United States Patent

[11] **3,632,918**

[72] Inventors **James H. Anson**
Auburn;
Norman F. Marsh, Springfield, both of Ill.

[21] Appl. No. **857,275**
[22] Filed **Aug. 25, 1969**
[45] Patented **Jan. 4, 1972**
[73] Assignee **Dickey-john Corporation**
Chatham, Ill.
Continuation-in-part of application Ser. No. 797,171, Feb. 6, 1969, now abandoned. This application Aug. 25, 1969, Ser. No. 857,275

[54] **SENSING SWITCH CONSTRUCTION**
8 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** ..... **200/61.41,** 235/92 PC
[51] **Int. Cl.** **H01h 3/16**
[50] **Field of Search** ..... 200/61.41, 61.42, 166 H, 166.1, 164

[56] **References Cited**

UNITED STATES PATENTS

1,275,766	8/1918	Schoenwolf	200/166 H
2,648,731	8/1953	Despard	200/166 H
2,716,682	8/1955	Franklin	200/164 R
2,804,514	8/1957	Peters	200/61.41 X
3,145,275	8/1964	Gildart	200/61.41
3,355,102	11/1967	Gregory	235/98
3,527,928	9/1970	Ryder et al.	235/92

Primary Examiner—Robert K. Schaefer
Assistant Examiner—M. Ginsburg
Attorney—Olson, Trexler, Wolters & Bushnell

ABSTRACT: Switch units designed for use with electrical apparatus for detecting discrete articles passing along a path of travel, wherein said units are engaged by the articles to energize or interrupt an energized circuit, thus producing a detectable signal. Each switch unit includes a pair of leaf spring arms having juxtaposed contacts on the respective ends thereof, and a pivotally mounted actuating element adapted to be engaged by articles passing along said path. The engagement of said actuating element results in the operation of said unit to produce said signal. The leaf spring arms are prepositioned such that during operation the respective contacts will slide relative to one another, thereby effecting a wiping action which keeps the contacts free of deposits and in good working order. In addition, novel dampening means are employed, which provide for improved accuracy and control.

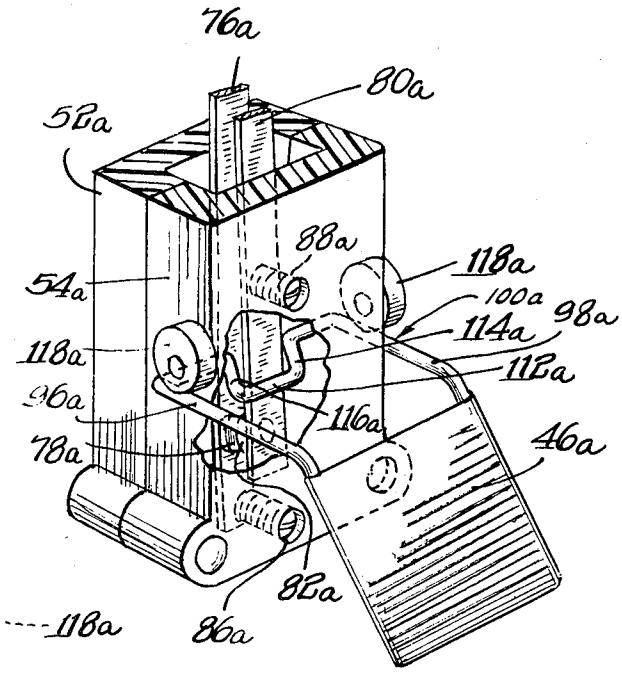


Fig. 1.

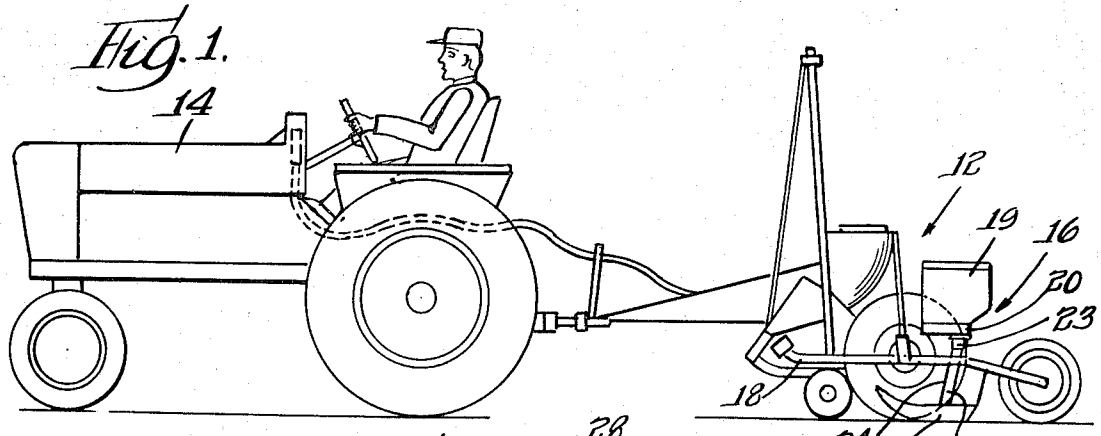


Fig. 2.

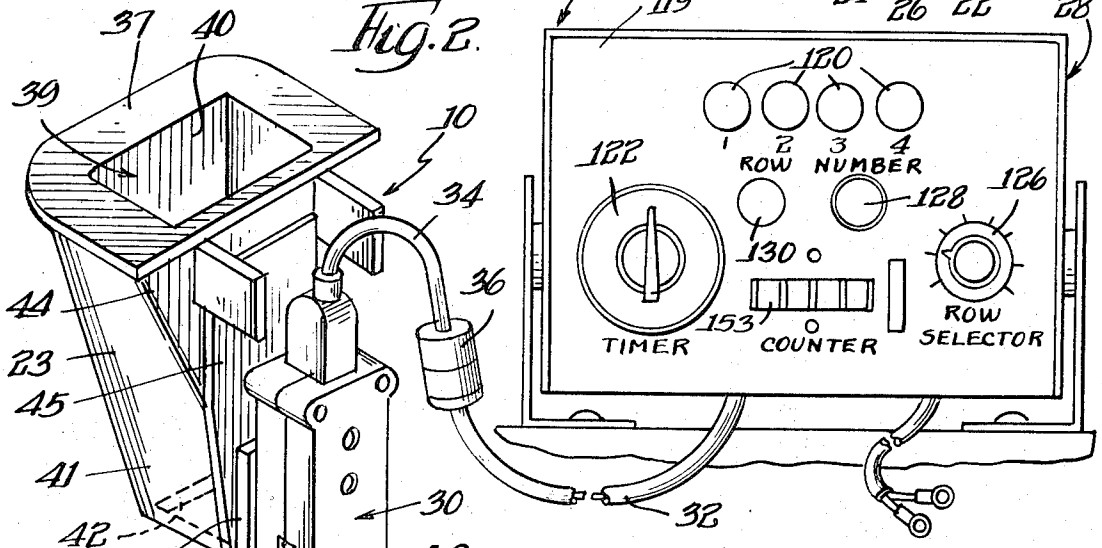


Fig. 3.

