This invention relates to new and useful improvements in bowling pin detecting devices and more particularly to a bowling pin detecting device for determining whether a bowling pin is standing on a pin spot of a bowling lane bed or within a predetermined area surrounding the pin spot.

It is desirable in the game of bowling to have a means for automatically detecting the standing pins on a bowling lane in order to provide indications to the bowler for his scoring purposes. These detecting means may indicate the difference between a standing pin and a fallen pin and also indicate any standing pins which may have been moved off of the pin spot yet are within a predetermined area surrounding the pin spot.

It is the general object of the invention to provide a new and improved device for detecting pins having magnets therein.

Still another object of the present invention is to provide a new and improved device for differentiating between the presence of standing pins and fallen pins.

A further object of the present invention is to provide a detecting device which is simple yet reliable in construction, inexpensive to manufacture and relatively free from moving parts.

A more specific object is to provide a new and improved detecting means in the form of a magnetically operable switch.

Other objects will become readily apparent from the following detailed description, taken in connection with the accompanying drawings, in which:

FIG. 1 is a plan view of an arrangement of ten pin detecting devices embodying the invention;

FIG. 2 is an enlarged plan view, with portions broken away, of a single device;

FIG. 3 is an enlarged view of the underside of plate 13 and the circuit wiring connected thereto; and

FIG. 4 is a sectional view along line 4—4 of FIG. 2 showing a bowling pin standing on one of the detecting devices.

As shown in FIG. 1, individual detecting devices are located at the ten pin positions #1 to #10 of a bowling alley bed 12 and each of a size to cover the pin spot, as at 11, and a portion of the spaces between the pin spots. Generally, the detecting devices are rectangular in shape and the detecting areas are arranged so as to prevent a magnet in a pin from activating two detecting devices simultaneously.

Each device, as shown best in FIGS. 2, 3 and 4, consists of an upper horizontal plate member 13, a lower parallel plate member 14, and an intermediate spacing member 15 all of suitable electrically nonconductive material such as plastic. The member 15 is provided with a plurality of holes 16 therethrough which are uniformly spaced throughout a predetermined detecting area 16a and cooperate with the upper and lower members 13 and 14 to form a plurality of chambers. Each chamber contains a predetermined quantity of electrically conducting and magnetically responsive particles 17 of relatively small size, the particles normally resting on the lower plate 14 in piles insufficient in height to cause the particles to contact the upper plate member 13. The plates 13, 14, and 15 are suitably held together as by adhesive or cement represented at 15.

As shown best in FIG. 3, the upper plate member 13 has formed on its under surface exposed portions of a control circuit generally commensurate in over-all area with the pattern of pockets 16. Thus, in the exemplary form of the invention, alternate parallel wires or other conducting strips 18, which may be printed in a conventional manner, are connected together at one end by a transverse connector 19, and intermediate conducting strips 20 are connected together at the other end of the plate member by a connector 21. Connectors 19 and 21 include terminals connected respectively with terminals of leads 22 and 23 in a circuit including a source of electrical energy represented at 24 and a coil 25 of a relay 26 or other device for producing a signal indicating the presence of a pin on a pin spot area. A relay armature 27 is adapted to form a movement of a switch having another contact 28 for controlling a circuit 29 to utilize the signal produced by a detector.

FIG. 4 illustrates a pin 30 standing on a pin detector plate 13. As one means for activating the particles 17 in one or more chambers below the pin, the pin 30 is provided with a permanent magnet 31 which attracts the particles and causes them to form a conducting bridge between two or more conducting strips 18 and 20, thus energizing the relay 26 in the circuit to indicate a pin standing on the pin spot or adjacent detecting area.

If no pin is standing on a detector plate 13, the magnetic particles 17 rest on the bottom of the chambers formed by the plate 14 with the result that a relay spring 32 holds the relay switch open. Similarly, if a pin has fallen and lies on a detector plate 13, the magnet of that pin is ineffective to attract the metal particles against the conducting strips 18 and 20 because of the distance of a magnet in a fallen pin above the plate 13.

While the pin detecting areas have been illustrated as rectangular, the shape may be varied, and while all areas have been illustrated as similar, one or some could be modified relative to others, particularly in the #7 to #10 row. The particular size and shape shown facilitate the use of a uniform pattern throughout the spacing and location relative to the pin spots vary. An important advantage is that of providing pin detection over almost the entire area in the vicinity of the pin spots. While separate devices are illustrated for each of the ten detecting areas, it should be understood that all the detecting areas may be provided in a single structure utilizing, for example, a single cover sheet with all the printed circuitry, a single intermediate plate with chambers for all detecting areas, and a single bottom member.

