May 31, 1966 T. C. BURNETTE, JR 3,253,338

ELECTRICAL GAUGING MEANS

Filed Feb. 8, 1962 2 Sheets-Sheet 1

Fig. 1

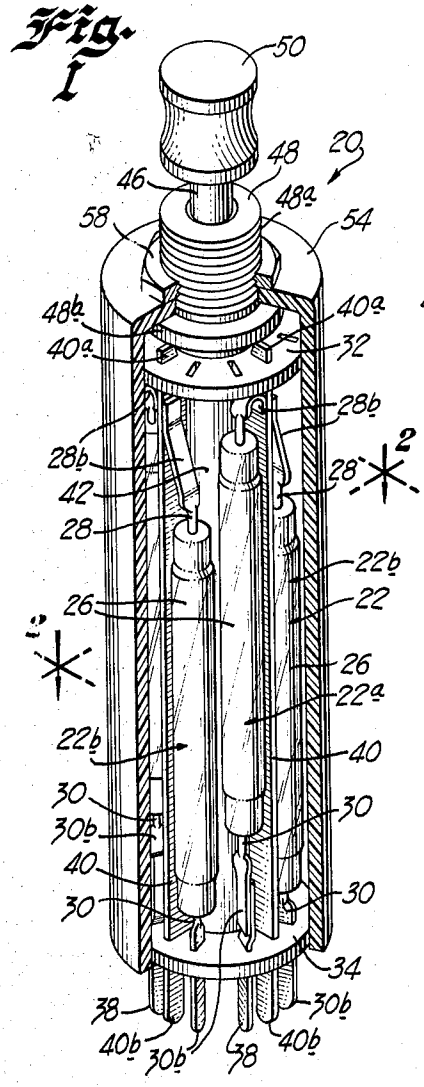


Fig. 3

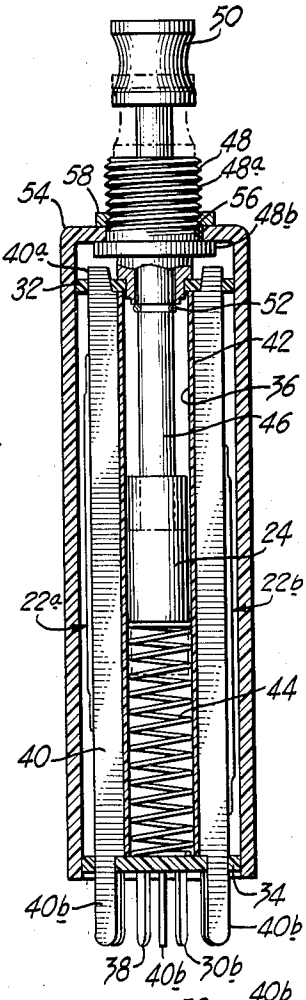


Fig. 4

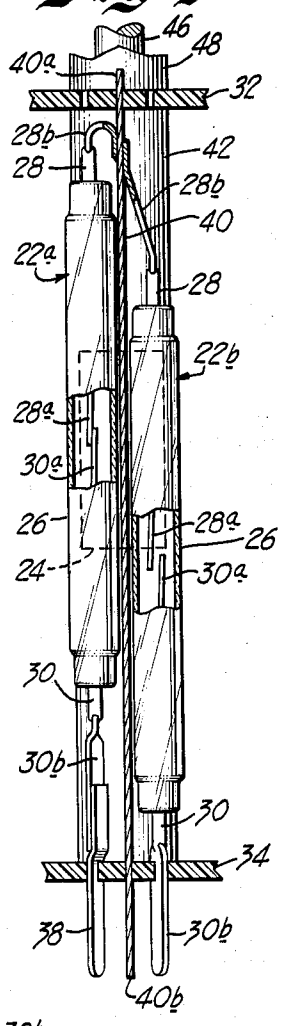


Fig. 7

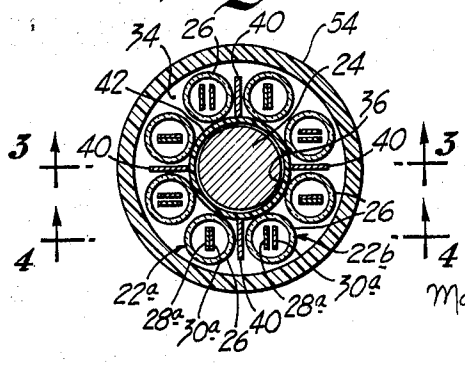
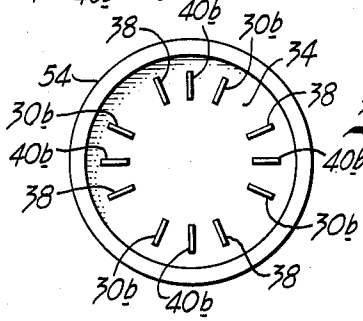


