June 19, 1962 V. WINKLER 3,039,203

APPARATUS FOR DEMONSTRATING VACUUM EXPERIMENTS

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Fig.1

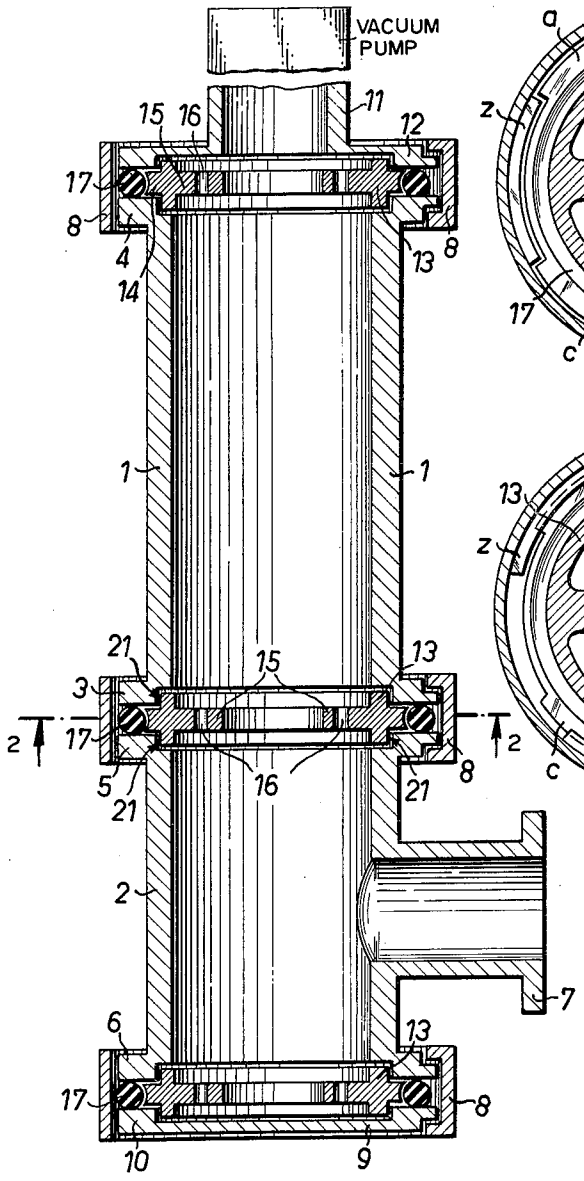


Fig.2

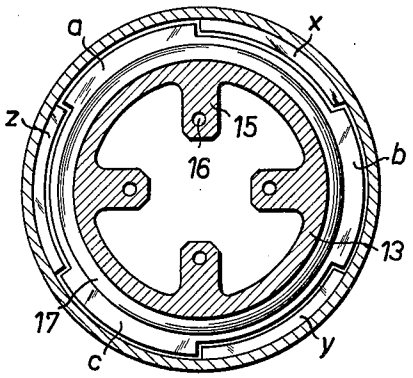
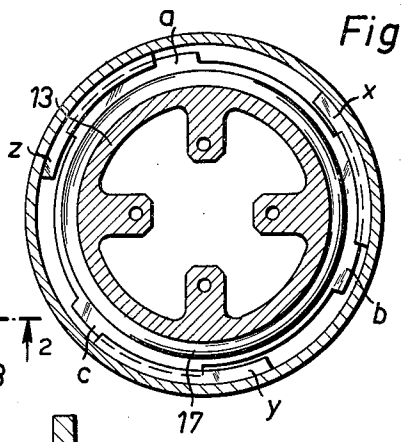


