Dec. 28, 1948. E. B. FERRELL 2,457,218

METHOD OF MANUFACTURING SEALED CONTACT DEVICES

Filed Dec. 14, 1944

FIG. 1

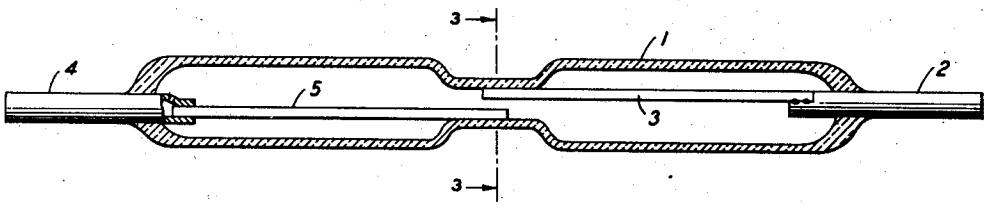


FIG. 2

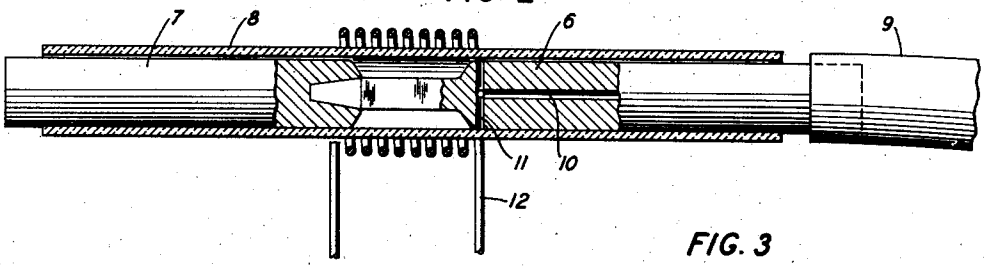


FIG. 3

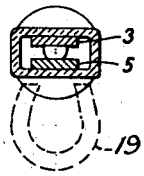


FIG. 4

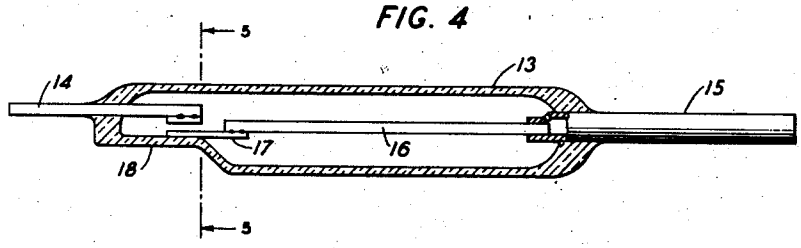
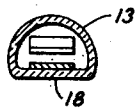


FIG. 5



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2,457,218

METHOD OF MANUFACTURING SEALED CONTACT DEVICES

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3 Claims. (Cl. 49—81)

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This invention relates to contact makers and breakers and particularly to magnetically operated sealed contact devices.

The object of the invention is to provide a method by which uniformity of product in the manufacture of sealed contact devices which after manufacture are not adjustable may be attained. The glass sealed contact device in which the various parts are secured one to the other by fusion has many desirable points of superiority over prior art devices. It has proved, however, to be difficult to produce these devices by mass production methods and still attain a desired uniformity in operating characteristics. The present invention therefore is a step forward in the art since it provides a method by which unskilled operators may perform various steps in the manufacture of these glass sealed contact units and produce thereby a product having an even higher degree of uniformity in ultimate operating characteristics than has been found possible heretofore by ordinary methods pursued by highly skilled operators.

In accordance with the present invention, the inside surface of the glass body portion is prepared by softening by heat while under suction to draw the inside surface down to conform to a precisely formed mandrel. The glass envelopes therefore will be highly uniform in their inside dimensions. The flexible reed is thereafter held by magnetic force against such a precisely formed surface and the reed under no mechanical strain is sealed into the tube. Given reeds of uniform mechanical and magnetic characteristics, the product bound together by fusion will attain a very high degree of uniformity in service.

A feature of the invenion is a mehod of manufacturing sealed magnetic reed contact devices which consists of holding the flexible end of a reed against the wall of the body while the other end thereof under no mechanical strain is being sealed into the said body.

Another feature of the invention is a step in the manufacture of glass sealed magnetic reed contact devices which consists of magnetically holding the movable end of a reed in its ultimate non-operated position without mechanical strain therein while fusing the said reed to the said glass body.

Another feature of the invention is a method of manufacturing glass sealed reed contact units which consists of forming a seat on the inside surface of the glass body for the movable end of a reed and then holding the movable end of the reed against such a seat by means which will

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place no mechanical strain on the reed while fusing the other end of the reed to the glass body.

