Feb. 12, 1963 W. R. GOLDBACH ETAL 3,077,527

CIRCUIT INTERRUPTER

Filed June 21, 1961 2 Sheets-Sheet 1

Fig. 1

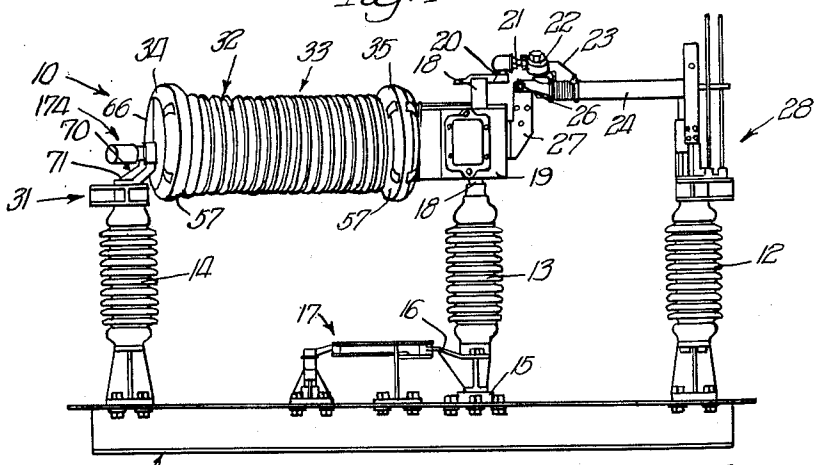


Fig. 5

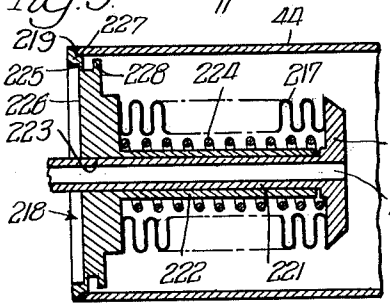


Fig. 2

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CIRCUIT INTERRUPTER

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Fig. 3

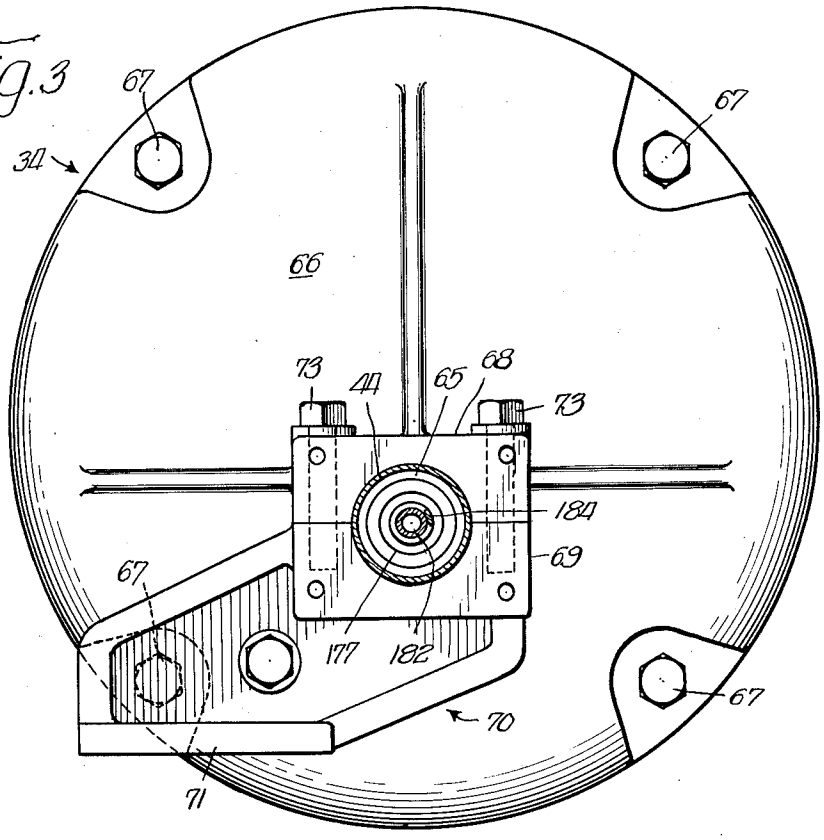
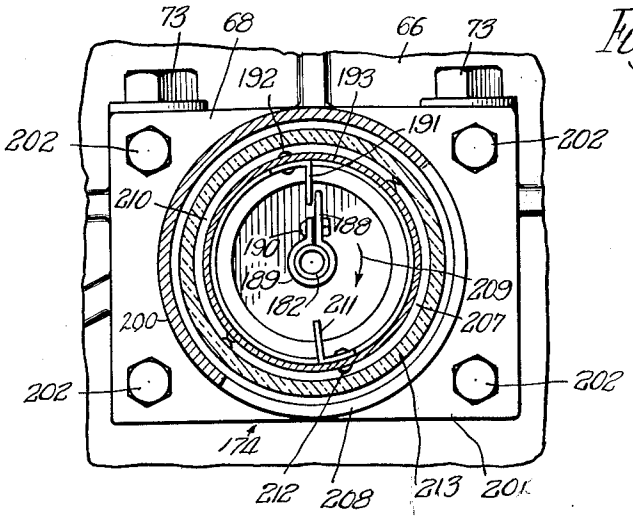