Fig.3



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APPARATUS FOR DEMONSTRATING VACUUM EXPERIMENTS

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Fig. 4

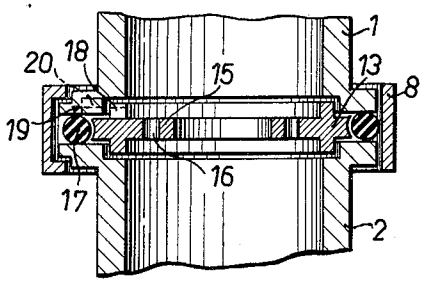


Fig. 6

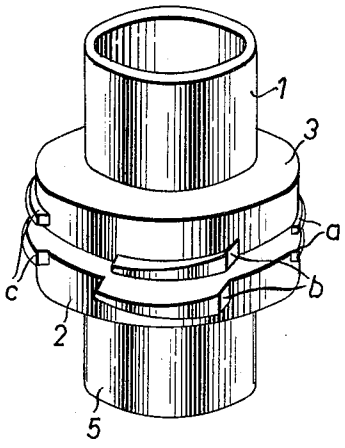


Fig. 5

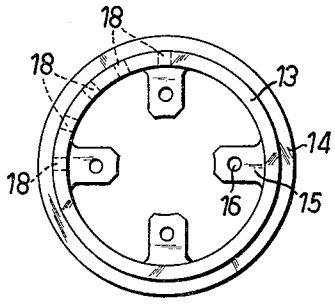


Fig. 7

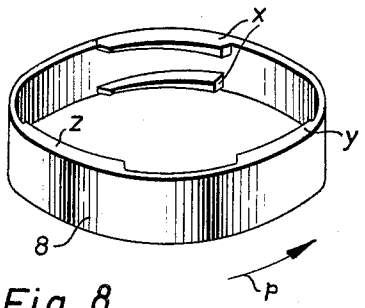
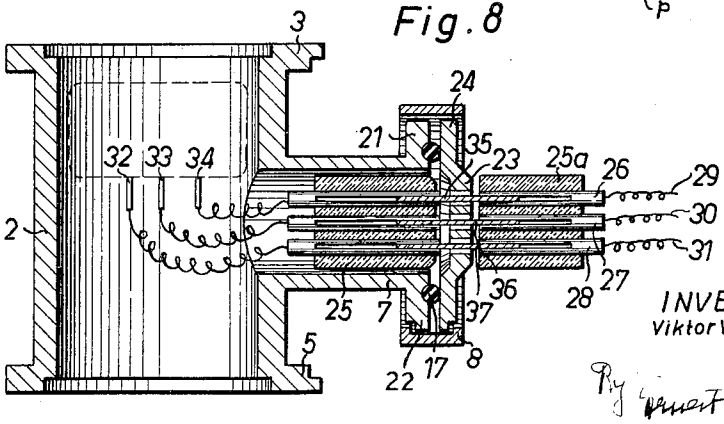


Fig. 8



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APPARATUS FOR DEMONSTRATING VACUUM EXPERIMENTS

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The present invention relates to a physical working- and demonstration-apparatus operating under vacuum conditions and assembled in accordance with the building-box principle.

In particular, the present invention is concerned with a physical working- and demonstration-apparatus, which is to be used as technical means of instruction in schools and as means of demonstration for lectures and each apparatus comprises a plurality of individual building parts which are designed in such manner that, if necessary, they may be used speedily and easily for assembling of the apparatus for the presentation with the building-box principle at particular times.

It is one object of the present invention to provide a physical working- and demonstration-apparatus operating under vacuum conditions which comprises substantially a vacuum chamber consisting of one or a plurality of housings and one or more systems mounted therein and sealed from the outside atmosphere and humidity.

Such apparatus which operates under vacuum conditions are, for instance, such devices which serve the production of high electrical voltages, the production and investigation of electron and ion rays, or which are applied as electron microscopes, mass spectrographs, particle accelerators, etc., without limiting the apparatus thereto.

Such apparatus deals with devices, which require a careful and difficult design, in order to render them safely vacuum tight and to mount the systems suitably therein, and for this reason they have been manufactured carefully in special shops and marketed as finished products.

The diversity of the physical problems requires, however, a great number of different and expensive special apparatus, so that in view of the great expenses in acquiring such special apparatus by technical schools, the funds of which are usually limited, it was not possible, to purchase a special apparatus for each experiment to be performed in vacuum.

These drawbacks have been removed by the present invention in such manner that the above mentioned devices, which constitute the object of the present invention, are assembled in accordance with the building-box principle from vacuum construction elements or housing parts and of constructing elements for the inner parts of the apparatus or system.

Apparatus which may be assembled in accordance with the building-box principle are known.

A great number of construction elements or parts, as well as devices are known which could be used for the mentioned building-box principle.

