Aug. 16, 1955 K. L. SCHAUS 2,715,336

GAS METER DIAPHRAGM

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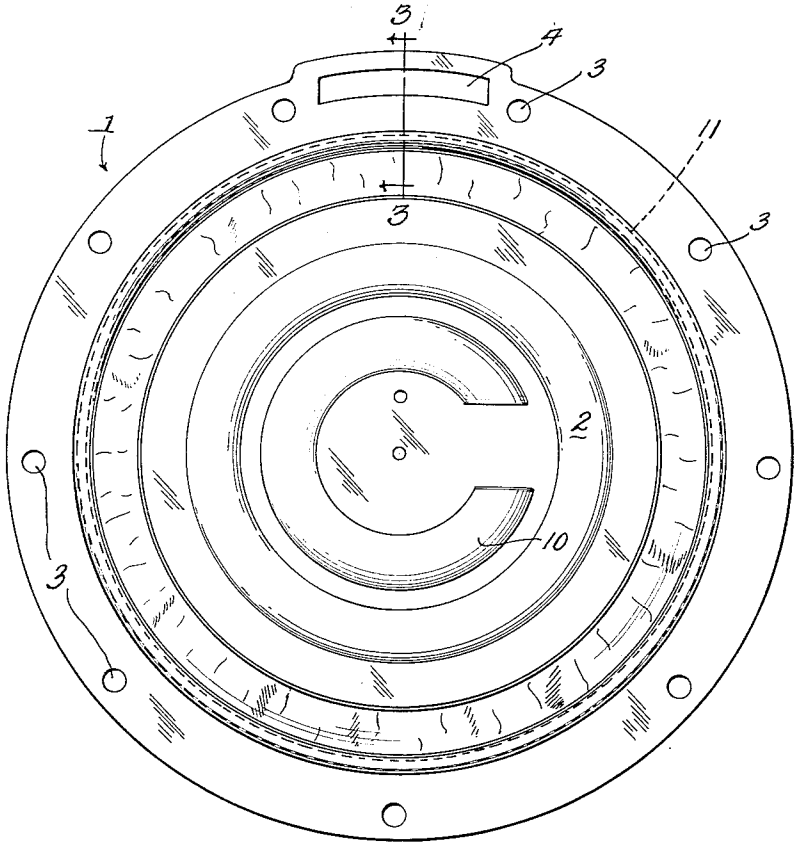


FIG. 1

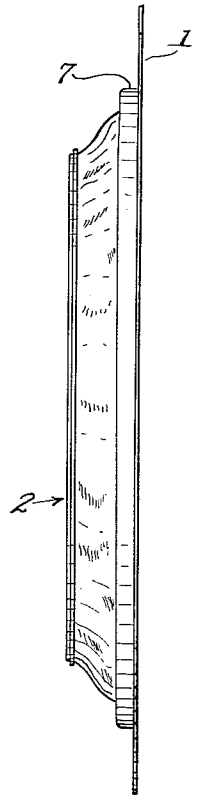


FIG. 2

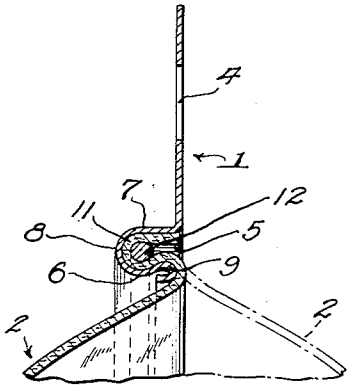


FIG. 3

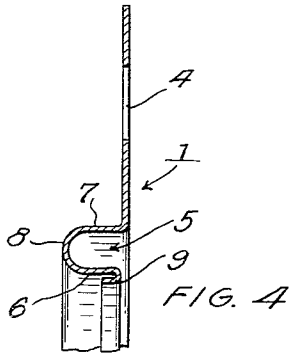


FIG. 4

INVENTOR

KARL L. SCHAUS

BY W. N. Rambo

ATTORNEY

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GAS METER DIAPHRAGM

Karl L. Schaus, Tempe, Ariz.

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7 Claims. (Cl. 73—278)

The present invention is concerned with diaphragm devices of the pulsatory type and employed in gas flow-registering or recording meters.