Fig. 5



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ELECTRICAL GAUGING MEANS

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Fig. 12

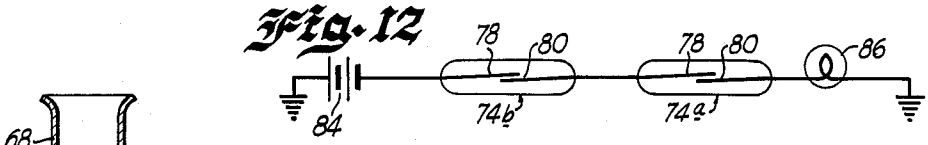


Fig. 6

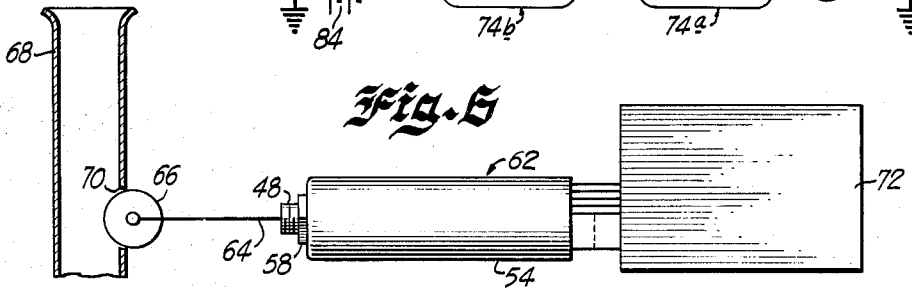


Fig. 7

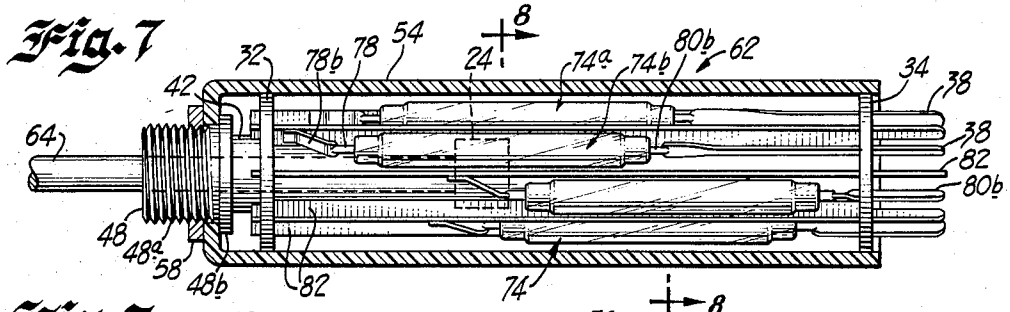


Fig. 9

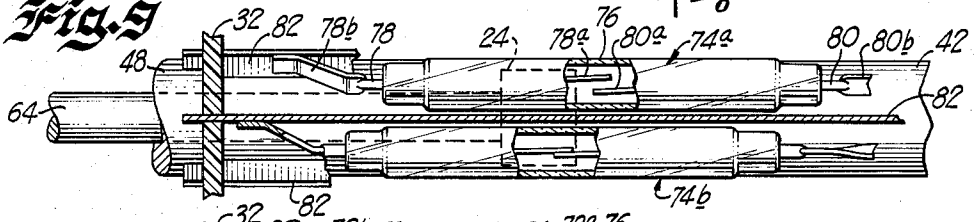


Fig. 10

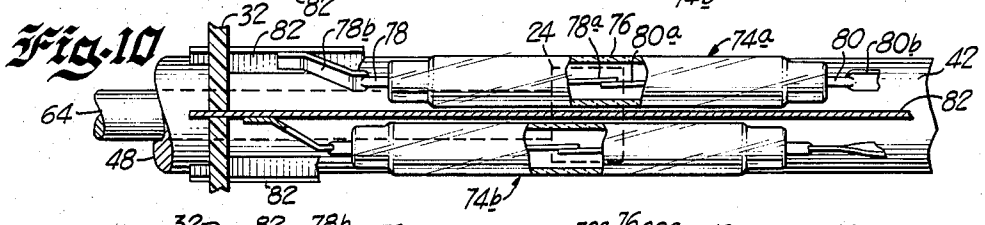
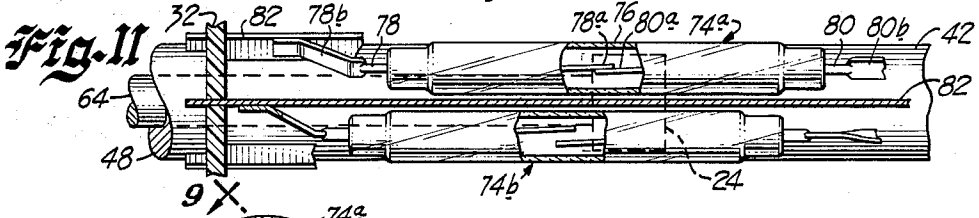