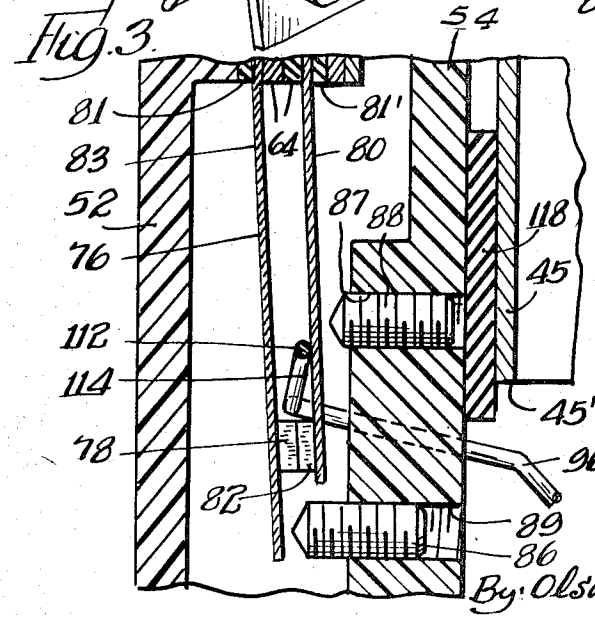
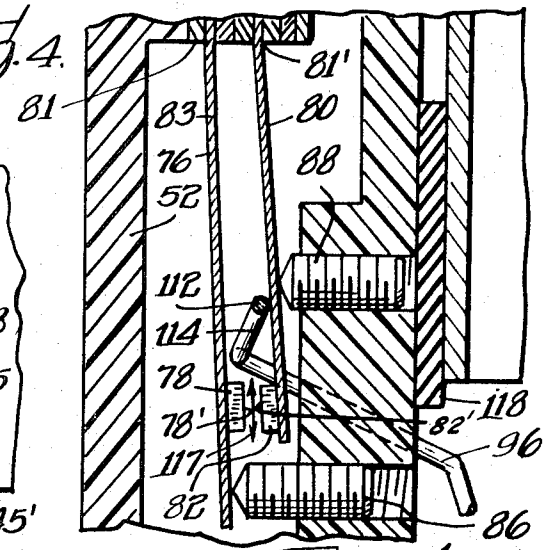


Fig. 4.



Inventors:
James H. Anson
Norman F. Marsh
By: Olson, Trulen, Wolters & Bushnell attys

Fig. 5.

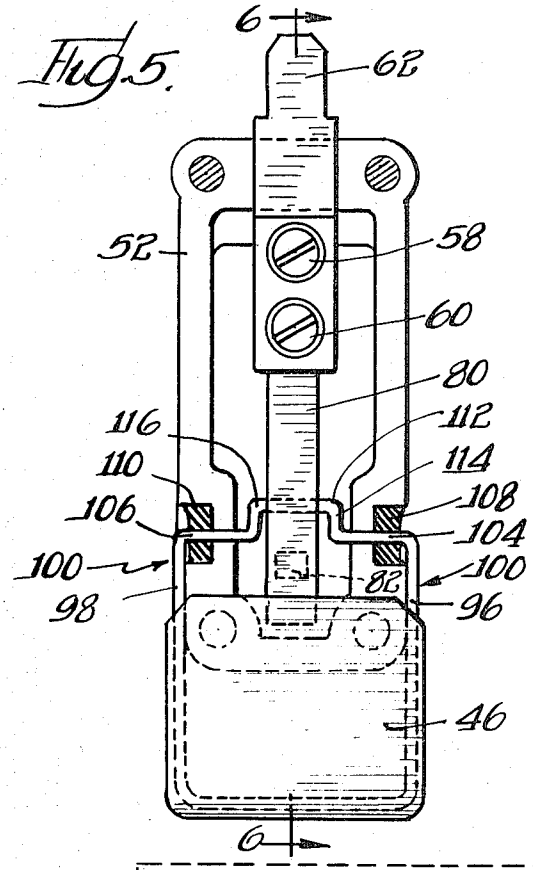


Fig. 6.