Such diaphragm devices are formed commonly to provide outer, frame-forming annular rims composed of rigid, thin sheet materials, such as sheet metal or the like, so that said rims may be clamped, when operatively installed in associated meters, between relatively united but separable casing members thereof. Such diaphragm rims, as heretofore constructed, have had their inner peripheral edges formed with laterally directed flanges disposed in substantially perpendicular relation to the planes occupied by the thin, flat, body portions of the rims. To these lateral flanges there have been securely fastened the outer circumferential edge portions of flexible diaphragm bodies, usually made of leather or the like, which are adapted to pulsate back and forth upon the application of unbalanced gas pressure to the opposite sides thereof, as provided for in the construction and operation of such meters.

In these conventional diaphragm devices, the presence of the laterally disposed flanges, employed in uniting the outer circumferential portions of the leather diaphragm bodies with the metallic rims, provides on each device an annular fixed edge which is outwardly and longitudinally offset from the plane of the associated rim. About this edge the diaphragm body is flexed as it pulsates during meter operation. As a result of this construction, the flexing area of the leather body of the diaphragm device is offset, about one-fourth of an inch in practice, from the center plane of the rim. Therefore, in order to compensate for this offsetting, whereby to enable the leather body to move back and forth through the rim opening on stroke movements of equal length when measured from the center plane, it is necessary that the leather body be given an added fullness to provide for a longer stroke in one direction in compensating for the offsetting produced thereon by the rim flange. Thus, the movement of the leather body in one direction from the diaphragm flexing outer edge of the flange is greater than it is in an opposite direction. In practice, this surplus leather in the flexible diaphragm body, in providing for unequal stroke lengths, has been found to be the cause of considerable variance in gas displacement and to be largely responsible for inaccurate gas measurement.

Accordingly, the present invention has for its leading objects: to provide a metal rim meter diaphragm wherein the flexible pulsatory body thereof has its outer circumferential portion joined to the inner peripheral edge of an associated rim in precise registry with the center plane of the rim, whereby to enable the stroke movements of said body to be of uniform length on both sides of the plane of said rim and wherein the same degree of flexure of the body is present at the ends of its stroke, eliminating error-producing excess material heretofore present in such bodies; to provide a metal rim diaphragm structure in which the inner peripheral edge region of the rim is formed with a concentric wall

formation projecting laterally to one side of the plane of the rim proper to form an annular open-sided groove for receiving the outer circumferential edge portion of a leather or other flexible diaphragm body, the arrangement of the groove in said rim providing a flexing or fulcruming edge on the inner periphery of the rim which is disposed in the plane of the rim in a position centering the diaphragm body with respect thereto and providing for equalized flexure of the body to the same degree in equal distances from the center plane throughout its full stroke; to provide a metal rim diaphragm in which a reenforcing circular wall projects laterally from one side of and in concentric relation to the inner peripheral edge of the diaphragm rim for producing an open-sided annular groove for the reception of the outer circumferential edge portion of a flexible diaphragm body and wherein said circumferential portion of the body is retained in securely fastened relationship with the inner wall surfaces of the groove by a continuous locking ring removably positioned in the groove; to provide a meter diaphragm of this character wherein the seating groove is provided with an annular deformable lip capable of adjustment to narrow the open side of the groove to facilitate the operation of securing the outer circumferential portion of a flexible diaphragm body and an associated locking ring in a retained position in the groove, the construction and arrangement of the lip being such that when said circumferential edge of a diaphragm body and said ring are positioned therein, the open side of the groove will possess an effective width less than that of the transverse cross-sectional diameter of the ring, whereby to retain the parts of the diaphragm in secured relationship.

With these and other objects and advantages in view, the construction and nature of which will appear from the following detailed description thereof, the invention consists in the novel features of construction, combinations of elements and arrangement of parts as hereinafter defined and illustrated in the accompanying drawings, wherein:

Fig. 1 is a front elevation of a metal rim meter diaphragm formed in accordance with the invention;

Fig. 2 is an edge elevational view thereof;

Fig. 3 is a detail vertical sectional view taken through the diaphragm on the line 3—3 of Fig. 1;

Fig. 4 is a similar view, disclosing the cross-sectional configuration of the rim prior to inserting and securing the outer circumferential edge portion of the flexible diaphragm body in the annular seating groove of the rim.