Fig. 11



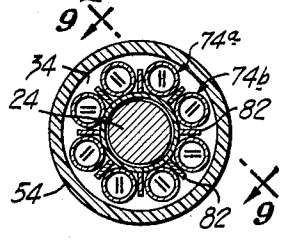


Fig. 8

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United States Patent Office 3,253,338 Patented May 31, 1966

3,253,338

ELECTRICAL GAUGING MEANS

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Filed Feb. 8, 1962, Ser. No. 171,893
5 Claims. (Cl. 33—169)

This invention relates to a switching assembly and, more particularly, to a new and improved switching assembly using sealed switch units and an electrical gauging apparatus embodying the switching means.

In many different types of equipment, it is necessary to determine whether the dimensions of an article fall within certain predetermined ranges of value. For example, many manufacturing operations include a gauging step in which the manufactured article is checked to determine whether certain dimensions of the article fall within a given tolerance range. Coin handling apparatus also includes means for determining the values of tendered coins by gauging the sizes thereof.

In some types of coin handling equipment, a switching assembly is provided in which a wiper is moved relative to a plurality of fixed contacts under the control of the displacement of a gauging element that is moved into engagement with a coin passing through a coin inlet or gauging station. In this type of gauging apparatus, the acceptable range of dimensions for each different size of coin is established by the size or width of the fixed contact individual to each coin. However, there are a number of deficiencies in this method of measuring article dimensions.

In order to obtain the necessary discrimination between coins of different sizes and to insure electrical contact in only the range between the lowest and highest acceptable dimensions for each coin, it is necessary to provide a considerable amount of movement or mechanical amplification between the gauging element and the switching assembly. This is necessary because the amount of displacement of the gauging element produced by coins of different sizes is rather small compared to the movement required to provide acceptable discrimination in the switching means. This movement amplification means results in increased pressures on the gauging element and introduces large moving masses interposed between the gauging element and the switching means which not only reduce the response speed of the gauging system but also the accuracy thereof. In addition, the exposure of the fixed contacts to atmospheric conditions and mechanical abrasion reduces the reliability and operating life of the switching means.

Accordingly, one object of the present invention is to provide a new and improved switching assembly.

Another object is to provide a switching assembly including a plurality of sealed switch units with their gaps spaced in a given direction and permanent magnetic means movable in said given direction to selectively operate the switch units.

A further object is to provide a switching assembly including both a plurality of sealed switch units mounted in a circular array with their gaps spaced axially along the opening formed by the circular array and permanent magnetic means movable along the axis of the opening to different positions to operate different ones of the switch units.

Another object is to provide a gauging system providing an electrical output which does not require mechanical amplifying means.

Another object is to provide an electrical gauging system using sealed switch units actuated by permanent magnetic means to provide greater contact reliability and life.

Another object is to provide an electrical gauging apparatus in which the gaps of a plurality of sealed switch units are spaced different distances from each other in a given direction corresponding to the dimensional ranges of articles to be gauged and in which a permanent magnetic means is moved in said given direction to operate different ones of the switches to indicate the dimension of the gauged article.

In accordance with these and many other objects, a switching assembly embodying the invention comprises a plurality of sealed switch units supported in a circular array to provide an axially extending opening in which is disposed an axially movable permanent magnet. The sealed switches are displaced from each other along the axis of the opening so that the gaps formed by the magnetic elements therein are spaced from each other in an axial direction. When the permanent magnet is moved to different axially spaced positions by an operating means connected thereto, different ones or combinations of the sealed switch units are operated in dependence on the position of the permanent magnet.

