Aug. 10, 1965 M. R. UHLIG 3,200,388

WATER LEAKAGE ALARM SYSTEM

Filed Aug. 12, 1960

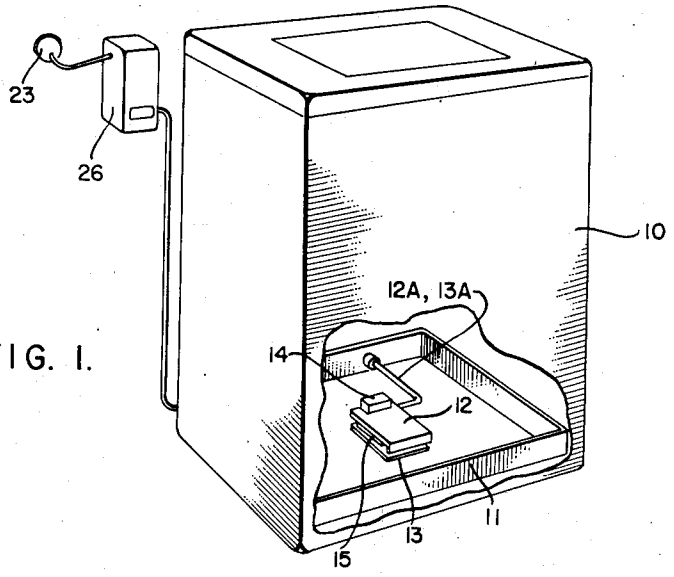


FIG. 1.

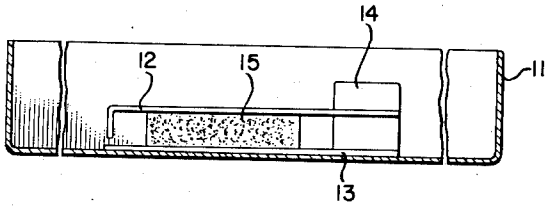
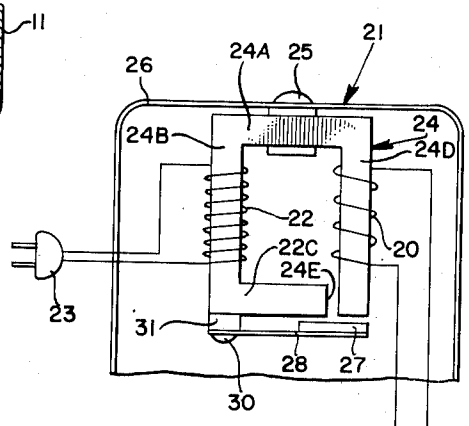
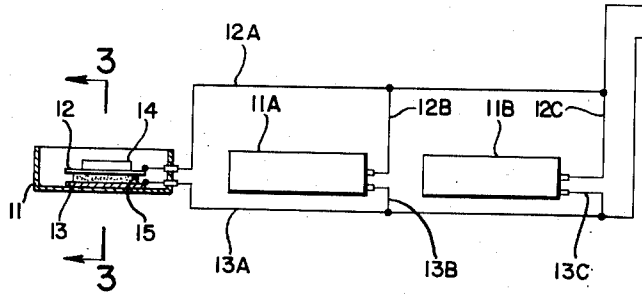


FIG. 3.

FIG. 2.





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United States Patent Office 3,200,388 Patented Aug. 10, 1965

3,200,388

WATER LEAKAGE ALARM SYSTEM

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Filed Aug. 12, 1960, Ser. No. 49,328
1 Claim. (Cl. 340—242)

The present invention relates to improved signalling systems and in particular to a new and improved system for producing a signal in response to an accumulation of water under undesirable conditions such as, for example, below washing machines and other similar appliances.

Briefly as illustrated, the system involves an alarm comprising a transformer having its primary winding connected to a suitable A.C. source and having its secondary winding connected to a pair of electrodes. Normally, a substantially non-conductive path exists between such electrodes but such path is made sufficiently conductive in the presence of water to load the transformer and produce a relatively large amount of magnetic flux in the core of the transformer. Such relatively large flux causes vibration of a spring-mounted armature to produce a noise signal. This noise signal is amplified by a sounding board effect which is accomplished by mounting a transformer core on a suitable resonating housing.

It is therefore an object of the present invention to provide an improved system of this character in which water leakage produces a sound alarm.

Another object of the present invention is to provide a system of this character in which a signal alarm may be actuated by one of a plurality of electrode systems placed under corresponding appliances where water leakage may possibly be expected.

Another object of the present invention is to provide a system of this character which is relatively simple and inexpensive.

Another object of the present invention is to provide a system of this character in which the electrodes, after wetting, may be reconditioned for subsequent use.

Another object of the present invention is to provide a system of this character in which the sensing element is supplied with relatively low voltage so as to minimize any danger from electric shock or fire hazard.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claim. This invention itself, both as to its organization and manner of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

FIGURE 1 illustrates a system embodying features of the present invention in relationship to an appliance illustrated for purposes of exemplificaton as a closed washing machine.

FIGURE 2 illustrates the electrical circuitry and general physical arrangement of the electrical elements in the system shown in FIGURE 1.

FIGURE 3 is generally a sectional view taken on the line 3—3 in FIGURE 2.

Referring to the drawings, FIGURE 1 illustrates the system associated with a closed washing machine **10** although it is understood, of course, that the system may be associated with any other appliance or apparatus which in use may possibly leak a fluid. For example, the system may be used to detect leakage of fluid from a malfunctioning appliance such as a hot water heater, an electric dish washer, a wash basin or the like. The present system is particularly useful in these instances since due to faulty fabrication, installation or wear, it is observed that appliances of this class are often located in such a manner that small leaks are not visible but remain unnoticed until extensive damage occurs. These conditions are obviated by the present system which senses the water leakage and causes an audible alarm to be produced.