I claim:

1. A bowling pin detecting device for a pin carrying a magnet in its lower end comprising, an upper electrically nonconductive plate member of a size and shape including a predetermined area in which a pin is to be detected, a lower parallel electrically nonconductive plate member of a size and shape including a predetermined area of the same dimensions, the pin spot area being coincident with the predetermined area of the lower plate member, a plurality of conducting strips on said upper plate member disposed parallelly to one another and spaced apart a predetermined distance, the conducting strips on said upper plate member being spliced at one end to a transverse conducting wire, and a plurality of conducting strips on said lower plate member disposed parallelly to one another and spaced apart a predetermined distance, the conducting strips on said lower plate member being spliced at one end to a transverse conducting wire, the said nonconductive plate members being held together at said spliced sections of the conducting strips on said upper and lower plate members by a plurality of magnets spaced uniformly throughout said predetermined areas of said upper and lower plate members, said magnets being arranged to be attracted to said conducting strips on said upper and lower plate members, the said magnets being attracted to said conducting strips on said upper plate member, the conducting strips on said upper plate member being adapted to conduct electrical current when the magnets are attracted to said conducting strips on said upper plate member, the conducting strips on said lower plate member being adapted to conduct electrical current when the magnets are attracted to said conducting strips on said lower plate member.

2. A bowling pin detecting device for a pin carrying a magnetic device comprising, an upper plate member of
a size and shape approximating a desired area in which a pin is to be detected, a lower parallel plate underlying substantially the desired area, an intervening means which forms chambers between said plates uniformly distributed over said area, a circuit having exposed portions extending across the upper ends of said chambers, and a plurality of electrically conductive and magnetically responsive elements in each of said chambers normally out of contact with said exposed portions.

3. A bowling pin detecting device comprising, an upper plate member of a size and shape including the desired area in which a pin is to be detected, a lower parallel plate underlying substantially the desired area, an intervening means cooperating with said plates to form walls enclosing closely adjacent chambers between said plates, which chambers are distributed over said area, quantities of electrically conductive and magnetically responsive particles in said chambers normally resting principally on the bottom wall thereof and insufficient to contact the upper plate, and a circuit having exposed portions on walls of said chambers adapted to be closed when some of said particles are magnetically energized and are moved into contact with said exposed portions.

4. A bowling pin detecting device for pins carrying a magnetic device comprising, an upper plate member of a size and shape fitting the desired area in which a pin is to be detected, means underlying substantially the desired area and forming chambers distributed throughout said area, a switch having exposed portions extending across the upper ends of said chambers, and a plurality of electrically conductive and magnetically responsive elements in each of said chambers normally out of contact with said exposed portions and movable to bridge said portions in response to a magnetic field thereof.

5. A bowling pin detecting device for a pin carrying a magnet in its lower end comprising, an upper plate member of a size and shape including a desired area in which a pin is to be detected, a lower parallel plate underlying substantially the desired area, an intervening plate cooperating with said upper and lower plates and having holes to form chambers between said plates distributed over said area, means securing the plates together, quantities of electrically conductive and magnetically responsive particles in said chambers normally resting upon the lower plate and insufficient in height to contact the upper plate, spaced switch contact members on the lower surface of the upper plate having exposed portions extending across the upper ends of said chambers adapted to be closed when some of said particles are moved upwardly in any one of said chambers and into contact with said exposed portions.

6. A bowling pin detecting device for detecting the presence of a standing bowling pin in a predetermined detection area larger than the base of said bowling pin, comprising: an upper plate member of a size and shape fitting the detection area; means underlying substantially the desired area and forming chambers distributed throughout said area, contact means having exposed portions extending across the upper ends of said chambers, and electrically conductive and magnetically responsive particles in said chambers normally out of contact with said exposed portions and movable to bridge said portions in response to a magnetic field from a pin thereabove.

7. A bowling pin detecting device for detecting a bowling pin having a small magnet in the base thereof and standing on a predetermined detection area larger than the magnet, comprising: an upper plate member of a size and shape fitting the desired area in which the pin is to be detected, means underlying substantially the desired detection area and forming chambers distributed throughout said area, quantities of electrically conductive and magnetically responsive particles in said chambers normally resting principally on the bottom wall thereof and of insufficient height to contact said upper plate, and a circuit having exposed portions on the upper wall of said chambers adapted to be closed when some of said particles are magnetically energized and are moved into contact with said exposed portions.

8. A bowling pin detecting device for use with a bowling lane having a pin spotting surface thereon, comprising: bowling pins each having a small magnet in its base; a plurality of pin detecting areas in said pin spotting surface, each larger than the base of a pin, and including an upper plate member of a size and shape approximating the desired area in which said pin is to be detected, a lower parallel plate underlying substantially the desired area, and an intervening means which forms chambers between said plates uniformly distributed over said area; a circuit having exposed portions extending across the upper ends of said chambers; and a plurality of electrically conductive and magnetically responsive particles in each of said chambers normally out of contact with said exposed portions, said particles being movable in said chambers so that the presence of a pin magnet above said detecting area will cause some of said particles to move upwardly in some of said chambers and thereby come into contact with said exposed portions and complete the circuit on the upper ends of said chamber.

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