Thus, for instance, in the vacuum technique or in other technical fields cylindrical or other hollow bodies are known which are equipped at their ends with a flat or conical flange, which has either throughout or partly arranged segments and which hollow bodies may be equipped with connecting branches, to be used as housing parts for the entire unit. Furthermore, construction parts having blind flanges and covers are known, in order to make it possible to close up such hollow bodies either at one side, or both sides or also at the connecting branches.

Different devices are also known in order to connect together such hollow bodies. For instance, a connection of adjacent flanges of the hollow bodies by means of screws or bolts and nuts is known, whereby the screws

or bolts extend through the flanges of the hollow bodies or through discs which engage the flanges. A connection of the hollow bodies by screwing together is also known, in which case the screwing together is obtained by threads or by some type of bayonet-joint, which connection may be obtained either outside or inside of the hollow bodies. A still further known connecting means resides in a spigot and socket joint type and is designed in such manner that a collar which is rotatably provided on one of the flanges to be connected is attachable to the second flange to be connected either by thread or by means of a type of bayonet-joint.

It is also known to connect hollow bodies by means of a tubular coupling member which can be screwed to the inside of the hollow bodies to be connected or the hollow bodies are pulled together in such manner that the tubular coupling member has two flanges with wedge shaped inner faces and which are equipped with two or more recesses to be cooperated with upon rotation.

Devices are also known in order to close up vacuum tight such connections. Thus it has been proposed to provide a sealing ring of elastic material which is disposed in a circular groove of one of the flanges to be connected. Another known arrangement resides in the provision of a sealing ring which is mounted on a metallic carrying ring and is thus disposed between the sealing faces or thin and soft metal foils can also be used, which are rigidly compressed between the sealing faces.

These known devices and arrangements for connection and sealing of hollow bodies are either poorly or not at all suitable to be used as connecting elements for the construction parts of physical working and demonstration apparatus, which can be assembled in accordance with the building-box principle and which constitute the object of the present invention, since its operation is rather difficult and time consuming, its operation is not possible during the use of the physical apparatus, furthermore because the connection requires too much room either outside or inside of the construction parts and also because the connection is too difficult and too expensive in its manufacture. In addition many other drawbacks could be cited which prohibit the use of the known devices for the purpose of the present invention.

It is, therefore, one object of the present invention to provide a fast operating vacuum sealing connection, which is provided at the end flanges of the hollow bodies, which end flanges are equipped with recesses and segments, respectively, and which permit connection of the flanges of adjacent hollow bodies by means of a flat cylindrical securing ring, which has at its upper and lower ends thereof radially inwardly extending segments complementary to the recesses on the flanges of the hollow bodies and which securing ring thus forms a U-shaped cross-section which receives the projections of the flanges.

In order to bring about this result, the two flanges to be connected of the hollow bodies are first brought into adjacent position upon insertion of a carrying disc therebetween, which has a sealing ring surrounding the same. Then the securing ring is moved axially thereover, so that its segments move through the corresponding recesses in the flanges and then is subjected to a rotary motion until the segments of the securing ring assume a position aligned with the projections of the flanges of the hollow bodies.

By proper design of the flanges as well as of the segments of the securing ring, for instance, by means of wedge-shaped formations thereof on the oppositely disposed sides of the flanges, during the assembly of the hollow bodies with the closing covers, bottoms or other closing means, an additional axial force towards each other is created during the rotation of the securing ring, so that a completely air-tight and secure connection between

the hollow bodies is brought about, which has the advantage that it can be assembled rapidly and can be released likewise rapidly.

It is another object of the present invention to provide a connection means for the arrangement of physical working and demonstrating apparatus to be assembled in accordance with the building-box principle and which permits an easy and fast mounting of the different systems in the vaccum housing.

For the purpose of proper mounting of such systems a carrying disc is provided which is properly secured between the flanges of the hollow bodies to be connected.

It is still a further object of the present invention to provide an apparatus wherein the feeding of electric current to the special apparatus or system mounted in the vacuum housing is performed by means of a connecting branch which is closed up by a cover member in which a double plug is embedded, so that the double plug provides feeding of electric current inwardly to the system, on the one hand, and electrical connection means outside of the housing, on the other hand.