In one embodiment of the invention, the plurality of sealed switch units are divided into two separate groups, one of which has their gaps disposed adjacent the normal position of the permanent magnet so that the magnetic elements are held in engagement to complete electric circuits therethrough. The other group of sealed switch units are disposed with their gaps spaced from the normal position of the permanent magnet so that the magnetic elements are not engaged. When the operating means for the switching assembly is actuated to move the permanent magnet from its normal position to a displaced position adjacent the gaps in the second group of switch units, the contacts in the first group of switch units are opened and the contacts in the second group of switch units are closed. By controlling the spacing of the gaps in the two groups of switch capsules and the strength and configuration of the field of the permanent magnet, the switching assembly can either provide a plurality of transfer or type C contacts or a plurality of make-before-break or type D contacts in which the normally open switch capsules in the second group are operated to a closed condition prior to the release of the normally operated switches in the first group.

In another embodiment of the invention providing an electrical gauging system, the gaps in the plurality of sealed switch units are axially displaced from each other distances proportional to the dimensions of the articles to be gauged, and the operating means connected to the permanent magnet is connected to a gauging element or surface that is adapted to engage an article, such as a coin. The deflection of the gauging element displaces the permanent magnet in an axial direction relative to the spaced gaps and operates a particular one or combination of the sealed switch units in dependence on the degree of movement to provide an indication of the size of the gauged article.

The strength and configuration of the magnetic field provided by the permanent magnet and the spacing of the gaps in the sealed switch units can be such that the permanent magnet is shifted in direct response to the engagement of the gauging element by the article and without the use of intervening movement amplifying means. The sensitivity of this arrangement is such that mechanical displacements in the order of thousandths of an inch can be directly measured and indicated. The sealed switches protect the contact elements from atmospheric contamination and are free from the adverse effects of mechanical abrasion. Further, since the sealed switches are operated by moving the permanent magnet relative to these switches without the use of an intervening mechanical amplifying means, the pressure applied to the

article to be gauged is reduced to a minimum, and the system responds quickly to displacement of the article engaging element.

Many other objects and advantages of the present invention will become apparent from considering the following detailed description in conjunction with the drawings, in which:

FIG. 1 is a perspective view, in partial section, of a switching assembly embodying the present invention;

FIG. 2 is a sectional view taken along line 2—2 in FIG. 1;

FIG. 3 is a sectional view taken along line 3—3 in FIG. 2;

FIG. 4 is an enlarged sectional view taken along line 4—4 in FIG. 2;

FIG. 5 is an end view of the switching assembly;

FIG. 6 is a schematic view of a coin gauging apparatus embodying the switching assembly of the present invention;

FIG. 7 is a sectional view of the switching assembly used in the apparatus shown in FIG. 6;

FIG. 8 is a sectional view taken along line 8—8 in FIG. 7;

FIG. 9 is an enlarged sectional view taken along line 9—9 in FIG. 8 illustrating the switching assembly in a normal condition;

FIG. 10 is a sectional view similar to FIG. 9 illustrating the switching assembly in a first operated condition;

FIG. 11 is a sectional view similar to FIGS. 9 and 10 illustrating the switching assembly in a second operated condition; and

FIG. 12 is a circuit diagram illustrating one indicating means that can be used in the gauging apparatus shown in FIG. 6.

Referring now more specifically to FIGS. 1–5 of the drawings, therein is illustrated a switching assembly, indicated generally as **20**, which embodies the present invention and which includes a plurality of sealed switch units **22** supported in a circular array to define an axially extending central opening. Each of the sealed switch units **22** includes a pair of magnetic elements forming a gap, and the plurality of sealed switch units **22** are divided into two groups **22***a* and **22***b* mounted with their gaps spaced from each other along the axis of the central opening. A permanent magnet **24** is slidably mounted in the central opening and is normally retained in a position adjacent the gaps in the sealed switch units **22***a* to hold the magnetic elements therein in a closed condition completing a conductive circuit.

When the permanent magnet **24** is displaced from a position adjacent the gaps in the switch units **22***a* to a position adjacent the gaps in the switch units **22***b*, the magnetic elements in the switch units **22***a* separate to interrupt the conductive circuits therethrough, and the magnetic elements in the switch units **22***b* are moved into engagement to complete conductive circuits therethrough. In this manner, the staggering or spacing of the gaps in the two groups of switch units **22***a* and **22***b* and the axial movement of the permanent magnet **24** in the direction in which the gaps are spaced permit the selective operation of different groups of the sealed switch units **22** in response to an axial displacement of the permanent magnet **24**. As illustrated in FIGS. 1–5, the switching assembly **20** can comprise a manually actuated key.