Fig. 4



United States Patent Office 3,077,527 Patented Feb. 12, 1963

3,077,527

CIRCUIT INTERRUPTER

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Filed June 21, 1961, Ser. No. 118,620
10 Claims. (Cl. 200—167)

This invention relates, generally, to high voltage alternating current circuit interrupters and it has particular relation to gas pressure indicating means for such circuit interrupters in which an arc extinguishing gas is employed for assisting in the circuit interruption and prevention of restriking of the circuit once it has been opened. It constitutes an improvement over the invention disclosed in copending application Serial No. 111,998 filed May 23, 1961.

Among the objects of this invention are: To provide for indicating in a new and improved manner the gas pressure in a circuit interrupter; to construct the indicating means such that the indication provided thereby is readily visible from a substantial distance from the interrupter; to employ for the indicator a member that moves promptly from one position to another position upon the reduction in the gas pressure below a predetermined value; to employ for the movable member a cylindrical member that is spring biased for rotation about its longitudinal axis and which has semi-cylindrical indicia of contrasting colors on its periphery to indicate whether the gas pressure is at or above or below the predetermined pressure; and to provide for relief of overpressure in the current interrupter in a new and improved manner.

In the drawings:

FIG. 1 is a view, in side elevation, of switch means having indicator means embodying the present invention.

FIG. 2 shows, at an enlarged scale, a vertical cross sectional view of one end of the current interrupter which forms a part of the switch means shown in FIG. 1.

FIG. 3 is a view taken generally along the line 3—3 of FIG. 2 showing partly in end elevation and partly in section the terminal at the left end of the housing for the current interrupter and how the indicating means of the present invention is mounted thereon.

FIG. 4 is a vertical sectional view taken generally along the line 4—4 of FIG. 2.

FIG. 5 is a vertical sectional view of a portion of modified indicator means showing provision for overpressure relief.

Referring now particularly to FIG. 1 of the drawings, it will be observed that the reference character **10** designates, generally, switch means having indicator means in which the present invention is embodied. Only a portion of the details of construction of the switch means **10** is shown and described herein since a complete description thereof is set forth in the application above referred to. However, insofar as possible, the same reference characters are employed herein to facilitate understanding of the invention of this application. The switch means **10** includes a base, indicated generally at **11**, that may be formed of a pair of rolled steel channels suitably secured together. Mounted at the base **11** are a first insulator **12**, a second insulator **13** which is rotatable and a third insulator **14**. The second insulator **13** is rotatably mounted on a bearing **15** that is carried by the base **11** and it has an arm **16** extending therefrom for connection to a suitable operating linkage that is indicated, generally, at **17**. It will be understood that, for three phase operation, three of the switch means **10** are mounted on a suitable switching structure in proper spaced relation, depending upon the voltage of the circuit, and that suitable operating means, common to the operating linkage **17** is provided for effecting the simultaneous rotation of the second insulator **13** of each switch means **10** for effecting simultaneous operation of the three switch means **10** for either opening or closing the circuit as may be required.