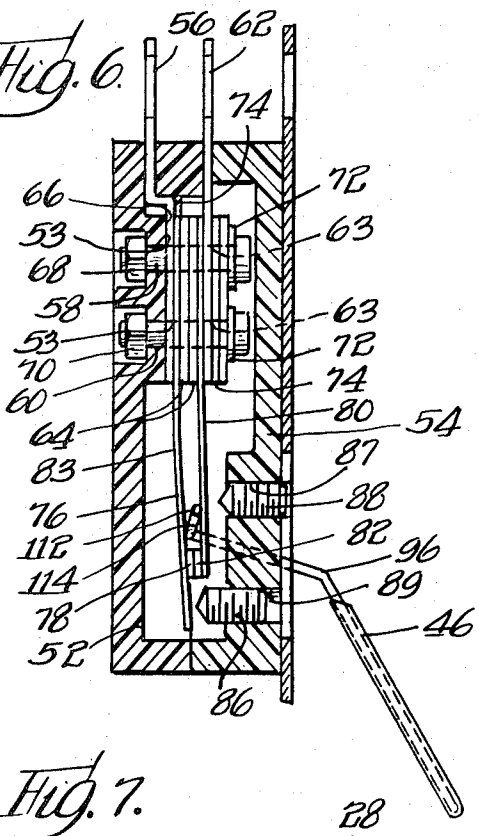
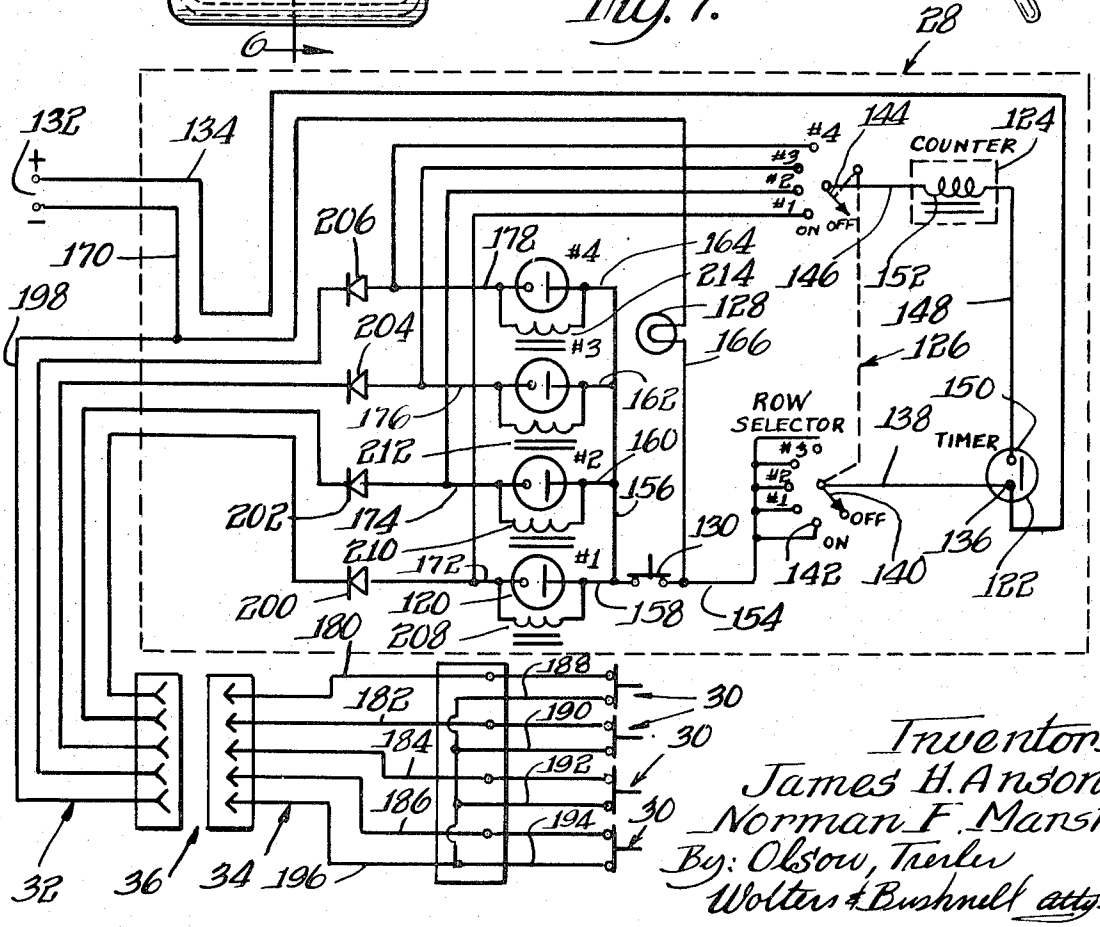


Fig. 7.



Inventors
James H. Anson
Norman F. Marsh
By: Olson, Trexler
Wolters & Bushnell attys.

Fig. 8.

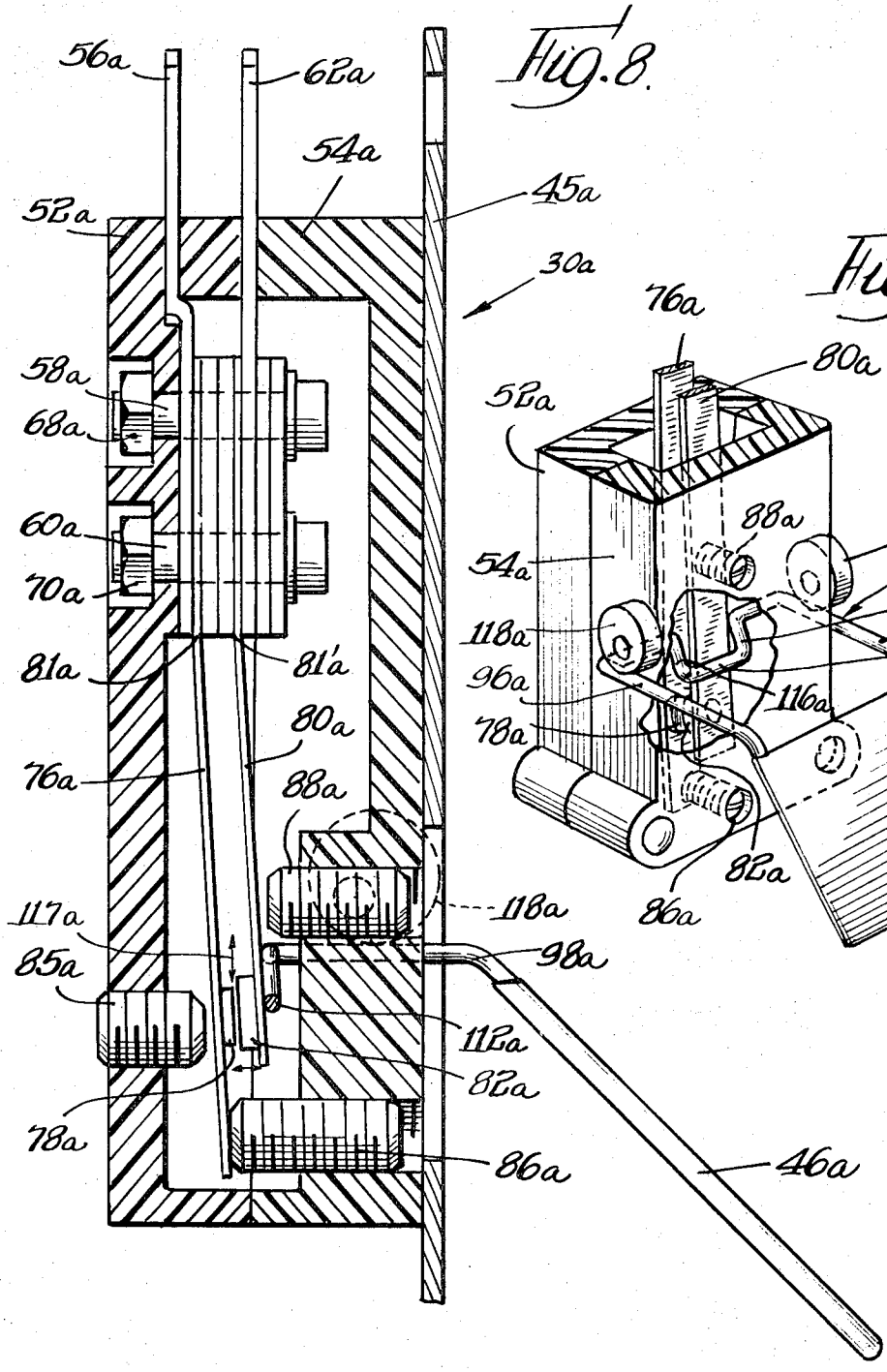


Fig. 9.