Each of the sealed switch units **22** can comprise one of the well known sealed switch constructions, such as a mercury wetted contact switch or a "dry type" contact switch. The illustrated switch units **22** are "dry type" or magnetic reed switches including an elongated dielectric or glass envelope **26** from the opposite ends of which a pair of magnetic reed elements or terminals **28** and **30** extend. The inner ends of the magnetic elements **28** and **30** are provided with overlapping portions **28***a* and **30***a* that are normally maintained in a spaced relation to define a gap. When a magnetic field of sufficient strength is applied to the magnetic elements **28** and **30** in the vicinity of the gap, the overlapping portions **28***a* and **30***a* are flexed or deflected to move into engagement to complete a conductive circuit through the sealed switch unit **22**. The magnetic elements **28** and **30** are moved out of engagement by the inherent resilience of these elements when the applied magnetic field is removed.

The plurality of sealed switch units **22** are supported in a circular arrangement or array by a pair of circular dielectric supporting plates or elements **32** and **34** to define an axially extending opening **36**. The lower ends of the switch units **22** are mounted on the supporting plate **34** by inserting either flattened terminal portions **30***b* of the elements **30** in the switch units **22***b* or terminal extensions **38** that are secured to the terminal portions **30***b* of the elements **30** in the switch units **22***a* into slots in the supporting plate **34**. Upper terminal portions **28***b* (FIG. 4) of the elements **28** on the switch units **22***a* are arcuately formed and connected to an upper end of an electrically conductive and nonmagnetic connector or supporting element **40**. The terminal portions **28***b* of the magnetic elements **28** in the switch units **22***b* are also connected to the upper portions of the elements **40**. The upper ends of the connector elements **40** are inserted into slots formed in the upper supporting plate **32**, and the lower ends of the elements **40** extend through slots in the lower supporting plate **34**. The terminal portions **30***b* in the switch units **22***b*, the lower ends of the terminal extensions **38**, and the lower ends of the connector elements **40** provide terminals for connecting the switching assembly **20** to external circuits.

In the embodiment of the switching assembly **20** shown in FIGS. 1–5, the supporting or connector elements **40** not only support the pairs of sealed switch units **22***a* and **22***b* but also provides a common electrical connection to the terminals **28***b* thereof. If desired, the element **40** could be formed of a dielectric material with a conductive layer or printed circuit on opposite sides thereof to which the terminal portions **28***b* of the magnetic elements **28** in the switch units **22***a* and **22***b* can be connected. In this manner, separate electrical connections can be made to the magnetic elements **28** in the two sealed switch units **22***a* and **22***b*.

To provide means for guiding axial movement of the permanent magnet **24**, a dielectric sleeve or tube **42** is disposed in the axial opening **36** defined by the sealed switch units **22** with its lower end resting on the upper surface of the supporting plate **34**. The upper end of the tube **42** is secured to the lower surface of the upper supporting plate **32**. A compression spring **44** interposed between the upper surface of the plate **34** and the lower end of the permanent magnet **24** provides means for normally holding the permanent magnet **24** in its normal position adjacent the gaps provided by the magnetic elements **28** and **30** in the sealed switch units **22***a* (FIG. 4) and spaced from the gaps defined by the magnetic elements **28** and **30** in the sealed switch units **22***b*. The other end of the permanent magnet **24** preferably is provided with a recess in which is secured the lower end of a dielectric and nonmagnetic operating shaft **46**. This shaft extends through a bushing **48** which is mounted in a centrally disposed opening in the upper supporting plate **32** and which is provided at its upper end with a knob **50**. A circular lock spring **52** carried in a groove on the shaft **46** engages the lower end of the bushing **48** to limit upward movement of the permanent magnet **24** by the compression spring **44** and determines the normal position of this permanent magnet.

The switching assembly **20** is provided with an external housing **54** formed of a dielectric material and having an open lower end and an upper wall having an opening **56**. When the sealed switch units **22** and the supporting and operating means therefor are to be mounted on the housing **54**, an externally threaded portion **48***a* of the bushing **48** is inserted through the opening **56**

until a flange 48*b* on this bushing engages the lower surface of the upper wall of the housing 54. A nut 58 is then threaded on the portion 48*a* to secure the switching assembly in position within the housing 54. In this assembled position, the circular supporting plate 34 closes the lower end of the housing 54.

