG. 5 is a side view partially in cross section of the cover of the coin receptacle, the top of the coin receptacle vault and certain structural elements of the coin level detecting arrangement affixed thereto;

FIG. 6 is a side view of a portion of the sensor assembly of FIG. 3 showing coins in the receptacle before contact is made with the signal plate; and

FIG. 7 is a side view of a portion of the sensor assembly of FIG. 3 showing coins in the receptacle after contact is made with the signal plate.

The simplified schematic telephone circuit diagram of FIG. 1 shows a conventional telephone speech network **10** connected across subscriber lines R and T with a line relay LR in the ring lead R. A path to ground from the network **10** is provided through the coin relay CR, the armature actuated switching member CR_1 of the coin relay, the break contact BK, resistor R1 and the coin level detector **11**. In accordance with the invention, the coin lever detector **11** completes the path to ground as described only when the level of coins collected in the coin receptacle exceeds some predetermined height. Irrespective of whether the coins in the coin receptacle exceed the predetermined height, however, the operation of the hopper trigger contact HT1, which is acuated conventionally by the deposit of any coin, shunts the coin level detector **11** and its associated resistor R1, thus, in effect, removing it from the circuit. The path to ground through the operated hopper trigger contact HT1 is detectable by the operator in the central office and is an indication that a coin or coins have been deposited in the hopper and that neither collection nor refund has been effected.

When the coin relay CR is operated by a suitable pulse from the central office to effect either coin collection or coin refund, the hopper trigger contact HT1 is reset in a well-known manner by associated apparatus, not shown; the path shunting the coin level detector **11** and resistor R1 is opened and the central office is once again able to determine whether or not the coin collection level in the coin receptacle has been exceeded by the presence or absence of a circuit to ground through the coin level detector **11**.

Resistor R1 limits the flow of current to ground and effects a detectable voltage drop when the path to ground is completed through the coin level detector **11**. Resistor R2 is conventional and its purpose is to limit the current flow to ground when the coin relay CR is shunted by the path through the coin relay armature switch CR_1 and its make contact MK. In summary, from a circuit standpoint, a conventional coin telephone station circuit in order to utilize a coin level detecting arrangement in accordance with the invention, need only be modified by the addition of the coin level detector **11** and resistor R1 in the manner indicated in FIG. 1.

The key element of a coin level detector in accordance with the invention is a dual element sensor plate **301** shown in FIG. 3. The sensor includes an electrically conducting ground plate **302**, an electrically conducting signal plate **303** and an insulating plate **304** sandwiched between. The lower edge of the signal plate **303** is bent outwardly to form a substantially horizontal ledge **303A**. A similarly protruding ledge **304A** is formed from the lower portion of the insulating plate **304**. It should be noted in particular that the insulating ledge **304A** extends slightly beyond the ledge **303A** of the signal plate as shown clearly in FIGS. 6 and 7.

The signal plate **303** also includes a slotted tab **305** partially bent over an insulating tab **306** that limits the distance that the tab **305** may be depressed. The upper edge of the signal plate **303** is positioned by insulating clips **307—307**, and the entire sensor assembly is fixed rigidly together by fasteners **308—308**. The upper portion of the ground plate **302** terminates in a pair of integral clip members **309—309**.

As shown in FIG. 2 the clips **309—309** permit the sensor assembly **301** to be affixed simply yet securely to the rear wall of the coin receptacle **200**. In FIG. 2 the cover **201** of the coin receptacle **200** is shown in the open position pivotally secured to the coin receptacle **200** by tabs **203—203** inserted in accommodating slots in the upper portion of the rear wall of the coin receptacle. When the cover **201** is closed, electrical contact is made between the cover and the clips **309—309**. When the coin receptacle **200** is inserted in its protective enclosing vault in the conventional manner, the receptacle cover **201** is in electrically conducting contact with the vault **502**, a portion of which is shown in FIG. 5. The vault **502** is a main structural part of the telephone and accordingly remains at ground potential.

OPERATION

From the foregoing it is seen that in the absence of coins in the receptacle **200**, the ground plate **302** is at ground potential and is completely insulated from the signal plate **303**. As the level of coins in the receptacle **200** increases as additional coins are deposited, the top of the coin stack eventually contacts the insulating ledge **304A** as shown in FIG. 6. Conducting contact with the signal plate **303** cannot occur, however, until the coins exceed the height of the ledge **303A** at which point they form a conducting path between the ground plate **302** and the signal plate **303** as shown in FIG. 7. Once such contact is made, it is maintained inasmuch as intermittent or temporary contact between the signal plate and the coin stack that might otherwise be caused by edge-balanced or temporarily leaning coins is avoided in accordance with the invention by the relative positioning of the ledges **304A** and **303A** as shown in FIG. 6. The ledge **303A** serves an additional function in that its horizontal surface ensures the aid of gravity in maintaining good electrical contact with the coins in physical contact therewith as shown in FIG. 7.