Inventors
James H. Anson
Norman F. Marsh
By: Olson, Trexler, Wolters & Bushnell attys.

SENSING SWITCH CONSTRUCTION

REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part, based upon United States application for Letters Patent, Ser. No. 797,171, filed Feb. 6, 1969, now abandoned, the benefit of which is claimed with regard to 35 USC 120.

BACKGROUND OF THE INVENTION

The present invention relates to counting or monitoring apparatus, and more specifically, to novel switch means for use with said apparatus. Said switch means, in conjunction with said apparatus, is capable of providing accurate detailed signals upon being actuated by the passage of discrete articles along a selected path.

Farmers engaged in mechanized planting utilize planting machines which have a plurality of separate planting devices supplied with seed from a hopper so that a plurality of rows may be planted at one time. These planting machines are pulled behind a tractor which normally operates at a speed between 3 to 7 miles per hour. With the planting equipment heretofore in general use it has been difficult, if not impossible, for the farmer to determine the rate at which the seeds are being planted, or for that matter whether seeds are even being dispensed. Accordingly, to overcome these problems which arise when one or more hoppers become clogged or empty without the farmer knowing it, seed-monitoring systems have been proposed which are placed in association with the individual planting devices and are operable to warn the farmer when a failure occurs.

A particular system of the type mentioned above, and of the type to which the present invention is directed, forms the basis for the disclosure in U.S. Pat. application, Ser. No. 540,873, filed Apr. 7, 1966, now U.S. Pat. No. 3,527,928, issued Sept. 8, 1970. Briefly, with this system a switch unit is associated with each planting device so that as seeds are dispensed therefrom they will engage the actuator portion of said unit to operate the switch. The switch is placed in circuit with a control panel mounted for viewing by the farmer, so that each time said switch is operated a light will flash on said panel indicating to the farmer that seeds are being dispensed. On the other hand, an absence of flashing indicates to the farmer that a failure of the planting device has occurred. In addition, the system may be equipped with a counter and a timer so that the number of seeds dispensed in a given period of time may be counted.

While the system disclosed in the above-mentioned copending application has proven entirely satisfactory in service, certain problems have been encountered with the particular switch unit disclosed therein; the present invention providing improvements thereover. For example, sparking causes pitting of the contact points, as well as the buildup of deposits, all of which eventually lead to failure of the unit. Also, since the switch unit must be able to respond quickly and accurately to engagement by a constant, successive flow of articles, it is necessary to dampen the actuator member action in order to insure against bouncing or rebounding thereof after each engagement. If said bouncing occurs, the switch cannot accurately monitor the passage of seeds and errors will result, both from spurious signals and the failure to monitor properly a subsequent instance of seed passage.

In addition, the aforementioned system employed a switch arrangement of the normally closed variety; and while there will be disclosed hereinafter a modification of the present invention of this nature, it should be noted that switches of this type require complex, expensive monitoring apparatus. While the cost of such an arrangement is totally justified with respect to the sensitivity and accuracy of results achieved, there are, however, customers that do not desire such a refined system. Accordingly, the present invention also contemplates an improved switch construction capable of functioning in a system employing normally closed switch units, as will be detailed more fully hereinafter.

Accordingly, it is an object of the present invention to provide improved switch unit constructions adapted to be employed with seed monitoring systems of the general type described above to improve the sensitivity, accuracy and dependability thereof.

Another, more specific, object of the present invention is the provision of switch unit constructions wherein the respective contacts will move laterally with respect to each other during operation to effect a cleaning action which precludes pitting and the formation of microscopic welds, all of which detract from the operational life thereof.

Another object of the present invention is the provision of a switch unit having a pair of leaf spring contact arms that are positioned initially for joint, arcuate movement about different centers whereby the contact members on said arms will slide relative to each other.

A further object of the present invention is to provide a novel switch unit construction of the type described above having at least one said leaf spring contact arm canted, so that upon actuation, the wiping action will be enhanced to insure against pitting or the buildup of deposits thereon.

Still another object of the present invention is to provide a switch unit construction which employs damping means to positively insure against bouncing of the contact member after engagement by an article.

Another, somewhat more specific object of the present invention is the provision of a switch unit construction wherein the free, contact carrying portion, of leaf-springlike arms are canted with respect to the mounting portion to provide a preselected disposition when in a static position, which will achieve the desired wiping action during use.

Another object of this invention is to provide a novel switch unit of the normally open variety which will function to provide said desired wiping action.

A further object of the present invention is to provide a novel switch for monitoring apparatus of the type described which is of simple, rugged construction and adapted to be installed with the chute elements of various known seed planters now in use.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified side-elevational view showing a tractor pulling a seed planter of the type to which the present invention relates.

FIG. 2 is a partial perspective view illustrating the seed-monitoring system of the present invention, and showing one of the switch units associated with the chute portion of a seed feeder or dispenser.

FIG. 3 is an enlarged fragmentary sectional view of the leaf spring contact members of the switch structure of the present invention, with the contact members in the closed position.

FIG. 4 is an enlarged fragmentary sectional view similar to FIG. 3, but showing the actuator arm depressed and the contacts in the open position.

FIG. 5 is an enlarged elevational view of the switch structure of the present invention, with one-half of the housing removed.

FIG. 6 is a sectional view taken along the line 6—6 of FIG. 5, in the direction indicated.

FIG. 7 is a schematic wire diagram of a seed-monitoring system of the type to which the present invention relates.

FIG. 8 is a sectional view similar to FIG. 6, but illustrating a modified form of the invention; said switch unit illustrated being of the normally open variety.

FIG. 9 is a partial perspective view of the embodiment of FIG. 8, with the upper portion of the unit broken away, and the front portion of the unit housing removed to expose to view the disposition of the respective switch unit elements.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Referring now more specifically to the drawings, with regard to the embodiment of FIGS. 1–6 like parts are designated

by the same reference numbers throughout the various figures; the corresponding parts or elements of the embodiment of FIGS. 8 and 9 being designated with the same numerals followed by the suffix *a*.

The seed-monitoring apparatus **10** shown in FIG. **2** is adapted to be installed in association with a planter **12** pulled by a tractor **14** as shown in FIG. **1**. The planter **12** and tractor **14** may be of various known constructions and need not be described in detail. It suffices to state that the planter includes a plurality of planting units **16** mounted on a frame **18**. In the particular embodiment shown for the purpose of illustrating one form of this invention, the seed-monitoring apparatus is constructed for association with a planter having four units **16**. It is understood however that the monitoring apparatus may be adapted for association with planters having any desired number of planting units.