With these and other objects in view which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings, in which:

FIGURE 1 is an axial section of a vacuum portion, consisting of individual building parts, of a working- and demonstration - apparatus, designed in accordance with the present invention;

FIG. 2 is a section along the lines 2—2 of FIG. 1;

FIG. 3 is a section similar to that shown in FIG. 2, however, the clamping or securing ring being shown in a displaced position;

FIG. 4 is a fragmentary sectional view of the part shown in FIG. 1, indicating the arresting of the carrying disk;

FIG. 5 is a top plan view of the carrying disk as shown in FIG. 4;

FIG. 6 is a perspective front view of the connecting member between the upper and the lower housing portions, without showing the clamping or securing ring;

FIG. 7 is a perspective front view of the clamping or securing ring for the connection of two building parts; and

FIG. 8 is a vertical section of the housing with said flanges and a device for an electric cable connection.

Referring now to the drawings, and in particular to FIGS. 1 to 3, the vacuum part of the working- and demonstration-apparatus comprises two cylindrical housing parts 1 and 2, which are equipped at their respective ends with the outer flanges 3, 4 and 5, 6, respectively.

The lower housing part 2 is additionally equipped with a radially outwardly projecting connecting branch 7, which serves the feeding of electric current. The outer flanges 3, 4 and 5, 6, respectively, are interrupted at three places, as may be ascertained from FIGS. 2 and 3, and they form, therefore, three housing flange parts *a, b, c* of equal length, which are separated from each other by equally large sections *x, y, z*. The number of the flange parts and their length may be chosen at will. The interruptions disposed between the flange parts correspond in each case as to their number and their length with the corresponding flange parts and interruptions of the securing ring 8, which is provided for securing together the two housing parts 1 and 2, and at their opposite ends with a flange 10 of the closing cap 9, and with the flange 12 of the connecting branch 11.

A carrying disk 13 having an outer flange 14 is disposed between the flanges 3, 5 of the two housing parts 1 and 2 and between the latter and the flanges 6, 10 and 4, 12, respectively. The carrying disk 13 abuts with its cylindrical outer face against the inner shoulders 21 formed by the flanges 3, 4, 5 and 6, as well as, 10 and 12. The carrying disk 13 has in addition, a plurality of radially, inwardly extending projections 15 having bores 16, the number of which may vary but may also be replaced

by a continuous inner flange. These projections 15 serve the purpose to build into the housings 1 and 2, respectively, the systems required for different situations.

In order to seal the housing parts 1 and 2 with the carrying disk 13 disposed therebetween, a rubber ring 17 is set around the carrying disk 13 between the flanges of the housings 1 and 2, the diameter of the rubber ring 17 being slightly larger than the thickness of the outer flange 14, so that the rubber ring 17 is compressed upon tightening of the clamping ring 8.

In order to connect the two housing parts 1 and 2 together, as well as with the closing cap 9 and the connecting branch 11, respectively, the securing or clamping ring 8, which is mounted already on one of the housing parts 1 and 2, is displaced in axial direction in such manner that its flange parts *x, y* and *z* project between the housing flanges *a, b* and *c*, until the inner faces of the flanges of the securing ring 8 assume a position which is at the same level as the outer faces of the housing flanges. Now it is merely necessary to perform a left or right rotation of the securing ring 8, in order to set its flanges *x, y, z* below the flanges *a, b, c* of the housing parts 1 and 2.

This connection is brought about not only speedily and easily, but has also the advantage that the housing parts to be connected remain immovable during the closing operation.

In order to achieve a good sealing at the connecting points of the housing parts 1, 2, the flanges *x, y, z* of the securing ring 8 and/or the flanges *a, b, c* of the housing parts 1, 2 are suitably designed, in accordance with the present invention, with a rising wedge or screw-shape or with a winding-like fortification, as shown, for instance, in FIGS. 6 and 7.

In the embodiment disclosed in FIG. 6 of the drawing, the housing flanges *a, b, c* of the housing parts 1 and 2 are formed rising from left to right and in FIG. 7 the flanges *x, y, z* of the securing ring 8 are formed rising from right to left, so that upon assembly of the housing parts 1 and 2, by rotation of the securing ring 8 in the direction of the arrow *p*, that is, upon left rotation the flanges *x, y, z* are moved over the flanges *a, b, c*, whereupon a tightening moment is exerted onto the housing parts 1 and 2.