The final extension of ground potential to the terminal of resistor R1 by the coin level detector **11**, as shown in FIG. 1, may be traced in FIG. 5. A conducting path is formed from the tab **305** of the signal plate **303** to a lug **202** which is in contact therewith when the cover **201** of coin receptacle **200** is closed. The lug **202** is mounted in an accommodating hole in cover **201** but is insulatedly separated therefrom. A conducting spring **505** is in electrically conducting contact with the top of the lug **202**, and is insulated from the top of the vault by an insulating strip **501**. A weld stud **504** attached to the conducting spring secures the spring **505** and strip **501** to the underside of the top of the coin telephone vault **502** and provides electrical continuity to a small nonconducting circuit board member **503** which is held in place on the upper surface of the vault **502** by the stud **504** and its associated nut **506**. The resistor R1 is mounted on this terminal board and its lead is in electrical contact with the stud **504**.

It is to be understood that the embodiment described herein is merely illustrative of the principles of the invention. Various modifications thereto may be made by persons skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A coin operated telephone station comprising, in combination,
a receptacle for deposited coins,
a speech network connectable across a telephone line,
a source of reference potential,
first circuit means in said receptacle for completing a first electrical path from said reference potential through deposited coins to said network and thence to said telephone line whenever the coins in said receptacle exceed a preselected level, and
second circuit means including a hopper trigger contact responsive to the deposit of coins for completing a second electrical path from said reference potential to said network and thence to said telephone line,
said second circuit means shunting said first circuit means whenever said hopper trigger contact is in the operated condition,
thereby effectively avoiding any possible interference with the coin control functions of said station by said second circuit means.

2. A coin operated telephone station comprising, in combination,
a speech network connectable across a telephone line,
a source of reference potential,
first circuit means responsive to the deposit of a preselected volume of coins for completing a conductive path from said source to said network and hence to said telephone line,
second circuit means including a hopper trigger contact responsive to the deposit of any coin for completing a conductive path to said network and hence to said telephone line,
said second circuit means shunting said first means whenever said hopper trigger contact is in the operated condition,
said hopper trigger contact remaining in the operated condition after the deposit of a coin or coins until the refund or collection of said last named coin or coins,
thereby avoiding any possible interference with said second circuit means by said first circuit means.

3. Apparatus in accordance with claim 2 including a coin receptacle,
said first circuit means comprising, in combination,
a first electrically conducting plate member affixed flat against the inside of one side of said receptacle and extending into the lower portion thereof,
an insulating plate covering the upper portion of said first plate,
first means connecting said first plate to said reference potential,
a second electrically conducting plate affixed to said insulating plate,
second means connecting said second plate to said network,
whereby deposited coins in said receptacle that reach the level of the lower portion of said second plate complete a conducting path between said first and second plates.

4. Apparatus in accordance with claim 3 wherein the lower edge of said insulating plate and the lower edge of said second pltae are bent outwardly to form a relatively narrow shelf,
the insulating plate portion of said shelf protruding beyond the second plate portion of said shelf,
whereby said insulating plate portion of said shelf avoids intermittent conducting paths that might otherwise be formed by temporarily edge-on or leaning coins,
and whereby said second plate portion of said shelf

ensures gravity enhanced electrical contact between said shelf and coins resting thereon.

5. Apparatus in accordance with claim 3 wherein said second connecting means includes at least one resisttive element.

6. Apparatus in accordance with claim 3 wherein the upper portion of said first plate terminates in at least one clip member that secures said first plate to said side of said receptacle.

7. Apparatus for electrically detecting the level of coins in a coin collection receptacle comprising, in combination,
a source of reference potential,
a first electrically conductive plate exposed to conductive contact with coins in said receptacle below a preselected level,
a second electrically conductive plate exposed to conductive contact with coins in said receptacle above said level,
said plates normally being insulatedly separate,
whereby, an electrically detectable conductive path between said plates is established through deposited coins whenever the coins in said receptacle exceed said preselected level,
wherein the lower edge of said second plate forms a shelf portion extending out from the plane of said plates,
insulating means covering the underside of said shelf portion and extending beyond said shelf portion,
thereby precluding intermittent and unreliable conducting paths between said plates that might otherwise be formed by temporarily edge-balanced or leaning coins.

8. A coin level detecting arrangement for coin operated apparatus, comprising, in combination,
a box-like coin receptacle,
a first conductive plate member vertically disposed in said receptacle,
a second conductive plate member insulatedly separated from said first member and vertically disposed in said receptacle,
said first member being exposed to electrically conductive contact with coins in said receptacle up to a predetermined level,
said second member being exposed to electrically conductive contact with coins in said receptacle above said level,
means connecting one of said members to a reference potential,
whereby coins in said receptacle complete an electrically detectable conductive path to said reference potential whenever the level of coins in said receptacle exceeds said level, the lower edge of said second member being formed into a substantially horizontal ledge, at least a portion of the underside of said ledge being insulatedly protected from conductive contact with deposited coins,
thereby preventing completion of said conductive path by coins balanced edge-on or leaning against the underside of said ledge.

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