Referring to the specific form of my invention as it has been illustrated in the above drawings, the numeral 1 designates the rim of my improved diaphragm structure, and the numeral 2 the pulsatory flexible body thereof. The rim, as usual, is formed from a thin sheet material possessing a desired degree of rigidity. Usually, the rim is formed from sheet metal, but other equivalent materials may be used as, for example, materials of the synthetic resin type.

The rim 1, when the diaphragm structure is operatively positioned in a gas meter has its flat surface body portion arranged between and securely clamped by separable casing sections, not shown, of an associated gas meter, the rim being formed with circumferentially spaced openings 3 for the reception of bolts, or other fastening appliances used in holding the casing sections together with the rim securely clamped therebetween. Also, the rim is formed with the usual slot 4 which customarily acts as a port for registration with passages, not shown, provided in the casing sections for the travel of gas undergoing measurement to the outer side of the

diaphragm structure. These parts are of standard design and do not form per se a part of the present invention.

In accordance with the present invention, however, the rim, adjacent to its inner periphery, is formed, as shown in Fig. 4, with an annular open-sided groove **5**. In this instance, the groove is formed by die-shaping the rim to include inner and outer concentrically disposed walls **6** and **7**, respectively. These walls extend horizontally and laterally from one side of the rim and are united by an arcuate back wall **8**. In this instance the circular outer lip formation **9** of the inner wall **6** is folded back upon itself to provide a reenforced rounded outer edge, the latter constituting a flexing or fulcruming edge about which the outer circumferential portion of the flexible diaphragm body **2** bends, as shown in Fig. 3. It will be noted that this edge is arranged in the center plane of the diaphragm structure as represented by the body of the rim. However, as disclosed in Fig. 4, the outer edge of the lip formation may be slightly offset in an inward and lateral direction with respect to said plane to an extent not substantially in excess of the thickness of the diaphragm material.

The flexible body **2** of the diaphragm is preferably formed from a soft, readily flexible grade of leather, although various other flexible and gas-impervious materials may be used in lieu of leather, such as flexible materials made from synthetic resins. The diaphragm body extends across the opening provided by the rim **1**. If desired, the center of the body **2** may carry reenforcing metallic disks **10**, or the like, for the association therewith of valve and counter-operating linkage, not shown.

In securing the outer circumferential edge portions of the diaphragm body to the rim, said edge portions, indicated at **11** in the drawings, are inserted in the groove **5**, with said edge portions encircling a continuous locking or retaining ring **12**. Such insertion is performed ordinarily when the open side or mouth of the groove possesses its greatest width; that is, the distance between the edge **9** and the inner surface of the grove wall **7**. Following such insertion and preferably through the use of a forming die, the wall **6** of the groove is bent or deformed from its original shape, as shown in Fig. 4, to its locking or retaining shape, as shown in Fig. 3. By reference to Fig. 3 it will be noted that the bottom wall **6** is bent around the center of the ring **12** in a manner forcing the annular lip edge **9** toward the outer wall **7** and thereby narrowing the width of the open side of the groove **5**, so that it will be impossible for the diaphragm body to be accidentally disengaged from its clamped and gas-excluding engagement with the rim proper. It is within the scope of the invention to form the groove wall **6** originally so that it will possess the configuration of Fig. 3 rather than that of Fig. 4. When so done the wall **6** is stiffly resilient so that its lip **9** may be flexed sufficiently to admit or remove the ring **12** through the open side of the groove **5**.

In view of the foregoing, it will be seen that the diaphragm structure of the present invention provides a construction in which the outer circumferential portion of the leather diaphragm body **2** is so attached to the supporting rim that the flexing zone of the body is disposed in the true center of the rim. This flexing zone is in direct contact with the lip **9** and since the latter is disposed in a position closely adjacent to the plane of the rim, the leather body **2** will flex to an equal amount as the body pulsates throughout its full stroke movement from one side of the rim to the other. By this construction the prior necessity of employing excess material in the diaphragm body to compensate for off center attachment thereof to the rim is avoided, and an unusually strong and secure attachment of the diaphragm body to the rim is at the same time provided. Such means for securing the leather diaphragm body to the metal rim render these parts permanently secure against disassociation under all operational conditions. The strength derived from the annular groove in the metal rim, together with the cooperation of the continuous retaining ring when the latter is firmly positioned in the groove, insures a truly circular securing and flexing seat for the outer circumference of the leather diaphragm body. As stated, but for purposes of emphasis, it will be observed that the groove construction in the rim holds the outer edge of the leather body **2** on center in relation to the distance the flexible body travels back and forth. Therefore, the amount of leather and the degree of flexure are equal in the inward and outward strokes of the diaphragm. This was not true of prior constructions which necessitated the use of more leather, or other similar material, on one of said strokes than was required on the other. This surplus material was disadvantageous in that it caused considerabble variance in displacement and was a major factor for inaccurate gas measurement. My improved construction provides a diaphragm with a consistently lower and smoother differential, and, therefore, higher meter accuracy.

