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[54] **PORTABLE EQUIPMENT SECURITY SYSTEM**

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[51] **Int. Cl.** **G08b 13/22**
[58] **Field of Search** ..... 340/280, 282, 276, 340/261, 258 D; 73/71.2; 324/47

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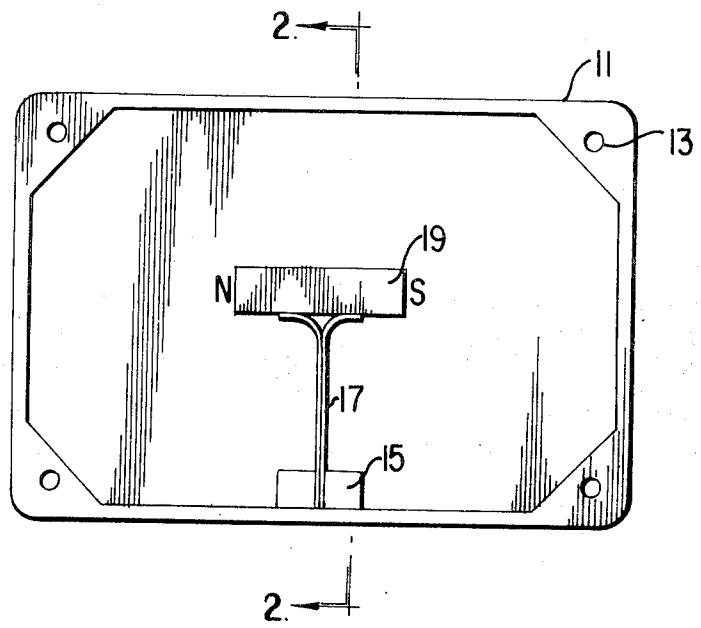
[57] **ABSTRACT**

A portable security equipment system having a magnet means mounted on the equipment to be monitored. The magnetic means is supported by means such as a spring so as to vibrate or oscillate at a substantially fixed frequency in response to acceleration caused by movement of the equipment. A magnetometer is located so as to detect the modulation of the magnetic field caused by the vibration of the magnet.