Extending upwardly from and rotatable with the second insulator **13** is a shaft **18**. The shaft **18** extends through and is rotatably mounted on a mechanism housing **19** the details of construction of which are set forth in application Serial No. 704,397, filed December 23, 1957, now Patent No. 3,030,481, issued April 17, 1962, together with the operating mechanism therein which is controlled by the shaft **18**. For present purposes it is pointed out that the shaft **18** extends through the mechanism housing **19** and carries at its upper end a switch crank **20** which is rotatable therewith. The switch crank **20** is pivotally connected to a link **21** that is pivoted at **22** to an arm **23** which extends from a switch blade **24** that forms a part of a disconnecting switch that is indicated, generally, at **25**. The switch blade **24** is pivoted at **26** on a bracket **27** which is carried by one wall of the mechanism housing **19**. At its swinging end the switch blade **24** is arranged to move into and out of high pressure contact engagement with a line contact member, shown generally at **28**, which is carried by the first insulator **12**. It will be understood that, on rotation of the second insulator **13** by the operating linkage **17**, a corresponding rotation of the switch crank **20** is effected for swinging the switch blade **24** out of or into high pressure contact engagement with the line contact member **28**, depending upon the direction of rotation. The details of construction of the disconnecting switch **25** are conventional and may be as disclosed in U.S. Patent No. 2,818,474, issued December 31, 1957.

It is desirable that the switch blade **24** be opened only after the circuit has been opened previously by some other means. The reason for this is to prevent the drawing of an arc between the swinging end of the switch blade **24** and the line contact member **28** when the circuit is interrupted under load which might result in damage to these parts or the creation of a fault by arcing over to an adjacent phase or to ground. For this purpose there is mounted between the mechanism housing **19** and a line terminal **31**, which is carried by the third insulator **14**, a current interrupter that is indicated, generally, at **32**. Separable contact means are provided in the current interrupter **32** which are operated by the mechanism within the mechanism housing **19** under the control of the shaft **18**.

The current interrupter **32** is provided with an insulating housing **33** that preferably is a one piece hollow porcelain housing having a cylindrical interior and external corrugations to increase its flashover value between the ends. At the ends of the housing **33** there are provided terminals that are indicated, generally, at **34** and **35**.

Referring now to FIG. 2 of the drawings, since the insulator housing **33** is intended to contain a filling of arc extinguishing gas, such as Freon, sulphurhexafluoride and the like, provision is made for hermetically sealing the ends thereof. Around the extreme end of each end of the insulating housing **33** there is provided an external metallic band **36**, preferably formed of platinum, which facilitates soldering thereto. In addition at locations spaced slightly from the extreme ends of the insulating housing **33**, there are provided sand bands one of which is shown at **37**. They facilitate the cementing of the terminals **34** and **35** thereto. In order to prevent the solder from flowing inwardly of the end of the insulating housing **33**, an annular dam **38** is located on the end surfaces.

Referring now particularly to the left end of the insulating housing **33**, as shown in FIG. 2, it will be observed that the annular dam **38** has an annular surface **39** in engagement therewith which is provided on a pan shaped diaphragm **40** that is formed preferably of thin

copper. The diaphragm 40 has a flat bottom 41 and an outflared rim 42 which overlies the platinum band 36. A filling of molten solder 43 is provided between the platinum band 36 and the outflared rim 42, as shown, to seal hermetically the diaphragm 40 to this end of the insulating housing 33. It will be understood that the annular dam 38 limits the extent of flow of the solder 43 essentially to the position shown. Extending outwardly from the flat bottom 41 of the diaphragm 40 and offset from the central portion thereof is a tubular extension 44 having a radially outwardly extending flange 44' which is brazed at 45 to the flat bottom 41.

Mechanical connection to the ends of the insulating housing 33 is provided by adapter rings 57 which, it will be understood, form parts of the terminals 34 and 35. Each adapter ring 57 has a corrugated inner surface 58, FIG. 2, for receiving between it and the juxtaposed end surface of the insulating housing 33 including the sand band 37 a filling of Portland cement 59.

As an initial step in the assembly of the current interrupter 32 the insulating housing 33 has the pan shaped diaphragm 40 applied and secured thereto in the manner described by the soldered joint 43. Another part of the preliminary assembly involves the application of a diaphragm (not shown) similar to the diaphragm 40 to the other end of the insulating housing 33 and of the adapter rings 57 with the Portland cement 59 securing them mechanically in place. Preferably this sub-assembly is completed as an entity and then it is used to make the complete assembly of the current interrupter 32.