The water-sensing means is positioned, for example, in a tray or water receptacle **11** and such sensing element comprises a pair of electrodes **12** and **13** preferably in the form of cantilever-supported spring elements having adjacent ends thereof secured in an insulating block **14** as, for example, by molding the spring electrode elements **12** and **13** in a plastic block **14**.

Normally, there is a relatively large resistance or impedance between such electrodes **12** and **13** and this may be established by providing a water-soluble substance **15** between the electrodes **12** and **13** to normally maintain the same spaced apart. When there is an accumulation of water in the receptacle **11**, the substance **15**, which may, for example, be sugar, melts or dissolves and the resiliency of the spring elements **12** and **13** causes engagement between the electrodes **12** and **13** to complete a circuit to the alarm device described later. The substance **15** may take other forms; for example, the same may be a water-deformable spacer made from cellulose fibres impregnated with a suitable salt that dissolves rapidly in water to form a conductive electrolyte. In this latter instance the electrodes **12** and **13** may not be resilient but simply comprise rigidly spaced electrodes. When the substance **15** comprises porous fibres impregnated with common sodium chloride salt, the same may be re-used after drying, in which latter case it offers a high impedance which degenerates into a sufficiently low impedance when wetted.

These electrodes **12** and **13**, as illustrated in FIGURE 2, are connected to leads **12A** and **13A** which sealingly extend through a side wall of the pan or receptacle **11** and such leads **12A** and **13A** are connected to opposite terminals of a low-voltage secondary winding **20** of a combined transformer and alarm **21**. Preferably one of such leads **12A**, **13A** is grounded, lead **13A** being shown grounded for this purpose. The primary winding **22** of transformer **21** has its terminals connected to a conventional wall plug **23** insertable in the usual 115-volt household receptacle.

These windings **20** and **22** are wound on a common laminated magnetic core member **24** which is affixed as, for example, by a rivet **25** to a sound-resonating housing **26**. This housing **26** in turn may be resiliently mounted on a wall adjacent the appliance **10**. The core member **24** is an open-frame core member having four legs **24A**, **24B**, **24C** and **24D** arranged in a generally rectangular pattern but with the leg **24C** shortened to provide the air gap **24E** between legs **24C** and **24D**. A spring-mounted armature **27** is mounted adjacent such air gap **24E** on the free end of a cantilever-supported spring **28**, the spring **28** having one end thereof affixed to the core member **24** as, for example, by a screw **30** with a spacing washer **31** between the spring element **28** and the core member **24**.

In operation of the system, in the absence of water in

the pan **11**, there is a relatively high impedance between electrodes **12** and **13** and consequently only an insignificant amount of current flows through the secondary winding **20** and primary winding **22**. However, in the presence of water in the pan **11** the initial high impedance between electrodes **12** and **13** degenerates into a low impedance, in which case a transformer **21** is loaded, i.e. a relatively high current flows through the windings **20** and **22**, with the result that a relatively high magnetic flux is established in the core **24** and particularly in the air gap **24E** to cause the armature **27** to be attracted in the direction of the air gap. However, such movement of the armature **27** is controlled by the spring **28** such that the armature **27** vibrates, and in some cases periodically contacts the core legs **24C** and **24D** to produce a sound or noise which is transmitted through the core to the sound-resonating chamber **26**, the latter serving generally as a sounding board for producing an enhanced sound alarm. Thus, a person's attention is directed to water leakage and he has an opportunity to remedy the same. The armature **27** vibrates under the conditions mentioned above since the core **24** has a magnetic flux which is periodically of maximum value and of minimum value in accordance with the maximum and minimum values of the alternating current wave flowing through the primary winding. When such current builds up to its maximum value, the flux increases and the armature **27** is attracted against the action of spring **28**; and when the current decreases, the flux decreases to a value where it is insufficient to overcome the force of spring **28** and such spring **28** causes the armature **27** to move to its position shown in FIGURE 2. Since the alternating current is periodic there will be a periodic attraction of the armature **27** causing it to vibrate.

The system will operate with one or more of such electrode systems **12, 13** connected to the secondary winding **20**. This is illustrated in FIGURE 2 wherein like water receptacles **11A** and **11B** each having like electrodes therein are connected by corresponding leads **12B, 13B** and **12C, 13C** to opposite terminals of secondary winding **20**. These receptacles **11A, 11B** may be placed under different appliances and in such case it will be appreciated that when there is an accumulation of water in any one of the receptacles **11, 11A** or **11B**, an audible alarm signal is developed as previously described.

While the particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications

may be made without departing from this invention in its broader aspects and, therefore, the aim in the appended claim is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

A water leakage alarm system of the character described comprising: a transformer having a primary and a secondary winding, each of said windings being wound on an open magnetic core, said magnetic core having an air gap therein, a vibratory armature supported on said core adjacent said air gap, and impedance means having its impedance changeable in the presence of water connected to said secondary winding to control magnetization of said core and vibration of said armature, said magnetic core having four legs arranged generally in a rectangular pattern, a resonant housing secured to one of said legs, said air gap being in a leg of said magnetic core which is opposite to said leg to which said housing is secured, said armature being supported on said leg in which said air gap is located, said vibratory armature bridging said air gap and being normally spaced from said air gap with the armature being attracted to said core member when said impedance means is changed in the presence of water to produce a sound which is transmitted through the core structure to said resonant housing which encompasses said core structure and said armature.

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