7 Claims, 6 Drawing Figures



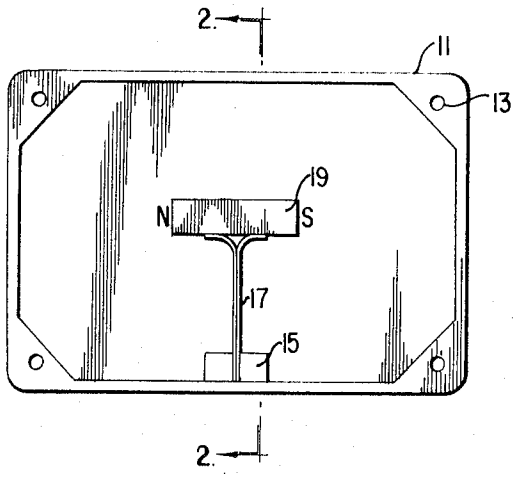


FIG. 1

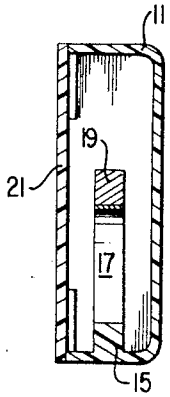


FIG. 2

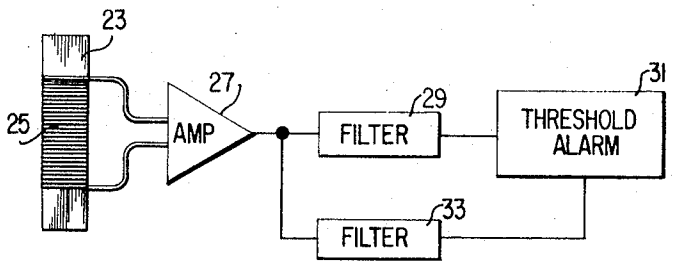
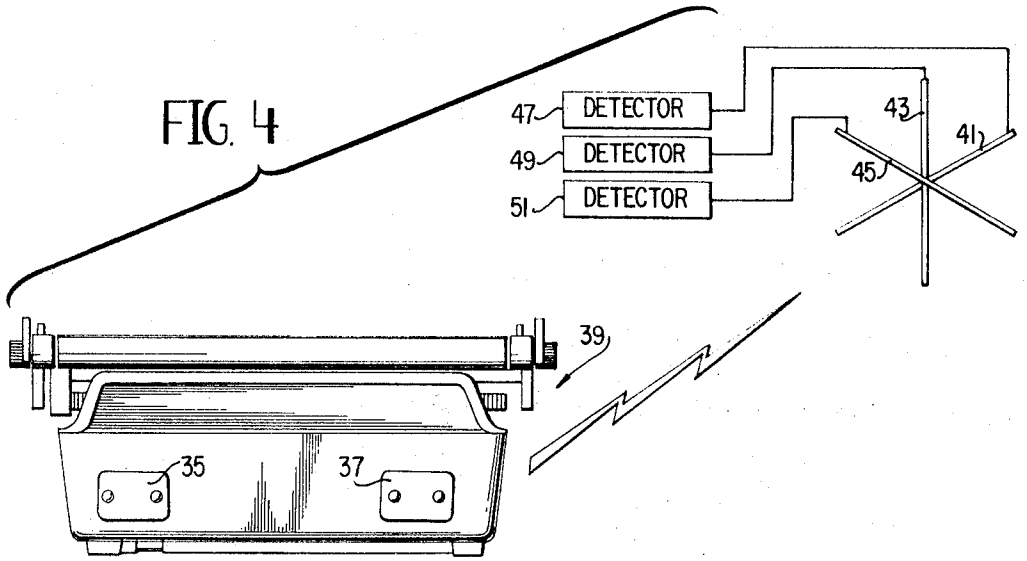


FIG. 3

FIG. 4



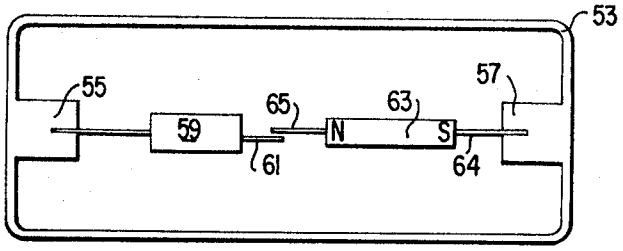


FIG. 5

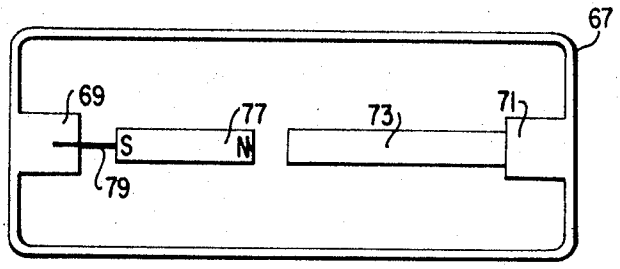


FIG. 6

PORTABLE EQUIPMENT SECURITY SYSTEM

The present invention relates generally to security systems for the prevention of theft of portable equipment and more specifically to a passive device included or attached to said system for providing a signal indicative of the movement of said equipment.

One of the major theft problems which occur in offices and office buildings is the removal of portable equipment such as typewriters, calculators, dictating machines and the like from the buildings during the hours in which the premises are not occupied.

Many systems have been devised to combat thefts of all types including thefts of portable equipment as described above. Two major approaches have been used, one being the detection of a person or persons entering an unoccupied space at an unlawful time and subsequently triggering devices which may provide alarms either locally or at remote points. This type of detection system is well-known and has a disadvantage in that it can often be disabled so as to prevent any such alarm being indicated. Additionally, installation is relatively expensive.

A further approach has been to make direct wire connections to all equipment so that movement of the equipment would require a breaking of the connection, and this breaking would trigger an alarm. One of the problems involved with using this type of alarm system with portable equipment is that, obviously, the electrical connections would have to be provided at a large number of places since the equipment is often moved from place to place within the office or building during working hours.

It is therefore an object of this invention to provide a means for detecting the movement of any transportable equipment when such movement is not desired.

A further object of the invention is to provide a means for detecting a movement of transportable equipment which involves the use of a passive device mounted on or incorporated in the equipment itself.