The internal details of construction of the current interrupter 32 are set forth in application Serial No. 111,998, filed May 23, 1961. Here it will be observed that there is provided within the insulating housing 33 a rigid separable contact structure that includes separable main contacts with separable auxiliary contacts. It will be understood that provision is made for first opening the separable main contacts then transferring the entire current flow to the auxiliary contacts which are opened quickly in the filling of arc extinguishing gas under pressure to complete the final circuit interruption. On reclosure the main contacts are closed simultaneously with closure of the auxiliary contacts. The operation of the main and auxiliary contacts is under the control of the mechanism within the mechanism housing 19 as determined by rotation of the shaft 18.

The separable main contacts are mounted at one end on a heavy gauge copper tube 65 which extends through the tubular extension 44 that is brazed to the flat bottom 41 of the pan shaped diaphragm 40. That portion of the copper tube 65 which extends into the tubular extension 44 is securely clamped thereto and to the terminal 34 by a terminal end adapter 66 which mates with the adapter ring 57 and is rigidly secured thereto by bolts 67. It will be understood that the terminal end adapter 66, which is preferably formed of good conducting material, such as aluminum, and the adapter ring 57 complete the assembly of the terminal 34.

As shown more clearly in FIGS. 2 and 3 of the drawings the terminal end adapter 66 is provided with an integrally formed semi-circular section 68 which mates with a semi-circular section 69 that forms an integral part of a terminal end support 70 that is formed of good conducting material, such as copper. The terminal end support 70 has a pad portion 71 for mounting on the line terminal 31 as shown more clearly in FIG. 1 of the drawings. The semi-circular sections 68 and 69, FIG. 3, are drawn toward each other by bolts 73 with the result that the end of the heavy gauge copper tube 65 is securely clamped to the terminal 34 in the manner described and since the copper tube 65 forms one support for the rigid separable contact structure of the current interrupter 32, it will be apparent that the contact structure is rigidly supported within the insulating housing 33 at one end on the terminal 34.

It is desirable to provide for indicating at a substantial distance from the switch means 10 whether the pressure of the arc extinguishing gas within the housing 33 remains at a predetermined pressure or whether it has fallen below this pressure as the result of leakage. For this purpose, as shown in FIGS. 2 and 4, indicating means, shown generally at 174, is provided. The indicating means 174 includes pressure sensitive means 175 in the form of an inner closure or washer that is subject directly to the pressure of the gas within the insulating housing 33. It will be noted that the pressure sensitive means 175 is located at the outer end of the copper tube 65. Since the inner end of the copper tube 65 is in communication with the interior of the insulating housing 33, the pressure applied to the pressure sensitive means 175 is the pressure within the insulating housing 33. It will be noted that the pressure sensitive means 175 is centrally apertured for a purpose that will be apparent presently. It is soldered at 176 to one end of a beryllium copper bellows 177 the other end of which is brazed at 178 to a closure plate 179, formed preferably of copper, which is soldered at 180 to the outer end of the tubular extension 44. In this manner the hermetic seal at the left end of the insulating housing 33 is completed.

The closure plate 179 has a central aperture 181 through which a filler tube 182 extends. The filler tube 182 functions not only for the purpose of introducing the arc extinguishing gas into the insulating housing 33 but also a rod like member in a manner described hereinafter for controlling the operation of the indicating means 174. At its inner end the filler tube 182 is brazed at 183 to the pressure sensitive means or washer 175 and, since its inner end opens into the insulating housing 33, the latter can be filled with arc extinguishing gas to the desired pressure by connecting a supply thereof to the outer end. A coil compression spring 184 surrounds the filler tube 182 and extends between the pressure sensitive means 175 and the closure plate 179 to bias them apart. Near its outer end the filler tube 182 is pinched off at 185, after the insulating housing 33 has been filled to the desired pressure by the arc extinguishing gas.

Now it will be apparent since the filler tube 182 is freely movable through the aperture 181 in the closure plate 179 and since the gas pressure within the insulating housing is applied to the pressure sensitive means 175, the latter will be positioned in accordance with the gas pressure. When the insulating housing 33 is filled with arc extinguishing gas at the predetermined pressure, the coil compression spring 184 is compressed and the pressure sensitive means 175 occupies a position in minimum spaced relation with respect to the closure plate 179. When the gas pressure within the insulating housing 33 decreases, the pressure exerted on the pressure sensitive means 175 inside the insulating housing 33 is correspondingly decreased. As a result it moves away from the closure plate 179 carrying with it the filler tube or rod-like member 182.