As indicated above, the compression spring 44 and the lock spring 52 normally hold the permanent magnet 24 in a position disposed adjacent the gaps formed by the overlapping portions 28*a* and 30*a* of the magnetic elements 28 and 30 in the sealed switch units 22*a* so that these magnetic elements are held in engagement to complete conductive circuits between the terminal extensions 38 and the connector elements 40. The permanent magnet 24 is spaced from the gaps formed by the overlapping portions 28*a* and 30*a* of the magnetic elements 28 and 30 in the switch units 22*b*. Thus, conductive circuits are not completed between the connector elements 40 and the terminal portions 30*b* in the switch units 22*b*. When the switching assembly 20 is operated, the knob 50 is depressed to the position shown in dot and dash outline in FIG. 3 to move the permanent magnet 24 downwardly to a position in which it is spaced from the gaps in the switch units 22*a* and is adjacent the gaps in the switch units 22*b*. This permits the magnet elements 28 and 30 in the switch units 22*a* to separate and interrupt the conductive circuits through the switch units 22*a* and moves the elements 28 and 30 in the switch units 22*b* into engagement to complete conductive circuits through the switch units 22*b*. The compression spring 44 restores the permanent magnet 24 to its normal position when the knob 50 is released, and the switching assembly 20 returns to its normal condition in which conductive circuits are completed through the switch units 22*a* and are not completed through the switch units 22*b*.

By suitably adjusting the axial spacing of the gaps in the switch units 22*a* and 22*b* and by controlling the configuration and strength of the magnetic field provided by the permanent magnet 24, each pair of switch units 22*a* and 22*b* can provide either type C or type D contacts. If the gaps in the switch units 22*a* and 22*b* are positioned more closely together along the axis of the opening 36 or if the strength of the permanent magnet 24 is increased, the contacts provided by the magnetic elements 28 and 30 in the switch units 22*b* will close to complete conductive circuits prior to the opening or separation of the magnetic elements 28 and 30 in the switch units 22*a*. This provides a type D or make-before-break contact arrangement. Alternatively, if the axial spacing of the gaps in the switch units 22*a* and 22*b* is increased or if the effective strength of the permanent magnet 24 is decreased, the switch units 22*a* open before the switch units 22*b* operate, and each pair of switch units 22*a* and 22*b* provides a normal transfer or type C contact arrangement.

FIGURE 6 of the drawings illustrates an electric gauging system, indicated generally as 60, which embodies the present invention and which provides an indication of the sizes of different articles. The gauging apparatus 60 includes a switching assembly 62 that is similar to the switching assembly 20 in including a plurality of sealed switch units whose gaps are displaced relative to each other in a given direction a distance proportional to the different acceptable dimensions of the articles to be gauged. The switching assembly 62 also includes a permanent magnet connected to a slidably mounted operating shaft 64 that is connected to a gauging element or roller 66 which extends into an article feeding passageway, such as a coin inlet 68, through an opening 70. The coin engaging roller 66 is displaced to the right or left a distance corresponding to the diameter of the coin advanced through the inlet 68 and produces a corresponding displacement of the permanent magnet in the switching assembly 62. The position to which the permanent magnet is adjusted within the switching assembly 62 closes a selected switch unit or combination of switch units to electrically control an indicating assembly 72 to provide an indication of the size of the sensed article. The displacement of the gaps of the sealed switch units used in the assembly 62 permits the permanent magnet to be directly connected to the article engaging roller 66 without the need for an intervening mechanical amplifying means, and the apparatus 60 is capable of detecting displacement on the order of thousandths of an inch. The sealed switch units used in the assembly 62 possess great reliability and an operating life far in excess of other switching arrangements.

FIGURES 7–11 illustrate the details of one switching assembly that can be used in the electrical gauging system 60. The assembly 62 is similar to the switching assembly 20 in including a plurality of sealed switch units 74 which are supported in a circular arrangement by the two dielectric supporting plates 32 and 34 surrounding the axial opening in which the dielectric tube 42 containing the permanent magnet 24 and the inner end of the nonmagnetic shaft 64 is disposed. The permanent magnet 24 is connected to the inner end of the shaft 64.

The sealed switch units 74 can be substantially identical to the sealed switch units 22 and include a dielectric envelope 76 containing a pair of magnetic elements 78 and 80 with overlapping inner end portions 78*a* and 80*a* normally defining a gap and operable into engagement to complete an electric circuit in response to the application of a magnetic field. A terminal portion 80*b* on the magnetic element 80 is either directly inserted into a slot in the supporting plate 34 or connected to a terminal extension 38 that is received within the slot in the supporting plate 34. A terminal portion 78*b* on the magnetic element 78 is secured to one of a plurality of nonmagnetic and electrically conductive supporting elements 82. If desired, the terminal portions 78*b* on the magnetic elements 78 in a pair of adjacent switch units 74 could be connected to a single element 82 in the same manner in which the terminals 28*b* are connected to the common supporting and conducting element 40 in the switching assembly 20.