Each of the planting units **16** may also be of various known constructions and need not be described in detail. In general each planting unit comprises a hopper **19** for containing a supply of seed, a valve or feeding mechanism **20** at the lower end of the hopper for delivering seed into an upper end of a long trough **22** via a chute **23**, shown in FIG. **2**. The trough **22** is mounted in a depending hollow shank **24** of the planting unit for directing seed into a furrow prepared by a compaction seed runner **26** secured to the lower end of the shank **24**.

As shown in FIGS. **1** and **2**, the seed-monitoring apparatus **10** comprises a control or indicating panel unit **28** adapted to be mounted at a convenient location on the tractor, a seed-sensing switch unit **30** mounted in association with the chute **23**, electrical cables **32** and **34** extending from the control unit **28** and switch **30** and a connector device **36** detachably connecting the cables **32** and **34**. It is to be understood of course that the apparatus **10** includes a switch unit **30** in association with the chute **23** of each of the planter units **16**, or in other words, for each row of seed to be planted. In the particular embodiment shown, it is contemplated that the apparatus **10** will include four associated switch units **30** and the electrical cables **32** and **34** are constructed for connecting the four individual switches to the control panel as will be discussed more fully below.

Each chute **23** is adapted by means of flange **37** to be disposed within a chute associated with the feed mechanism **20** of the planter unit. It is understood that the shape of the chute and the securing or fastening means therefor will vary in accordance with the particular make planting unit with which the monitoring apparatus is to be associated. In any event, each chute **23** comprises sidewalls defining a passageway **39** through which seeds must pass before entering trough **22** for planting. Passageway **39** has an open mouth or upper end **40** and a narrower throat portion **41** with a discharge opening **42**. The switch unit **30** is mounted to one wall **44** of the chute and has an actuating or sensing element in the form of a blade **46** positioned adjacent portion **41** so as to be struck by seeds as they pass out of the chute **23** by way of said opening **42**. Accordingly, seeds cannot pass through chute **23** without striking and depressing the blade element **46**.

As shown in FIGS. **5** and **6**, each switch unit **30** comprises housing members **52** and **54** secured together and to a mounting plate **45** connected to the wall **44** of the chute. A first electrical prong or strip **56** extends through an end of the housing or body member **52** and has apertures **53** so that it may be assembled over a pair of screws **58** and **60** positioned in apertures formed in housing member **52**. A second terminal or conductor strip **62** extends into the housing between the members **52** and **54** and has apertures at **63** for assembly over the screws **58** and **60** and is separated from the terminal strip **56** by insulating blocks **64**. The terminal strips are securely clamped against an abutment surface **66** of the body member **52** by the nuts **68** and **70** engaged with screws **58** and **60** and applying a clamping pressure through a washer **72** and an insulating spacer **74**.

A first contact leaf spring member **76** carrying a contact or point element **78** is assembled over the screws **58** and **60** and is also clamped in electrical contact with the terminal strip **56**. A second contact leaf spring member **80** carrying another point or contact element **82** is also assembled over the screws **58** and **60** and is clamped in electrical contact with the terminal strip **62**. Accordingly, the respective leaf spring members **76** and **80** are free to move in arcuate paths about the points **81** and **81'** as centers.

Turning first to FIG. **3**, it can be seen that a pair of stop members are provided in the form of set screws **86** and **88** engaged in threaded apertures **89** and **87**, respectively. The configuration of said leaf spring members **76** and **80** is such that the contact **78** bears against the opposing contact element **82**, with said member reaching a statically balanced position as illustrated. For reference purposes the spring members **76** and **80** may be viewed as disposed at an acute angle with respect to a line perpendicular to a line drawn through points **81** and **81'**, with each spring member spaced from its associated stop member **86** or **88**.

As is best seen in FIGS. **3** and **4**, the leaf spring member **76** is canted or bent at **83** whereby the lower, contact carrying portion thereof is disposed at an angle with respect to the upper portion of said member, that portion clamped in engagement with the respective terminal strip, **56** or **62**, by means of the nut and screw arrangements. Accordingly, with this arrangement the above noted disposition of said leaf spring members may be realized.

Before discussing in detail the mode of operation of switch **30**, attention is invited to FIG. **5**, wherein the structure for separation of contacts **78** and **82** is illustrated. Basically, the actuator blade or element **46** is mounted or carried by a pair of parallel, wirelike leg sections **96** and **98** of a frame member **100**. The parallel leg sections **96** and **98** are bent, as can be seen in FIG. **6**, to extend downwardly such that when said switch leg unit is affixed to wall **44** of chute **23**, the pedal or actuator **46** will be properly positioned for engagement by seeds as they pass out of said chute through discharge opening **42**. Wire element **100** also includes axially aligned pivot sections **104** and **106** which are pivotally mounted by the journals or bearings **108** and **110** formed integrally in one or both of the housing members **52** and **54**. In addition, said wire element **100** includes an actuator section **112** which is joined to the pivot sections **104** and **106** by lever arm sections **114** and **116**, whereby said section **112** is disposed between the respective leaf spring members **76** and **80**, as can be seen in FIG. **6**.

With the structural arrangement illustrated, it is believed clear that said wire element **100** and said blade **46** are supported for pivotal movement about a common axis defined by the wire sections **104** and **106**. The weight of the blade or actuator member **46** biases the wire element **100** in a clockwise direction as viewed in FIG. **6** so that the actuating or lever section **112** is normally maintained in engagement with the contact leaf spring member **80**. However, the combined weight of the panel member **46** and the wire sections **96** and **98** is insufficient to overcome the spring action of said leaf spring member so that the contact **82** remains in engagement with the oppositely disposed contact **78**, viz, the disposition illustrated in FIG. **3**.

When the actuator member **46** is struck or engaged by a seed passing out of the discharge opening **42** of chute **23**, said panel member is depressed so that the lever or actuating section **112** of the wire element **100** is pivoted in a clockwise direction to bias the leaf spring elements **76** and **80** toward the right as viewed in FIGS. **3** and **4**. Due to the spacing of leaf spring member **76** from its associated stop or set screw **86**, initially both contacts **78** and **82** will move together until the lower portion of leaf spring member **80** strikes said set screw **86**. However, due to the angular disposition of said springs **76** and **80** and especially due to the canted configuration of spring member **76**, during said initial movement the contiguous surfaces **78'** and **82'** on said contacts will slide relative to each other, as indicated by arrow **117** in FIG. **4**. This sliding movement effects a wiping action which will keep the contacts free from pitting and microscopic deposits that tend to buil-

dup during use. Accordingly, after the leaf spring member **76** strikes the setscrew **86** the contacts **78** and **82** will separate with the leaf spring member **80** continuing until it strikes its associated setscrew or stop member **88**, as seen in FIG. **4**. As will be detailed more fully hereinafter, this separation may be employed to produce a detectable signal indicating that sensing member **46** has been struck by one or more seeds.