Advantage is taken of the relative movement of the filler tube or rod-like member 182 from the position shown in FIG. 2 of the drawings corresponding to predetermined pressure of gas within the insulating housing 33 to an alternate position at a predetermined lower pressure for controlling the movement of a latch 188, in turn, to control the operation of the indicating means 174. As shown in FIG. 4 the latch 188 includes a portion 189 which extends around the filler tube or rod-like member 182 and is secured thereto against relative longitudinal movement by clamp screws 190. Thus the latch 188 has a translatory movement toward the outer side of the closure plate 179 on decrease in the pressure of the arc extinguishing gas within the insulating housing 33. As long as the latch 188 is held substantially in the position shown as the result of predetermined gas pressure within the insulating housing 33 and during a predetermined reduction thereof, it engages a stop bracket 191 which

extends radially inwardly from and is secured by rivets **192** to an indicator drum **193**. The indicator drum **193** is mounted at its left end by a cylindrical support plate **194** which has an inwardly extending hub **195** that is journaled on bearing sleeves **196—196** which are mounted on a shaft **197**. The shaft **197** has a head **198** at its inner end and its other end extends through an opening **199** in an end wall of a housing **200**, preferably formed of aluminum. The housing **200** has a rectangular base flange **201**, FIG. 4, that is held by bolts **202** in position on the semicircular sections **68** and **69** of the terminal **66** and the terminal end support **70**, respectively.

It will be noted that the outer end of the shaft **197** is threaded at **203** for receiving a nut **204** to clamp it in position against rotation on the outer end of the housing **200**. A kerf **205** is located in the outer end of the shaft **197** for receiving a screw driver to adjust its position and for tensioning a spiral spring **206** which extends around the hub **195** and is secured at its inner end to the head **198** and at its other end to the cylindrical support plate **194**. With the nut **204** loosened, a screw driver is inserted in the kerf **205** to rotate the shaft **197** and tension the spring **206** in order to hold the stop bracket **191** under tension against the latch **188**. Then the nut **204** is tightened.

In this position of the indicator drum **193** a first reflective indicator means **207**, FIG. 4, is visible through an opening **208** in the housing **200**. Preferably the first indicator means **207** is colored green and may comprise an appropriately colored sheet of reflective adhesive material which extends lengthwise over the indicator drum **193** for one half of its circumference. Since the opening **208** is somewhat less in arcuate length than the arcuate length of the first indicator means **207**, only the color thereof is visible through the opening **208**.

Should the gas pressure within the insulating housing **23** decrease to such an extent that the latch **188** is moved toward the closure plate **179** and entirely out of engagement with the stop bracket **191**, the spring **206** then rotates the indicator drum **193** in the direction indicated by the arrow **209**, FIG. 4. This removes the first reflective indicator means **207** from view through the opening **208** and brings a second reflective indicator means **210** of reflective adhesive material into view. Preferably it is colored red. In order to stop the rotation of the indicator drum **193** in a position where only the second indicator means **210** will be visible through the opening **208**, a second stop bracket **211** is secured by rivets **212** to the indicator drum **193**. It will be noted that the second stop bracket **211** is offset from the first stop bracket **191** so that it will be in a position to be intercepted by the latch **188** in its retracted position corresponding to a predetermined lowered pressure within the insulating housing **33**. The latch **188** is of sufficient length to maintain latching engagement with the stop bracket **191** under varying pressures due to temperature change to the end that a substantial pressure change, greater than that due to change in temperature, is required to disengage the stop bracket **191** and indicate actual loss of arc extinguishing gas.

It is desirable to protect the indicator drum **193** from the weather. For this purpose a transparent cylinder **213** is employed. It can be formed of suitable transparent plastic material. Gaskets **214** and **215** are provided at the ends of the cylinder **213** to provide a weather tight construction. It will be observed that the gasket **215** surrounds the projecting end of the tubular extension **44** and underlies a beveled end of the transparent cylinder **213**.

With a view to placing the interior of the transparent cylinder **213** in direct communication with the atmosphere to relieve any pressure that might develop therein, the gasket **214** is radially slotted (not shown) to provide the desired vent. Since such a vent is relatively small, the interior of the indicating means **174** is adequately protected from the weather by the means described.