However, the sealed switch units 74 are mounted on the supporting plates 32 and 34 in the switching assembly 62 in a slightly different manner than in the switching assembly 20. In the assembly 20, the sealed switch units 22 are divided into two separate groups with their gaps disposed in only two axially spaced positions. In the switching assembly 62, the switch units 74 are supported in a plurality of different positions spaced along the axis of the tube 42 or the path of movement of the permanent magnet 24 in accordance with the different dimensions of the articles or coins to be inserted into the passageway 68. As an example, a single sealed switch unit 74 could be supported with its gap disposed adjacent each of the different positions occupied by the permanent magnet 24 corresponding to the different sizes of the coins inserted into the inlet 68.

In FIGS. 7–11 of the drawings, the sealed switch units 74 are disposed in a different arrangement in which a pair of sealed switch units 74*a* and 74*b* is provided for detecting the size of each coin. In each pair of sealed switch units 74*a* and 74*b*, the gap in the sealed unit 74*a* is disposed in a position such that this switch will not be operated by the permanent magnet 24 when the article engaged by the roller 66 is smaller than a size or range of sizes acceptable for a given coin, such as a nickel. The switch unit 74*b* is mounted with its gap in a position such that this switch will not be operated by the permanent magnet 24 when the roller 66 engages an article larger than a size or range of sizes acceptable for the same coin. Therefore, when the permanent magnet 24 is moved to a position between the gaps in the switch units 74*a* and 74*b*, both of the switch units 74*a* and 74*b* are operated to indicate that the size of the coin is within the expected dimensional range and that

the coin has a known value. If the magnet **24** operates only one of the switch units **74***a* and **74***b*, the article inserted into the guide **68** is not within the accepted range and is not a coin of the given value.

FIGURE 12 of the drawings illustrates one circuit that can be used in the indicating means **72** in combination with one pair of sealed switch units **74***a* and **74***b* to indicate whether an article falls within an expected dimensional range and is a coin of a given value. The magnetic contacts or elements **78** and **80** in the two sealed switch units **74***a* and **74***b* are connected in series between a potential source, such as a battery **84**, and an indicator lamp **86**. The lamp **86** is energized by the potential source **84** only when both of the switches **74***a* and **74***b* are operated to indicate that a gauged article is within the expected dimensional range.

In operation, a coin is inserted into the coin inlet **68** and engages the roller **66** so that the shaft **64** is displaced to position the permanent magnet **24** in the switching assembly **62** in an axial position determined by the diameter of the engaged coin. If the engaged coin is too small, the magnet **24** is disposed in the position shown in FIG. 9 in which the magnetic elements **78** and **80** in only the switch unit **74***b* are closed. Thus, the lamp **86** is not illuminated to indicate that the coin is not of the given value. If the size of the inserted coin is within the tolerance range, the shaft **64** and the permanent magnet **24** are moved to the position shown in FIG. 10 in which the magnetic field of the magnet **24** moves the magnetic elements **78** and **80** in both of the switch units **74***a* and **74***b* into engagement. This completes a conductive circuit between the potential source **84** and the lamp **86** and illuminates this lamp to provide a visible indication that the coin has the given value. If the engaged coin is too large, the shaft **64** and the permanent magnet **24** are moved to the position shown in FIG. 11 in which the field of the magnet **24** closes the magnetic elements **78** and **80** in only the switch unit **74***a*. Thus, the circuit for the lamp **86** is not completed, and this lamp is not illuminated to provide an indication that the inserted object is not a coin of the given value.

The switching assembly **62** includes a pair of switch units **74***a* and **74***b* for each size coin that can be inserted into the coin inlet **68** (see FIG. 7). Each pair of the sealed switches **74** provides a positive indication only when the article inserted into the inlet **68** falls within the known dimensional range. The acceptable range of dimensions can be increased by moving the gaps in the switch units **74***a* and **74***b* further apart and by making a compensating change in the configuration and strength of the magnetic field of the permanent magnet **24**. This dimensional range can be decreased by moving the gaps of the switch units **74***a* and **74***b* closer together in an axial direction and by making a corresponding reduction in the effective field of the permanent magnet **24**.

It is also possible to provide a pair of switching assemblies **62** actuated in common or parallel by the coin engaging roller **66**. One of the switching assemblies **62** could contain all of the switch units **74***b*, and the other switching assembly **62** could contain all of the switch units **74***a*. Further, additional circuits could be provided in the indicating means **72** controlled by the individual switches **74***a* and **74***b* for providing positive indications when an engaged article is undersize and oversize as well as within the accepted range.