It is necessary in many cases to lock the carrying disk 13 which is built between the housing parts 1, 2, so that it remains non-rotatable during the assembly of the housing parts 1 and 2, in the desired position. For this purpose, a cylindrical part 14 of the carrying disc 13 is equipped with a plurality of radially disposed bores 18 each of which may be brought into registration with any one of a plurality of corresponding bores 19 provided in the shoulder of the flanges 3, 4, 5 and 6 and 10, 12, respectively, upon rotation of the carrying disc 13 whereupon the locking takes place by means of a pin 20 inserted radially into the registering bores 18 and 19.

As shown in FIG. 4, the carrying disc 13 is adapted to suspend any suitable system 40 by means of the screw bolts 41 inserted in the bores 16 of the carrying disc 13.

In order to make possible the feeding of the required electrical conduits 29, 30 and 31 in the embodiment shown in the drawing, the lateral branch connection 7 is provided, which receives a plug socket 25 of an outer diameter about equal with the inner diameter of the branch connection 7.

The plug socket 25 is made, for instance, of glass, porcelain or any other suitable artificial material having insulating characteristics and has at its outer side openings adapted to receive plugs, while on the inner side of the plug the electrical conduits 29, 30, 31 branch off, which are connected either directly or by means of plugs, for instance, spring contact plugs 32, 33 and 34 to the system 40 disposed inside of the hollow body.

A similar plug socket 25*a* is disposed on the outside of the apparatus, the electrical conduits of which are suitably combined into one cable leading to the source

of energy and also other measuring devices which may be connected thereto.

The electrical connection between the two plug sockets **25** and **25***a* is brought about by the closing cover **23** which is formed as a double socket and the flange **24** of which is connected with a flange **21** of the branch connection **7** by means of the clamping ring **8** which has been set forth above.

This closing cover **23** is equipped in the center with three plugs **35**, **36**, and **37**, projecting from both sides of the cover **23**, which plugs are inserted rigidly into the cover **23** by insulating means, such as glass, porcelain or a suitable artificial material.

While I have disclosed one embodiment of the present invention, it is to be understood that this embodiment is given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

I claim:

1. A physical working and demonstration apparatus comprising a vacuum source member and at least one hollow body, a closing member sealingly connected with one end of said hollow body, said vacuum source member being sealingly connected with the other end of said hollow body, said hollow body, said vacuum source member and said closing member forming flanges at their ends, said flanges of one end of said hollow member and of said closing member respectively, being disposed opposite and spaced apart from each other, and said flanges of the other end of said hollow body and of said vacuum source member, respectively, being disposed opposite and spaced apart from each other, each pair of said oppositely disposed flanges having alternate projections and recesses, in order to provide connecting means between each pair of cooperating flanges, a carrying disc disposed between each pair of said oppositely-disposed and cooperating flanges, a rubber ring surrounding each of said carrying discs and engaging the opposite end faces of the corresponding of said flanges a connecting branch extending radially from said hollow body and open at its end, a cover sealingly closing the open end of said

connection branch, a double socket embedded in said cover and adapted to feed electric current to a system supported by said carrying discs, and a cylindrical securing member surrounding each pair of said opposite, cooperating flanges and having radially inwardly extending upper and lower segments complementary to said recesses in said flanges, so that upon axial and following rotary movement of said securing members, said projections of said respective flanges are disposed between corresponding pairs of said upper and lower segments and, thereby, said securing members provide a connection between the corresponding projections of said opposite flanges.

2. The apparatus, as set forth in claim 1, wherein said projections of said flanges and said segments of said securing members are formed as complementary windings.

3. The apparatus, as set forth in claim 1, wherein said projections of said flanges and said segments of said securing members are formed as complementary threads.

4. The apparatus, as set forth in claim 1, wherein said carrying disc has radially disposed bores and said corresponding flanges having aligned bores extending from the faces of said flanges disposed opposite the cylindrical face of the corresponding carrying disc, and a pin inserted into each pair of said aligned bores.

5. The apparatus, as set forth in claim 1, wherein said double socket comprises an outer and an inner plug connection, said plug connections extending to both sides of said cover.

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