The indicating means **174** can be used for purposes other than to show loss of pressure. For example, if it is desired to show loss of vacuum within the housing **33**, the positions of the stop brackets **191** and **211** are reversed to release the drum **193** for rotation on predetermined outward movement of the pressure sensitive means **175** and of the tube **182** which then is used for evacuation rather than for filling purposes. When provision is made for rotating the drum **193** as a function of change in pressure within the housing **33**, the indicating means **174** operates as a pressure gauge. Such operation is effected by modifying the filler tube **182** to provide a helical driving connection between it and the drum **193** to position it at various angular locations depending upon the relative pressure within the housing **33**.

FIG. 5 shows a modified construction arranged to relieve predetermined overpressure within the housing **33**. The closure means for the outer end of the tubular extension **44** now to be described can be used in lieu of the closure means shown in FIG. 2 and previously described. Otherwise the construction is the same.

Pressure sensitive means **216** in the form of a disc exposed to the pressure within the housing **33** is employed and it is hermetically connected by bellows **217** to the inner side of a closure plate **218** that is soldered at **219** to the outer end of the tubular extension **44**. A central aperture **220** is provided in the pressure sensitive means **216** which is formed integrally with a filler tube **221** through which the arc extinguishing gas can flow to fill the housing **33**. Thereafter the outer end of the filler tube **221** is pinched off (not shown) as described hereinbefore for the filler tube **182**. The filler tube **221** is freely slidable in and is guided by a tubular extension **222** from the closure plate **218** and extends slidably through an opening **223** therein. A coil compression spring **224** surrounding the tubular extension **221** reacts between the pressure sensitive means **216** and the closure plate **218** to bias the former away from the latter. The functioning of the pressure sensitive means **216** for controlling the release of the drum **193** is the same as described above for the operation of the pressure sensitive means **175**.

In order to relieve overpressure within the housing **33** the closure plate **218**, which is formed of copper for example, has an annular frangible section **225** between a central section **226** of the closure plate **218** and an outer annular mounting section **227** that is soldered at **219** to the tubular extension **44**. When the pressure within the housing **33** exceeds a predetermined value, the annular frangible section **225** is ruptured and the central section **226** is blown out thereby permitting the gas in the housing **33** to escape into the indicating means **174** and more particularly into the glass cylinder **213** when it can flow to the atmosphere through the radial vent provided in the gasket **214** or through a suitable vent in the housing **200** or in the glass cylinder **213**.

It is desirable that the movement of the central section **226** into the indicating means **174** be limited to avoid damage thereto. Accordingly, a peripheral flange **228** is formed on the central section **226** of the closure plate **218** in spaced relation to the annular frangible section **225** and it is of such diameter as to overlie the annular mounting section **227** and engage it on rupture of the annular frangible section **225** thereby limiting outward movement of the central section **226**. After rupture of the annular frangible section **225** and discharge of the major portion of the gas from the housing **33** the pressure within the housing **33** is reduced and the pressure sensitive means **216** and the filler tube **221** move inwardly as previously pointed out in connection with the embodiment of the invention shown in FIG. 2 to release the drum **193** for rotation to indicate, as described, that the pressure within the housing **33** has been lost.

What is claimed as new is:

1. Pressure indicating means comprising, in combination, a housing having a filling of gas, an outer apertured closure for said housing having a bellows extending

therefrom into said housing with an inner closure at its inner end subject to the pressure of said gas, a rod like member secured at one end to said inner closure and extending loosely through the aperture in said outer closure to a position outwardly thereof, a latch secured to and extending radially from the other end of said rod like member and movable therewith from a first position corresponding to predetermined gas pressure in said housing to a second position corresponding to a different gas pressure, an indicator drum telescoped over said other end of said rod like member and rotatably mounted about the longitudinal axis thereof, a stop bracket carried by and extending radially inwardly from said indicator drum, a spring biasing said indicator drum for rotation, said stop bracket being engaged by said latch to hold said indicator drum against rotation under the influence of said spring as long as said latch is in said first position, movement of said latch to said second position releasing said indicator drum to rotate to an alternate position, and first and second indicator means on said drum, said first indicator means being visible when said latch engages said stop bracket and said second indicator means being visible when said indicator drum occupies said alternate position.