Yet another object of the invention is to provide an elastically supported magnetic means either attached to or incorporated in the equipment which vibrates at a predetermined frequency and means located within an area adjacent said equipment for detecting the magnetic field variation caused by movement of the instrument.

These and other objects of the invention will become apparent from the following description taken in conjunction with the drawings wherein

FIG. 1 shows a housing, with a cover removed, including the magnet and support means therein;

FIG. 2 is a sectional view taken along the lines 2—2 of FIG. 1;

FIG. 3 is a schematic representation of a means for detecting the signal output of the device of FIG. 1;

FIG. 4 is a representation of a typewriter having two of the devices such as FIG. 1 mounted thereon together with a representation of one type of detection system which might be used with the device of the present invention; and

FIGS. 5 and 6 are schematic representations of modifications of magnetic means and supports therefor.

Broadly speaking, the present invention comprises a completely passive signalling device consisting of a magnet or magnetic means having a north pole at one end and a south pole at the other end which is elastically supported by means such as a spring or springs so that it is free to vibrate or oscillate about its rest position with a known frequency of vibration. This magnetic means-spring assembly is supported by a frame or enclosed within a housing made of non-magnetic material with the housing being constructed so as to be easily fastened or concealed within a piece of transportable property such as an office machine. Located in a vicinity wherein the device would have to be moved to remove it from the office or the building is a detecting device such as a magnetometer or other suitable magnetic field detector which is responsive to the vibration of the magnetic means inevitably caused by the acceleration occurring during transportation of the piece of equipment.

Turning now more specifically to the drawings, there is shown in FIGS. 1 and 2 a housing 11 of non-magnetic material having enclosed therein the device of the present invention. The housing of FIG. 1 is shown with the outer cover removed. The cover is fitted thereto and may be attached thereon by means such as internally threaded holes 13 which then desirably would be secured with non-removable screws or the like.

Mounted within the housing on a fixed mount 15, which could be integral with the housing itself, is an elastic supporting material 17 such as a spring steel reed or the like. Secured to the other end of reed 17 is a magnetic means such as permanent magnet 19. The magnet may be secured to the reed in any wellknown manner such as adhesives or the like. FIG. 2 is a sectional view which shows the cover 21 in place on the housing proper.

The elastic means for supporting the magnetic means such as the spring steel reed 17 is designed so as to provide a substantially predetermined frequency of vibration of the magnet when ever dislocation of the housing 11 occurs. Thus, any inevitable small acceleration which occurs on movement of the property as it is moved from one place to the other, will produce the predetermined vibration frequency of the magnet and a corresponding modulation in the magnetic field surrounding the area in which the device or equipment is being carried.

With such a modulation occuring, any detecting device such as the magnetometer shown in FIG. 3 may be used for sensing the magnetic field variations occasioned by the vibration of the magnet. The device of FIG. 3 includes a pick-up loop comprising a ferrite rod 23 and coil 25 with the output of the coil being delivered to an amplifier 27. By constraining the response of the detector to the oscillation frequency of the magnet through the use of an output filter 29, the detector becomes relatively insensitive to unwanted frequency signals thus reducing the probability of false alarms. The output of the filter may be used to trigger any indicating device such as threshold alarm 31.

It will be readily seen that two or more magnets vibrating or oscillating at different frequencies may be mounted on or in a piece of equipment and used in conjunction with two or more corresponding filters in the detecting device. Such a further filter 33 is shown in FIG. 3. The threshold alarm is designed so that it will be triggered only by an output from all the filter circuits before identification of the particular equipment is confirmed. The use of a plurality of filters further reduces the probability of false alarms.

The indication of a back view of a typewriter **39** of FIG. **4** is shown as having two of the magnetic means **35** and **37** mounted thereon. It is to be understood that these means could be enclosed in the same housing or they could be concealed because of their small size within the housing. As indicated above, any number thereof could be used.

If desired, a magnetometer system having a non-directional response may be used. One such system is shown in FIG. **4** wherein three magnetometers are arranged in opposed direction, or orthogonally, so as to have a directionally sensitive response. In this manner, at least one of the magnetometers will detect the magnetic field created by the magnetic means in the equipment in a favorable aspect no matter what the orientation of the magnetic means may be as it passes the check point. Again, separate detectors **47, 49, 51** are shown and may comprise the type of circuit as shown in FIG. **3** or any other well-known acceptable detector circuit.