Although the present invention has been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art than will fall within the spirit and scope of the principles of this invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An apparatus for gauging articles falling within a plurality of ranges between different high and low dimensions, a plurality of sealed switch units having magnetic elements defining gaps, supporting means mounting said sealed switch units in positions with the gaps spaced from each other in a given direction, said sealed switch units being mounted so that the gaps in different pairs of said switch units are spaced in said given direction distances proportional to the high and low dimensions of said plurality of ranges, permanent magnetic means disposed adjacent said switch units, operating means including means adapted to engage said article for moving said permanent magnetic means in said given direction a distance proportional to the size of the engaged article, and indicating means connected to the magnetic elements in said sealed switch units and responsive to the operation of both of the switch units in the pair representing a given range for indicating the size of the engaged article.

2. An apparatus for gauging articles having a size in a range between a lower dimension and a higher dimension comprising a pair of sealed switch units, each of said switch units including a dielectric housing containing at least a pair of magnetic elements spaced from each other to form a gap and operable by an applied magnetic field to close said gap and complete an electric circuit, supporting means for supporting said pair of sealed switch units with their gaps spaced from each other in a given direction a distance corresponding to the difference between said higher and lower dimensions, permanent magnetic means disposed adjacent said sealed switch units, article engaging means adapted to engage an article to be gauged and including means for moving said permanent magnetic means in said given direction relative to the gaps in said sealed switch units, said permanent magnetic means operating different ones of said switch units when the engaged article is below or above said range and operating both of said switch units when said article falls within said range, and indicating means controlled by said pair of switch units for indicating whether the engaged article falls within said range.

3. An apparatus for gauging articles having different sizes in ranges between lower dimensions and higher dimensions comprising a plurality of pairs of sealed switch units, each of said switch units including a dielectric housing containing at least a pair of magnetic elements spaced from each other to form a gap and operable by an applied magnetic field to close said gap and complete an electric circuit, supporting means for supporting said pairs of sealed switch units with their gaps spaced from each other in a given direction a distance representing the difference between the higher and lower dimensions for each range, permanent magnetic means disposed adjacent said sealed switch units, article engaging means adapted to engage articles to be gauged and including means for moving said permanent magnetic means in said given direction relative to the gaps in the sealed switch units, said permanent magnetic means operating different ones of said switch units when the engaged article is below or above said range and operating both of the switch units for a given range when the article falls within this given range, and indicating means controlled by said switch units for indicating whether the engaged article falls within a range and the range in which the engaged article does fall.

4. A switching assembly comprising a plurality of electrically conductive supporting members, a plurality of sealed switch units having elongated dielectric housings with magnetic terminals projecting from their opposite ends, each pair of magnetic terminals having spaced portions defining a gap, means securing the magnetic terminals at one end of a pair of the sealed switch units to opposite sides of a supporting member, the gaps of the pair of sealed switches being spaced from each other along the length of the supporting member, permanent magnet means movable in a direction generally

along the length of the supporting members between positions adjacent different ones of the gaps, and means for mounting the sealed switch units including a first structure for engaging the supporting members at one end and for engaging the supporting members and the other two magnetic terminals of each pair of sealed switches at the other end.

5. A switching assembly comprising a plurality of pairs of sealed switch units each including an elongated dielectric housing with magnetic elements extending from its opposite ends, the inner ends of said magnetic elements being movable into and out of engagement to define a gap, supporting means mounting said sealed switch units in a circular array defining an axially extending opening, said supporting means mounting a first group of said sealed switch units with their gaps at a first position relative to the axis of said opening and a second group of said sealed switch units with their gaps at a second position spaced from said first position along said axis, said supporting means including a first dielectric supporting element at one end of said circular array and a second dielectric supporting element engaging the magnetic elements at the other end of the circular array, connecting means connected to the magnetic elements at said one end of said array and carried on said first and second supporting elements, said connecting means being electrically conductive and disposed between alternate ones of the sealed switch units extending generally parallel thereto, each of said connecting means being disposed

between one sealed switch unit from the first group and one sealed switch from the second group and connected to the magnetic elements of these two switches, terminal means for the sealed switch units and the connecting means at said other end of the array, permanent magnetic means disposed in said opening, and operating means for moving said permanent magnetic means to different axially spaced positions within said opening to selectively operate the first and second groups of sealed switch units, said operating means extending from said one end of the array.

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