2. Loss of gas pressure indicating means comprising, in combination, a housing having a filling of gas at a pressure above atmospheric pressure, an outer apertured closure for said housing having a bellows extending therefrom into said housing with an inner closure at its inner end subject to the pressure of said gas, a rod like member secured at one end to said inner closure and extending loosely through the aperture in said outer closure to a position outwardly thereof, a latch secured to and extending radially from the other end of said rod like member and movable therewith from a first position corresponding to predetermined gas pressure in said housing to a second position corresponding to a lower gas pressure, an indicator drum telescoped over said other end of said rod like member and rotatably mounted generally about the longitudinal axis thereof, a stop bracket carried by and extending radially inwardly from said indicator drum, a spring biasing said indicator drum for rotation, said stop bracket being engaged by said latch to hold said indicator drum against rotation under the influence of said spring as long as said latch is in said first position, movement of said latch to said second position releasing said indicator drum to rotate to an alternate position, and first and second indicator means on said drum, said first indicator means being visible from a given position when said latch engages said stop bracket and said second indicator means being visible from said given position when said indicator drum occupies said alternate position.

3. Loss of gas pressure indicating means comprising, in combination, a housing having a filling of gas at a pressure above atmospheric pressure, an outer apertured closure for said housing having a bellows extending therefrom into said housing with an inner closure at its inner end subject to the pressure of said gas, a rod like member secured at one end to said inner closure and extending loosely through the aperture in said outer closure to a position outwardly thereof, a latch secured to and extending radially from the other end of said rod like member and movable therewith from a first position corresponding to predetermined gas pressure in said housing to a second position corresponding to a lower gas pressure, an indicator drum telescoped over said other end of said rod like member and rotatably mounted generally about the longitudinal axis thereof, stop brackets carried by and extending radially inwardly from and in longitudinal and circumferential spaced relation to said indicator drum, a spring biasing said indicator drum for rotation, one of said stop brackets being engaged by said latch to hold said indicator drum against rotation under the influence of said spring as long as said latch is in said first position, movement of said latch toward said second position releasing said indicator drum to rotate to an alternate position where the other stop bracket engages said latch thereby stopping further rotation of said drum, and first and second indicator means on said drum, said first indicator means being visible from a given position when said latch engages said one stop bracket and said second indicator means being visible from said given position when said latch engages said other stop bracket.

4. Loss of gas pressure indicating means comprising, in combination, a housing having a filling of gas at a pressure above atmospheric pressure, an outer apertured closure for said housing having a bellows extending therefrom into said housing with an inner apertured closure at its inner end subject to the pressure of said gas, a filler tube secured at one end to said inner closure at the aperture therein and extending through said bellows and loosely through the aperture in said outer closure to a position outwardly thereof, said filler tube being closed off at its outer end, a latch secured to and extending radially from the other end of said filler tube and movable therewith from a first position corresponding to predetermined gas pressure in said housing toward a second position corresponding to a lower gas pressure, an indicator drum telescoped over said other end of said filler tube and rotatably mounted generally about the longitudinal axis thereof, a stop bracket carried by and extending radially inwardly from said indicator drum, a spring biasing said indicator drum for rotation, said stop bracket being engaged by said latch to hold said indicator drum against rotation under the influence of said spring as long as said latch is in said first position, movement of said latch to said second position releasing said indicator drum to rotate to an alternate position, and first and second indicator means on said drum, said first indicator means being visible from a given position when said latch engages said stop bracket and said second indicator means being visible from said given position when said indicator drum occupies said alternate position.

5. Loss of gas pressure indicating means comprising, in combination, a housing having a filling of gas at a pressure above atmospheric pressure, an outer apertured closure for said housing having a bellows extending therefrom into said housing with an inner apertured closure at its inner end subject to the pressure of said gas, spring means within said bellows reacting between said closures and biasing them apart, a filler tube secured at one end to said inner closure at the aperture therein and extending through said bellows and loosely through the aperture in said outer closure to a position outwardly thereof, said filler tube being closed off at its outer end, a latch secured to and extending radially from the other end of said filler tube and movable therewith from a first position corresponding to predetermined gas pressure in said housing toward a second position corresponding to a lower gas pressure, an indicator drum telescoped over said other end of said filler tube and rotatably mounted generally about the longitudinal axis thereof, stop brackets carried by and extending radially inwardly from and in longitudinal and circumferential spaced relation to said indicator drum, a spring biasing said indicator drum for rotation, one of said stop brackets being engaged by said latch to hold said indicator drum against rotation under the influence of said spring as long as said latch is in said first position, movement of said latch toward said second position releasing said indicator drum to rotate to an alternate position where the other stop bracket engages said latch thereby stopping further rotation of said drum, and first and second indicator means on said drum, said first indicator means being visible from a given position when said latch engages said one stop bracket and said second indicator means being visible

from said given position when said latch engages said other stop bracket.