It will be appreciated that in order to monitor the passage of seeds through the chute **23** reliably and accurately, the actuator or sensing member **46** must be capable of operation at high speeds. In order to promote such operation which may, for example, be in the order of 1,500 cycles per minute, the switch unit is provided with means to minimize the inertial effects of the sensing member **46**. That is to say, to prevent said member **46** from bouncing after being struck by a seed, whereby said sensing member will be correctly or properly positioned for engagement by subsequent seeds. The leaf spring members **76** and **80** are quite stiff so as partially to dampen any vibrations or oscillations of the actuator **46** transmitted thereto by means of the wire element **100**.

To control positively the movement of the panel or actuator member **46**, the switch unit of the present invention includes a damping means in the form of an elastomeric member **118**. In the fabrication of member **118**, it is desirable to use a butyl rubber composition although not absolutely necessary. The elastomeric member **118** is positioned between the mounting plate **45** and the switch unit housing section **54**. The elastomeric member **118** is disposed inwardly of the opening **45'** in said mounting plate **45**, said opening having the parallel leg sections **96** and **98** extending therethrough. Accordingly, the lower end of said elastomeric member is disposed slightly above said leg sections **96** and **98**, whereby after the actuator has been depressed and then moved upwardly, said leg sections **96** and **98** will engage the elastomeric member **118** positively to prevent further movement of said wire element **100** and its associated blade or actuator element **46**.

At this point, it should be noted that the length of the lever arm provided by actuator element **46** and the associated parallel leg sections **96** and **98** is quite large as compared to the lever arms **114** and **116** which join the actuator section **112** of wire element **100** to the journaled wire sections **104** and **106**. In practice, the former is about eight to 10 times as large as the latter, this feature thus promoting easy operation of the switch unit **30** and sensitivity to the application of a small force to the panel member **46**.

As previously indicated, the switch units **30** associated with each of the planter devices **16** are connected by cables **32** and **34** with the control or indicating panel unit **28**. As shown in FIG. **2** and in the schematic wiring diagram of FIG. **7**, the unit **28** comprises a housing **119** in which indicating lights **120** are mounted. In the embodiment shown, the indicating lights **120** are numbered **1** through **4** and correspond to the number of rows of seeds to be planted. It is understood, of course, that the electrical circuit and number of indicating lights can be modified for association with planting apparatus having either a larger or smaller number of planting devices **16**. The housing also contains a timer **122**, a counter **124** and a gang switch **126** which may all be of known construction and need not be described in detail and which function in a manner described below. A light **128** is provided for indicating when the system is turned on and a test switch **130** is connected as described below for enabling an operator to test the circuit to insure operation of the lights.

Referring particularly to the wiring diagram shown in FIG. **7**, the circuit of the apparatus is connected with a suitable source of energy such as a battery **132** of the type usually installed in a tractor. A wire **134** extends from one terminal of the battery to a terminal **136** of the timer **122**, which terminal is connected by wire **138** with a blade or movable contact **140** of one side of the selector switch **126**. As indicated heretofore, selector switch **126** may be of known construction and the movable contact **140** is mounted on a rotor for movement between an "off" position and a contact **142** at an "on" position. In addition, the blade **140** may be moved to contacts numbered **1** through **4** in FIG. **8** which correspond to the indicator lights **120** which are also numbered **1** through **4**. The selector switch **126** has a second movable contact or blade **144** movable in unison with and electrically insulated from the blade **140**. The blade **144** is adapted to be moved from an "off" to an "on" position and then for selective engagement with another series of contacts numbered **1** through **4** in FIG. **7**. The blade **144** is connected by a wire **146** with the counter **124** which in turn is connected through wire **148** with a second terminal **150** of the timer.

The switch of the timer **122** is normally open so that the coil **152** of the counter **124** is normally deenergized. When the timer is activated, the terminal **150** is connected with the terminal **136** for energizing the coil of the counter and enabling the counter to respond to the passage of seeds as will be described below.

The first of the previously mentioned groups of contacts in the selector switch are connected by wires **154** and **156** to branch wires **158**, **160**, **162** and **164** which in turn are respectively connected to one side of the indicator lights numbered **1** through **4**. The test switch **130** is connected in the wire **154** and the "on" light **128** is connected by wires **166** and **168** between the wires **154** and a wire **170** which in turn is connected with the battery. The indicator lights number **1** through **4** are respectively connected in series with the switches **30** also numbered **1** through **4** in FIG. **7** and to the wire **170**. Thus, wires **172**, **174**, **176** and **178** extend from the lamps numbered **1** through **4** respectively to the connector **36** for connection to wires **180**, **182**, **184** and **186** which are respectively connected to one terminal of the switch units **30** numbered **1** through **4**. Opposite terminals of the switch units are respectively connected by wires **188**, **190**, **192** and **194** with a common wire **196** which extends through the connector **36** to a wire **198**. The wire **198** is connected with the battery by the wire **170**. Rectifiers **200**, **202**, **204** and **206** are respectively connected in the wires **172** through **178** for enabling all indicator lights to light when the test switch is depressed. The circuitry is such that the indicating lights **120** flash on in response to the passage of seeds past the switch units **30** and thereby provide an operator with a visual indication of the seed flow.

The battery or power source **132** is now generally conventional in tractors and the like provides 12 volts. The circuits for the lights **120** are normally energized, but it is important to note that the lights **120** are fluorescent gas lights or glow discharge lamps such as small neon lights of a known type for which 12 volts is insufficient to cause lighting. Inductance coils or chokes **208**, **210**, **212** and **214** are respectively connected in parallel with the lights **120**. When an individual light circuit is opened by the opening of its associated switch **30**, its inductance coil discharges so as to apply a relatively high voltage to the light which is sufficient to cause the light to flash on. The discharge of the coil is accomplished almost instantly so that the light goes out almost instantly. In other words, the arrangement is such that each time a switch **30** is opened, the inductance coil associated therewith discharges and the light gives off one sharp, short flash.

The heretofore described seed-monitoring apparatus is adapted to operate in the following manner. When the selector switch **126** is turned to move the contact **140** from the "off" position to the "on" position, the circuits are completed through the normally closed switch units **30** and the indicator lights so that the light circuits are energized. Then upon operation of the planting devices **16**, each individual seed or group of seeds dropping down through the chutes **22** will actuate, or in other words, open the contacts of the associated switch unit **30**.

