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GAS FLOW RESISTANCE

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Fig. 1.

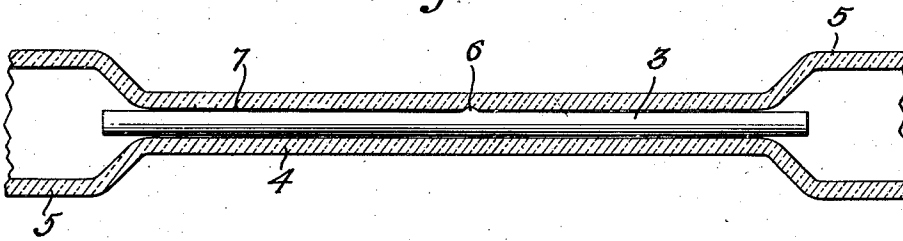
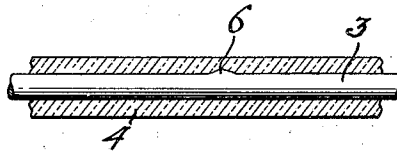


Fig. 2.



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GAS FLOW RESISTANCE

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2 Claims. (Cl. 138—40)

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This invention relates to the art of controlling the flow of a gas and has in view the provision of an improved gas flow resistance as well as to the method of making the same. It is particularly useful in connection with the provision of devices for producing high resistance to the flow of a gas.

Among the objects of the invention are the provision of a resistance of extreme simplicity as well as one which is capable of very accurate duplication. It is also my purpose to provide a device of the character described which can be readily adapted for use either as a fixed standardized resistance, as a variable resistance or as a calibrated variable resistance. In this way the field of usefulness of the invention can be greatly extended over what has been possible with devices heretofore known to the art.

In describing my invention reference will be had to the accompanying drawing wherein:

Figure 1 is a longitudinal section through a preferred form of my improved device; and

Figure 2 is a similar section of a portion of the device showing it in a preliminary stage of its fabrication.

The principle which I employ in the manufacture of my improved resistance revolves around the use of two dissimilar solid materials having different coefficients of thermal expansion, one of which materials is embedded as a solid core in a shell or housing of the other material, the embedding operation being performed at a temperature outside the range of temperature in which the device is to be employed at which temperature the two parts are in close contact with each other. After the embedding operation is completed and the device is brought to the temperature of use the parts are arranged so that the difference in their coefficients of thermal expansion will produce a small space between the two bodies, which space can be used as a resistance to gas flow.

As for the materials which can be employed in the manufacture of my device, the list is undoubtedly extremely long. Most of my preliminary experiments and tests have been carried out with metals embedded in glass although it is quite possible to use plastics, metals and ceramics or combinations of these materials as may be desired, giving due consideration to the particular use to which the resulting article is to be put.

By way of example I have illustrated in the accompanying drawing the use of a core of metal such as a stainless steel wire or rod 3 which

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has been embedded in a shell or housing 4 of glass. The wire or rod is coated with a substantial layer of glass at a temperature above the softening point of the glass and tubular extensions 5 of the glass at either end of the assembly may be provided as a convenient way for connecting the unit in the line through which the gas is to flow. The wire or rod may be provided with a nick or offset 6 whereby interengagement between the rod and the glass may be effected for the purpose of maintaining the rod in a fixed position in the glass so that in use the value of the resistance will not be changed due to inadvertent relative motion between the two elements.

At the temperature of the embedding operation the core and the housing are in close contact, as shown in Figure 2, but after the unit has been cooled to the temperature at which it is to be used the difference in the coefficients of thermal expansion of the metal and the glass will produce a slight annular space 7 between the rod and the glass as shown in exaggerated form in Figure 1. It is this small space which produces the resistance to the flow of the gas.

As already indicated, the use of metal and glass, while presenting some practical advantages, is not absolutely necessary to a realization of the invention as other materials having dissimilar coefficients of thermal expansion can be employed equally well provided only that the materials and their characteristics are suitable for the use to which the device is to be put. In other words, for measuring some gases certain types of materials would not be indicated as useful while for measuring others they might be perfectly satisfactory. This, however, comes well within the knowledge of anyone skilled in this art.

As will be apparent the invention is extremely simple and the device can be manufactured in quantity with great accuracy in the duplication which latter depends largely on the control of the properties of the materials being employed as well as the control of the temperature at which they are placed in close contact or embedded one within the other.

In the example illustrated the metal rod or wire, of course, has a coefficient of thermal expansion and contraction which is considerably greater than that of the glass so that when the article is cooled the core will contract more than the glass and provide the space 7 already described. Other materials might be employed and the unit might be fabricated at a low temperature with materials suitable for creating the

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small space desired for the resistance when the temperature rises.

If the unit is used as a standard gas resistance at room temperature it can be provided with a temperature correction curve, or if employed as a variable gas resistance it can be provided with means for heating or cooling so as to vary the size of the annular space between the core and the shell. If combined with a means for measuring the temperature, such as a thermocouple or resistance thermometer, my improved unit can be readily employed as a calibrated variable. Indeed its adaptability is unusually extensive as will be fully appreciated by those skilled in the art.

I claim:

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1. A gas flow resistance comprising a metal rod embedded in glass at a temperature above the softening point of the glass whereby a space is created between the rod and the glass in the article as used, the rod and the glass being provided with interengaging means for preventing relative motion therebetween.

2. A gas flow resistance, comprising a glass tube, and a metal rod in the bore of the tube and providing a gas flow resistance space between the wall of the tube and the wall of the metal rod, the size of the space being determined by the difference of contraction between the two materials when cooled from a heated state.

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