The drawing consists of a single sheet having five figures as follows:

Fig. 1 is a cross-sectional view very much enlarged of one form of the finished sealed contact device;

Fig. 2 is a view partly in section showing a mandrel inserted in the glass tube and indicating the manner in which the tube is heated to produce the particular form desired;

Fig. 3 is a cross-sectional view of the formation produced taken on the line 3—3 of Fig. 1;

Fig. 4 is a cross-sectional view of another form of the invention; and

Fig. 5 is a cross-sectional view taken on the line 5—5 of Fig. 4.

The glass sealed device in one of its embodiments shown in Fig. 1 consists of a glass envelope 1 into one end of which is sealed a rod of magnetic material 2 and to which is welded a magnetic reed 3. At the other end of this glass envelope there is sealed a tube of magnetic material 4 and to which is welded a reed of magnetic material 5. The tube 4 has an opening leading into the interior of the glass sealed device for the purpose of exhausing the device and possibly filling it with non-corrosive gases. The tube 4 is later sealed on the outside.

A feature of the present invention consists of the formation of the glass tube 1 to provide a section such as that shown in Fig. 3 whereby the reeds 3 and 5 will be seated permanently a specified distance from each other and since the rod 2 and tube 4 may be sealed into the envelope 1 in such a manner that there is no strain exerted on these reeds normally great uniformity in operation can be attained. A permanent magnet 19 may be used as indicated in Fig. 3 to hold the reed 5 against its seat while the tube 4 is being sealed into the end of the glass or ceramic tube 1. This magnet 19 is not the operating magnet which operates the reed contacts of the finally produced device nor is the winding 12 intended to cause such operation. In practice, as is well known, an operating winding surrounds the tube 1, that is, the tube 1 is inserted in an operating winding, and current traversing this winding magnetizes the reeds 3 and 5 in the case of Fig. 1 or the reed 16 in the case of Fig. 4 to cause the movable members 3 and 5 in the case of Fig. 1 or the movable member 16 in the case of Fig. 2 to close the contact. In the case of a device such as is shown in Fig. 1 having two magnetic

reeds it has been the practice to seal first the member 2 in one end of the glass tube and afterwards the member 4 in the other end of the glass tube; in such case the magnet is first applied to hold member 3 against its back stop while member 2 is being sealed into the glass tube and then the magnet holds member 5 against its back stop while the tube 4 is sealed into the glass tube 1.

The manner in which a cross-section such as that shown in Fig. 3 may be produced is indicated in Fig. 2. In this figure a mandrel consisting of a part 6 and a part 7 held together in any desired manner, as for instance by gravity or spring pressure, may be inserted within the unformed glass tube 8. A hose connection 9 may be made to the part 6 of the mandrel and connected to a vacuum pump so that by means of the passageways 10 and 11 the air within the tube may be partially exhausted while that part of the glass tube to be deformed is heated, as by an electric heating coil 12 (or if preferred, by a gas flame). Since the part 7 will be of practically the same diameter as the inside diameter of the tube 8, enough resistance will be established so that the side walls of the glass envelope 8 may be made to collapse when softened and to take the form indicated in Fig. 3.

The mandrel is made in two parts 6 and 7 so that after the formation of the glass tube has been completed and cooled then the part 7 may be separated from the part 6 and both withdrawn from the tube.

The device shown in Fig. 4 is similar in nature but somewhat different in form. In this device a glass or plastic envelope 13 has a rigid contact 14 sealed into one end and a tube 15 carrying a flexible reed 16 sealed into the other end. A seat for the contact end 17 of the reed 16 is formed as indicated in Fig. 4 and the cross-sectional view of Fig. 5, the seat consisting of the flattened portion 18 of the envelope. This seat may be formed in a similar manner to that indicated in Fig. 2 through a heating and exhausting procedure.

It should be noted that care should be taken in the selection of the material of which the mandrel is constructed in order to mis-match the temperature coefficients of the mandrel and the glass envelope, so that the mandrel can be easily slipped out after cooling. Silver, by way of example, has been found to be particularly useful for this purpose.

What is claimed is:

1. The method of manufacturing a sealed flexible reed contact device, which consists of forming a seat on the inside surface of a tubular glass body, inserting a flexible reed into said body, said reed being of smaller dimensions than the interior of said body, holding, by means of a magnetic force, the movable end of the flexible reed against the said formed seat without placing any strain thereon other than that incident to the application of said magnetic force, fusing the other end of said flexible reed to the said glass body, and removing said holding magnetic force whereby said movable end of the reed is free to move.

2. The method of manufacturing a sealed contact device, which consists in establishing a portion of the inside surface of an enclosing body as a back stop, inserting a flexible reed into said body, said reed being smaller than the interior of said body, holding the movable end of the reed against the back stop by a magnetic force produced by means located externally of the enclosing body, sealing the other end of the reed to the enclosing body, and removing the holding means to permit the free end of the reed to move.

3. The method of manufacturing a sealed contact device, which consists in forming a seat on the inside of an enclosing vitreous body, inserting a magnetically responsive flexible reed into said body, said portion of the reed extending into the body being smaller than the interior of the body, holding said reed against the said seat by an external magnetic field, fusing the reed to the body, and then discontinuing the external magnetic field whereby the reed can be flexed to move.

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