Upon opening of a switch **30**, its associated indicating light circuit will be deenergized and the discharge of the coil will energize the light sufficiently to cause it to flash. The combination of the neon light with an inductance coil or choke connected in parallel therewith provides an extremely rapid and sharp response for obtaining a distinct and easily readable

flashing of the light in accordance with the flow of the seed. This enables an operator to determine at a glance whether or not seeds are passing down any one or all of the chutes. Furthermore, an operator may determine the approximate rate at which seeds are being discharged by judging the rate at which the indicator light is flashing. In the event an indicator light for any one of the chutes remains steadily out or does not flash, the operator will know instantly that no seed is flowing through the chute.

When an operator wishes to obtain an accurate count of the seed population being planted through any chute, the selector switch **126** is first adjusted so as to move the contacts of blades **140** and **144** to the desired terminal associated with the chute to be checked. For example, the selector switch **126** may be adjusted so that the blades **140** and **144** respectively contact their associated terminals No. **1**. Then when the timer **122** is actuated, the counter **124** is energized. As previously indicated, the arrangement is such that when the timer **122** is actuated, the coil of the counter is normally energized. Then when a seed passes through the chute for opening the associated switch unit **30**, the circuit is opened so that the associated indicating light circuit is deenergized and the coil of the counter is deenergized. The inductance coil or choke connected in parallel with the light not only serves to actuate a readily discernable flashing of the light, but the circuit arrangement also promotes a rapid collapse of the magnetic field of the counter coil **152** for increasing the rate of response of the counter. As will be understood, each time the coil of the counter is deenergized and then reenergized in response to the passage of a seed past the associated switch unit **30**, the seed is recorded on the counter dials **153**.

The counter is of a known commercially available construction having a spring-biased shiftable element of magnetic material responsive to the magnetic field created when the coil is energized and adapted to actuate the counter dials **153** through a suitable mechanism. Such counters have heretofore been connected so that their coils are normally deenergized, but it has been found that, in the present apparatus, the counter can be made to function at a relatively higher rate by connecting it so that the coil **152** is normally energized as long as the timer is operating. Normally the counter continues to function for a predetermined time interval set by the timer **122** so that at the end of the interval, the rate at which the seeds are being planted may be determined by dividing the preset time into the total number of seeds recorded by the counter. However, the circuit may be provided with a manually or otherwise operable timer bypass for enabling the counter to be operated without a time limitation. Such a bypass may be provided separately by connecting a switch in a line bypassing the timer or it may be included in a timer device of known construction.

In FIGS. **8** and **9** a modified, or alternate form of the present invention is illustrated, which is adapted for use in a seed-monitoring system employing a normally open switch construction. Concerning this embodiment, it should be noted that parts or elements similar to those previously discussed are designated by like reference numbers, followed by the suffix *a*.

Before proceeding with the detailed description of the construction of switch unit **30***a*, it is believed desirable to set forth briefly the general nature of a system in which this form of the invention will be employed. Basically, the overall system is the same as that illustrated in FIG. **2**. That is to say, switch **30***a* is placed in circuit with an indicating unit and mounted in relation to a seed planter chute, such that it will be actuated to provide a detectable signal each time a seed or group of seeds pass therethrough.

The primary difference between the construction of switch **30***a*, and the previously discussed unit **30**, is that switch **30***a* operates on a normally open principle. That is, when the sensing element **46***a* is engaged, the switch is closed. According, with reference to FIG. **7**, in the lighting circuit for switch **30***a* the discharge lamps **120** and the associated inductance coils **208–214** and rectifiers **200–206**, are eliminated, with each switch **30***a* being connected in series with a simple incandescent lamp. Therefore, upon the actuation of a switch **30***a*, the circuit for an associated lamp will be closed and the lamp will light, to indicate the passage of a seed through the planter chute. However, subsequent to said instance of engagement, and prior to the next succeeding instance, switch **30***a* will open thus deenergizing or opening the lamp circuit.

Turning now to FIGS. **8** and **9**, the construction of normally open switch unit **30***a* is illustrated in detail. Said switch **30***a* comprises housing members **52***a* and **54***a* secured together, with member **54***a* also being secured to a mounting plate **45***a*. Electrical terminals **56***a* and **62***a* extend from the upper portion of the housing assembly to provide for an electrical connection with the signaling apparatus. The terminals **56***a* and **62***a* are in conducting engagement with the upper portions of the leaf-springlike blade members **76***a* and **80***a*, respectively. The assembly of said terminals, **56***a* and **62***a*, and the leaf spring members, **76***a* and **80***a*, to the housing or body member **52***a* is effected in the same manner as described previously with regard to FIGS. **5** and **6**, said description being incorporated herein by reference.

A contact element is carried on the free end of each said leaf spring member **76***a* and **80***a*, said elements being designated **78***a* and **82***a*, respectively. Accordingly, with the upper portion of each spring member being secured to the housing member **52***a*, the depending, contact-carrying portions are free to move in an arcuate path about the points **81***a* and **81'***a*.

As was the case with the previously discussed embodiment, the contact-carrying spring members **76***a* and **80***a* are canted or bent to achieve a desired equilibrium position that results in a wiping action upon actuation of the switch. In this regard, the members **76***a* and **80***a* are bent approximate the points **81***l* and **81'***a*, with the degree or severity of the bend being somewhat greater for member **76***a* than for member **80***a*. Accordingly, in the equilibrium position [not shown] the contacts will be engaged, with the free-depending portions of members **76***a* and **80***a* being disposed at an angle to their respective mounting portions which lie in parallel vertical datum planes.

With this arrangement, as illustrated in FIG. **8**, it is possible to move or pivot the member **76***a* away from member **80***a* to separate the contacts **78***a* and **82***a*, without either of said members **76***a* and **80***a* passing through the vertical datum plane. To achieve the illustrated normally opened condition, setscrew **86***a* is employed to move member **76***a* against the force established by the initial bending thereof. Under these circumstances, spring member **80***a* will assume a disposition dictated by the initial bend applied thereto; or, as is illustrated, its position may be determined by engagement with section **112***a* of actuator **46***a* after the position of said actuator is preset, as will be detailed hereinafter. In either instance, the contacts **78***a* and **82***a* may be spaced, one from the other by means of setscrew **86***a*.

Turning now to FIG. **9**, the construction of actuator **46***a* can be viewed in detail. Basically, the mounting arrangement for, and the general construction of, actuator **46***a* is similar to that previously discussed, with one exception. Said exception is that the lever arm sections **114***a* and **116***a*, which carry the spring-member-engaging portion **112***a*, depend downwardly, with the portion **112***a*, being disposed in back of member **80***a*, as compared to the positioning of portion **112** between the spring members in the previously discussed embodiment.