FIGS. **5** and **6** show modifications of the magnetic means which among others may be used in practicing the present invention.

FIG. **5** shows a housing **53** made of non-magnetic material and having a first fixed mount **55** and a second fixed mount **57** located therein.

A heavy weight **59** is secured to fixed mount **55** by means of a spring steel reed **60.** A magnet **63** is secured to the second fixed mount **57** also by means of a spring steel reed **64.** Extending from the free end of the heavy weight is a non-metallic rigid finger **61** and extending from the free end of the magnet is a rigid finger **65** which is so arranged that the finger **61,** as moved by the heavy weight during vibration, will pluck the finger **65** so as to cause the magnet **63** to vibrate.

It will be seen that the use of a device such as shown in FIG. **5** will enhance the vibration amplitude of the magnet. This is done by having the spring steel reed **60** supporting heavy weight **59** designed so as to provide a frequency of vibration of the weight at a low frequency such as for example 2.0 Hz. The spring steel reed **64** supporting the magnet is designed so as to provide a frequency of vibration of the manegt at a higher frequency such as for example 10 Hz.

Therefore, as heavy weight **59** moves up and down under the influence of movement, the non-metallic rigid finger **61** tends to pick or pluck against the rigid finger **65** in the free end of the magnet **63** thus forcing it to vibrate at its fixed higher frequency, i.e., 10 Hz, by imparting energy to it from the heavy weight **59** which is vibrating at the lower frequency.

FIG. **6** shows a further modification which includes the non-metallic housing **67** having two fixed mounts **69** and **71** therein. A soft iron shaft **73** is mounted rigidly on fixed mount **71** in close proximity to a magnet **77** which is mounted by a spring steel reed **79** to fixed mount **69.**

This arrangement tends to enhance the magnetic circuit and increase the field strength so that it may be detected at a distance greater than that of a normal vibrating magnet. Since the magnet swings close to and then away from the soft iron shaft, the field at a distance would vary more markedly.

As will be obvious, the present invention provides a simple and yet very effective method of protecting against theft of small portable objects. In effect, with most offices, only one detector would be required since the width of a normal hallway does not exceed the distances in which the field modulation is detectable.

It should be noted that the reference to a substantially fixed frequency includes a narrow band of frequencies. This is necessary since the frequency will vary slightly depending upon the physical position of the magnet as the equipment is being moved. That is, it will vary between positions wherein the magnet is hanging downwardly, oriented sideways or vibrating over the top of the reed.

It is to be understood that the above description and drawings are illustrative only since specific components may be substituted without departing from the scope of the invention as defined in the following claims.

I claim:

1. A system for detecting transportation of portable equipment comprising

a housing for mounting on said equipment;

at least one permanent magnetic means;

elastic means for supporting said permanent magnetic means in said housing;

said elastic means allowing said permanent magnetic means to vibrate at a predetermined frequency in response to minimal accelerations of said equipment; and

magnetic field detection means without said housing and remote from said magnetic means and responsive to said predetermined frequency of vibration of said magnetic means, said detection means being nonresponsive to a substantially stable magnetic field.

2. The system of claim **1** wherein said permanent magnetic means comprises

a plurality of magnets; and

said elastic means comprises a plurality of springs equal in number to said magnets, said springs supporting said magnets so that each of said magnets vibrates at a predetermined frequency different from each of said other magnets.

3. The system of claim **2** wherein said magnetic field detection means comprises

a detector for detecting the frequency of vibration of each of said magnets.

4. The system of claim **1** wherein said magnetic detection means comprises

a plurality of magnetometers having their axes of favorable response positioned in varying directions whereby at least one of said magnetometers will respond to the magnetic field created by the vibration of said magnetic means regardless of the orientation of said magnetic means.

5. The system of claim **1** wherein said elastic means comprises

a spring steel reed mounted between said magnetic means and said housing.

6. The system of claim **1** further comprising

a weight;

a spring steel reed for supporting said weight in said housing;

a finger extending outwardly from said magnetic means;

a pick extending outwardly from said weight in plucking relationship with said finger.

7. The system of claim **1** further comprising

a soft iron element mounted within said housing whereby said magnetic means moves to and away from said element as said magnetic means vibrates.

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