My improved diaphragm is subject to certain mechanical variations or modifications from the construction shown and described without departing necessarily from the scope of the invention as defined by the following claims.

I claim:

1. A meter diaphragm comprising: an outer integral, annular, flat-surfaced mounting rim composed of a thin rigid material uniform in its cross-sectional thickness, said rim contiguous to its inner periphery being provided with a laterally disposed wall formation arranged wholly at one side of the main plane of the rim and in perpendicular relation thereto, said formation providing an open-sided annular retaining groove in said rim, the open side of said groove being disposed in the plane of said rim and at one side thereof; a flexible diaphragm body arranged for pulsatory movement through said rim; and means cooperative with the inner surface of the wall formation of said groove and the outer circumferential portion of said diaphragm body for retaining the same in a secured position in said rim groove.

2. A meter diaphragm as specified in claim 1, and wherein the groove-positioned means for retaining the outer circumferential portion of the flexible diaphragm body in secured relation with the rim groove, comprises a continuous ring member.

3. A meter diaphragm as specified in claim 1, and wherein the wall formation defining the retaining groove is composed of inner and outer relatively spaced concentrically disposed walls united at their inner ends of the groove by a closure web.

4. A meter diaphragm, as specified in claim 1, and wherein the wall formation on said rim defines a retaining groove and is composed of inner and outer relatively concentrically disposed walls united at the closed side of the groove by a closure web, the inner of said walls terminating outwardly at the open end of the groove, and in the plane of the rim, in an annular lip about which the diaphragm body flexes in its pulsatory movement.

5. A meter diaphragm comprising: an integral, annular, outer rim member composed of thin, rigid, flat-surfaced material; said rim member contiguous to its inner periphery including a laterally projecting wall formation arranged wholly at one side of the principal plane of the rim member and in perpendicular relation thereto; said wall formation defining a retaining groove formed between inner and outer concentrically disposed annular walls and a closed end wall; the inner of said walls terminating outwardly at the open side of the groove and substantially in the plane of said rim member in an annular inwardly directed curved lip; a flexible and circular diaphragm body arranged for pulsatory movement through said rim member and engageable with said lip; and ring means cooperative with the inner surfaces of the wall formation of said groove and the outer circum-

ferential edges of the diaphragm body for retaining the latter in secured relation with said rim member.

6. A diaphragm for gas meters of the type having separably united casing elements between which the outer circumferential portion of the diaphragm is adapted to be clamped, said diaphragm comprising: an integral, annular, flat-surfaced mounting rim composed of a thin rigid material of uniform cross-sectional thickness and which is receivable between said casing elements; said rim contiguous to the inner periphery thereof including a laterally directed wall formation arranged wholly at one side of the principal plane of the rim, said wall formation including inner and outer relatively spaced concentrically disposed annular walls united at one side of the wall formation by a closure web, said walls and web defining an annular groove open on the side of the wall formation opposite to said closure web; a flexible diaphragm body arranged for back and forth pulsatory movement within and through said rim to produce strokes of substantially equal length when measured from each side of the principal plane of said rim; said diaphragm body having its outer circumferential edge portions seated in said groove; a ring member seated in said groove with the outer edges of the diaphragm body wrapped about the same; the outer of the annular walls of said formation being substantially flat while the complemental inner wall is shaped to conform to the cross-sectional curvature of the ring member and the diaphragm body disposed thereabout when said member and body occupy said groove, the curvature of said inner wall being such as to restrict the open side of the groove so that its width is less than that of the combined cross-sectional thickness of the ring member and diaphragm body in engagement therewith.

7. A diaphragm for gas meters as defined in claim 6, and wherein the outer portion of the inner groove-forming wall terminates in an inwardly directed arcuate lip about which the flexible diaphragm body has guided and direct flexing contact during normal pulsatory movement of the diaphragm.

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