6. Loss of gas pressure indicating and pressure relief means comprising, in combination, a housing having a filling of gas at a pressure above atmospheric pressure, an outer apertured closure for said housing having a bellows extending therefrom into said housing with an inner closure at its inner end subject to the pressure of said gas, a frangible section in said outer closure capable of being ruptured on the occurrence of predetermined pressure in said housing to relieve such pressure, a rod like member secured at one end to said inner closure and extending loosely through the aperture in said outer closure to a position outwardly thereof, and means responsive to predetermined movement of said rod like member through said outer closure for indicating predetermined pressure change in said housing.

7. Loss of gas pressure indicating and pressure relief means comprising, in combination, a housing having a filling of gas at a pressure above atmospheric pressure, an outer closure for said housing having a central apertured section with an annular mounting section connected thereto by a frangible section capable of being ruptured on the occurrence of predetermined pressure in said housing to relieve such pressure, a bellows extending into said housing from said central apertured section having an inner closure at its inner end subject to the pressure of said gas, a rod like member secured at one end to said inner closure and slidable through the aperture in said central apertured section, and means responsive to predetermined movement of said rod like member for indicating predetermined pressure change in said housing.

8. Loss of gas pressure indicating and pressure relief means comprising, in combination, a housing having a filling of gas at a pressure above atmospheric pressure, an outer closure for said housing having a central apertured section with an annular mounting section connected thereto by a frangible section capable of being ruptured on the occurrence of predetermined pressure in said housing to relieve such pressure, a peripheral flange on said central section overlying said annular mounting section and adapted to engage the same on rupture of said frangible section to limit the outward movement of said central section from said housing, a bellows extending into said housing from said central apertured section having an inner closure at its inner end subject to the pressure of said gas, a rod like member secured at one end to said inner closure and slidable through the aperture in said central apertured section, and means responsive to predetermined movement of said rod like member for indicating predetermined pressure change in said housing.

9. Loss of gas pressure indicating and pressure relief means comprising, in combination, a housing having a filling of gas at a pressure above atmospheric pressure, an outer apertured closure for said housing having a bellows extending therefrom into said housing with an inner closure at its inner end subject to the pressure of said gas, a frangible section in said outer closure capable of being ruptured on the occurrence of predetermined pressure in said housing to relieve such pressure, a rod like member secured at one end to said inner closure and extending loosely through the aperture in said outer closure to a position outwardly thereof, a latch secured to and extending radially from the other end of said rod like member and movable therewith from a first position corresponding to predetermined gas pressure in said housing to a second position corresponding to a lower gas pressure, an indicator drum telescoped over said other end of said rod like member and rotatably mounted generally about the longitudinal axis thereof, stop brackets carried by and extending radially inwardly from and in longitudinal and circumferential spaced relation to said indicator drum, a spring biasing said indicator drum for rotation, one of said stop brackets being engaged by said latch to hold said indicator drum against rotation under the influence of said spring as long as said latch is in said first position, movement of said latch toward said second position releasing said indicator drum to rotate to an alternate position where the other stop bracket engages said latch thereby stopping further rotation of said drum, and first and second indicator means on said drum, said first indicator means being visible from a given position when said latch engages said one stop bracket and said second indicator means being visible from said given position when said latch engages said other stop bracket.

10. Loss of gas pressure indicating means comprising, in combination, a housing having a filling of gas at a pressure above atmospheric pressure, an outer apertured closure for said housing having a bellows extending therefrom into said housing with an inner closure at its inner end subject to the pressure of said gas, a rod like member secured at one end to said inner closure and extending loosely through the aperture in said outer closure to a position outwardly thereof, latch means secured to and extending radially from the other end of said rod like member and movable therewith from a first position corresponding to predetermined gas pressure in said housing to a second position corresponding to a lower gas pressure, an indicator drum telescoped over said other end of said rod like member and rotatably mounted generally about the longitudinal axis thereof, stop bracket means carried by and extending radially inwardly from said indicator drum, a spring biasing said indicator drum for rotation, said stop bracket means being engaged by said latch means to hold said indicator drum against rotation under the influence of said spring as long as said latch means is in said first position, movement of said latch means toward said second position releasing said indicator drum to rotate to an alternate position where said stop bracket means engages said latch means thereby stopping further rotation of said drum, and first and second indicator means on said drum corresponding to said first and second positions of said latch means.

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