Accordingly, when the sensing element or actuator **46***a* is struck by a seed, the portion **112***a* will be pivoted in a clockwise direction to move spring member **80***a* also in a clockwise direction. As is clear from FIG. **9**, this movement causes the contacts **78***a* and **82***a* to engage, thus closing momentarily the lamp circuit. The respective spring members **76***a* and **80***a* will now move jointly, in a clockwise direction, with the contacts **78***a* and **82***a* closed, until member **76***a* engages the stop provided by setscrew **85***a*. After this engage-

ment, the spring members **76***a*, **80***a* move jointly in the counterclockwise direction, due to both the transfer of energy or rebounding occasioned by the engagement with stop **85***a* and the spring force stored in said members. Upon said counterclockwise movement, spring **76***a* will engage setscrew **86***a* to preclude further movement thereof, which results in the opening of contacts **78***a*, **82***a*, as the spring member **80***a* is free to move to the initial position. Accordingly, the switch unit **30***a* is now open, the lamp circuit is disengaged, and said switch is in condition to sense another, subsequent, instance of seed passage.

In a manner similar to that discussed previously, the initial canted disposition of the contact carrying portion of the spring members **76***a* and **80***a* provides for relative, sliding movement between the contacts **78***a* and **82***a* during the closing thereof. This relative movement effects a cleaning action, wherein pitting and the formation of harmful microscopic welds on the surfaces of said contacts is precluded, as indicated by arrow **117***a*.

Also, as will be recalled from the discussion of the embodiment of FIGS. **1–6**, the attainment of accurate results requires that the movement of actuator **46***a* be dampened after each instance of engagement by a seed. To effect this dampening action novel bumper or dampener means **118***a* are employed, which in addition to precluding rebounding, serve as means to adjust the sensitivity of switch **30***a*, as will be explained.

The dampeners **118***a* are mounted to a sidewall of housing member **54***a* and are engaged, respectively, by the leg sections **96***a* and **98***a* of wire frame element **100***a* of the sensing means **46***a*. As can be seen in FIG. **9**, dampeners **118***a* are of circular configuration, but are eccentrically mounted to the housing member **54***a* to provide a camlike arrangement. Thus, the initial or preengagement position of the leg section **96***a* and **98***a*, and correspondingly that of the actuator portion **112***a*, may be adjusted by rotation of the dampener means **118***a* about their eccentric mounting axes. While two dampener means **118***a* are illustrated, it is possible to employ only one, and still achieve the desired results.

The operation of dampeners **118***a*, in the precluding of actuator rebound is believed obvious in view of the previous discussion. However, the function of said dampeners with regard to the controlling of sensitivity via initial adjustment of the switch unit is believed worthy of further elaboration.

The sensitivity of a switch unit, be it unit **30** or **30***a*, is dependent upon several factors; for example, the spring constant of the spring member **76**, **76***a* and **80**, **80***a*, and the amount of actuator movement required to produce a detectable signal. It is this latter factor which lends itself to adjustment in the field; and which adjustment is facilitated by the novel dampener means **118***a*.

Turning to FIG. **8** and unit **30***a*, it can be seen that once setscrew **86***a* is adjusted, the preengagement position of spring member **80***a* determines the amount of actuator movement required to close contacts **78***a* and **82***a*. Also, it should be clear that this position of said spring **80***a* is or can be controlled by the disposition of the actuator portion **112***a* in conjunction with setscrew **88***a*, said disposition of portion **112***a* being easily adjusted by use of the camming action offered by dampener means **118***a*.

Concerning unit **30**, the dampener means **118***a* may be employed to advantage here also, replacing elastomeric member **118**. While the amount of actuator movement needed to separate contacts **78** and **82** can be controlled to a degree by the setscrews **86** and **88**, this can also be achieved by adjusting the preengagement position of the portion **112** of actuator **46**, an expedient readily accomplished with the eccentrically mounted dampener **118***a*.

While preferred embodiments of the present invention have been shown and described herein, it is contemplated that certain structural changes and substitutions may be made without departing from the spirit and scope of the invention, as defined in the appended claims.

The invention is claimed as follows:

1. A switch unit for use with electrical apparatus for monitoring seeds or the like passing along a prescribed path of travel, said unit being responsive to small pressures and capable of rapid successive operation and comprising: a support housing; first and second electrical contacts contained within said housing and adapted to be placed in circuit with electrical apparatus; a pair of leaf spring members contained within said housing and each having one end portion engaged with the support housing and a free end portion carrying one said contact, such that relative movement of said contacts from a first position to a second position may be effected by pivotal movement of said spring members; and actuating element operably associated with said spring members and adapted to project into said path, such that engagement of said actuating element by a seed will effect said relative movement of the contacts to said second position to produce a detectable signal when said switch unit is operably associated with said apparatus, said actuating element being pivotally mounted to a sidewall portion of said housing and including, an actuator section disposed within said housing and positioned for engagement with at least one of said spring members, at least one leg section disposed exteriorly of said housing, and a blade portion carried by said leg section and adapted to be engaged by seeds; and elastomeric dampening means carried exteriorly of said housing and disposed proximate said leg section and adapted to be engaged by said leg section upon deflection of said actuating element and thereby preventing excessive oscillations of said actuating element, said elastomeric dampening means comprise a camlike member mounted to said housing such that the relative position thereof can be employed to adjust the initial position of the leg section and correspondingly that of the actuator section and said leaf spring member.

2. A switch unit as defined in claim **1**, including a pair of leg sections and a pair of camlike members.

3. A switch unit as defined in claim **1**, wherein said camlike member comprises a rotatable disc element eccentrically mounted to the housing wall.

4. A switch unit as defined in claim **1**, wherein at least one of said spring members is canted such that in the first position said members are disposed so that pivotal movement thereof to the second position results in relative sliding movement between said contacts, effecting a wiping action therebetween.

5. A switch unit as defined in claim **4**, wherein both said spring members are canted.

6. A switch unit as defined in claim **1**, wherein said contacts are in engagement in the first position, thus constituting said unit a normally closed switch, said actuating section interposed between said spring members for effecting relative movement to the second position by separating said contacts to open said switch.

7. A switch unit as defined in claim **6**, further including stop means for engaging one of said spring members, said stop means being adjustably spaced from said one spring member such that initially both said spring members will move jointly until said one spring member engages said stop means to effect separation of the contacts upon continued movement of the other of said spring members.

8. A switch unit as defined in claim **1**, further including adjustable stop means engaging one of said spring members to bias said member to a location wherein the respective contacts are spaced from each other, the resulting disposition of the spring members constituting said first position and said switch unit a normally open switch with said actuating section being engaged with the other of said spring members, such that upon engagement by a seed said other spring member is moved toward said one spring member to bring said contacts into engagement to close said switch, the resulting disposition of the spring members constituting said second position.

* * * * *